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EVALUATION

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

{SWD(2026) 235 final}

Table of contents

PART 9

PART 10

PART 11

Glossary

Term or acronym	*Meaning or definition*
CAP	Common Agricultural Policy
CJEU	Court of Justice of the European Union
EU	European Union
GW	Groundwater
HD	Habitats Directive
MSFD	Marine Strategy Framework Directive
NAP	Nitrates Action Programme
ND	Nitrates Directive
NECD	National Emission reduction Commitments Directive
NRR	Nature Restoration Regulation
NVZ	Nitrate vulnerable zone
RPx	Reporting Period X
SW	Surface water
UN SDG	The United Nations Sustainable Development Goals
UWWTD	Urban Wastewater Treatment Directive
WFD	Water Framework Directive
IED	Industrial Emissions Directive
DWD	Drinking Water Directive

Terminology

“Nutrients” refers to Nitrogen (N) and phosphorus (P)

“Nitrate” (NO_3) is a form of nitrogen which is soluble in water

“Ammonia” (NH_3) is a form of nitrogen gas

“Phosphates” (PO_4) is a form of phosphorus soluble in water

“fertiliser” means any form of fertiliser (chemical fertiliser, organic fertiliser and manure)

“chemical fertiliser” refers to nitrogen fertilisers manufactured from natural gas

1. INTRODUCTION

1.1 Purpose and scope of the evaluation

The Nitrates Directive[1], adopted in 1991, aims to protect water quality across Europe by reducing and preventing pollution by nitrates from agriculture. The Directive was based on Article 130s of the Treaty establishing the European Economic Community. The evaluation of the Nitrates Directive was announced in the 2024 Commission work programme [1]. The evaluation covers all compulsory evaluation criteria set out in the Commission's better regulation guidelines to investigate effectiveness, efficiency, relevance, coherence and EU added value of the EU intervention.

The assessment of **effectiveness** will investigate to what extent the Directive's objectives are being achieved and to what extent it can continue to help reduce and prevent nutrient pollution from agriculture. It will consider how the Directive has been implemented, challenges that have arisen in applying the Directive, and any factors limiting its effectiveness. **Efficiency** will be considered by assessing whether the efforts and costs involved in implementing the Directive are proportionate for public administrations and farms, and whether the environmental and socio-economic benefits outweigh these costs. The assessment will also look at the potential for simplification, including in reporting and reducing the associated costs. In terms of **relevance**, the evaluation will assess the extent to which the objectives pursued by the Directive meet current societal needs, such as clean water and air and healthy soils, sustainable and resilient agriculture, and circularity. It will also assess whether the Directive is still in sync with the EU's environmental and climate commitments, the Water Resilience Strategy [2], and the Vision for Agriculture and Food [3]. The assessment of **coherence** will focus on the internal consistency of the Directive and its consistency with related EU legislation and policies, in particular on water, nature and agriculture. The evaluation of the Directive's **EU added value** will look at the extent to which an EU-level approach has improved on what could have been achieved by the Member States acting alone at national level. On 10 December 2025, the Commission adopted a **communication on the simplification of administrative burdens in environmental legislation** [4], in which it announced that it would complete the ongoing evaluations of the Nitrates Directive and take follow up measures, looking into how the objectives of the Directive could be achieved in the most effective and proportionate way[2].

1.2 Methodology

The evaluation is supported by several external studies (see **Annex I**) covering aspects such as: (i) changes in key input and results parameters at EU and Member State level; (ii) the effectiveness of measures under the Directive; (iii) the implementation of measures in the Member States; (iv) an analysis of historical nutrient flows; (v) implementation costs; (vi) the cost of nutrient pollution and the benefits of the Directive; (vii) impacts on competitiveness; (viii) case studies on Member State implementation of the Directive; (ix) coherence of the monitoring and reporting under the Nitrates Directive and other

[1] All references to legislation and regulations can be found at the back of this document.

[2] In line with the Commission's better regulation guidelines, Commission evaluation reports do not make any commitment for future action.

legislation; (x) overview of national implementation [5] and action programmes and (xi) an overview of case-law. The evaluation has also drawn on studies from the Commission's Joint Research Centre on the safe use of processed manure [6], on knowledge for Integrated nutrient management [7], and on the impact of the Nitrates Directive and the effectiveness of the manure limit [8].

To ensure that the public interest across the EU was properly reflected in the evaluation, consultation activities included an online public consultation[3], an implementation dialogue[4], three stakeholder events on specific topics, and interviews and questionnaires feeding into the support studies. Member State experts were consulted extensively in the Nitrates Expert Group[5]. Dedicated stakeholder events covered topics such as the objectives and scope of the Nitrates Directive, the costs and benefits of the Directive for farms and society, and opportunities for streamlining and simplification of monitoring and reporting under the Directive for public authorities. These topics were also covered by interviews and questionnaires, which were used to complement the information gathered through the literature review. The outcomes of the consultation activities are described in **Annex V –** *stakeholders' consultations: synopsis report* and in **Annex VI -** *outcome of consultations with the nitrate expert group***.**

The evaluation also relied on the implementation reports published by the Commission every four years [9] [10] [11] [12] [13] [14] [15] [16]. These reports cover changes in water quality and agriculture pressures in all Member States, based on the information formally reported by the national authorities. Data from these reports was a key source for the evaluation. Other sources of data from Eurostat, FAOSTAT and the European Environmental Agency (EEA) covering a longer time scale and external to the Nitrates Directive reporting complemented the data sources.

The evaluation covers the period since the Directive was adopted in 1991 until approximately 2023. It assesses how EU Member States have applied the Directive since it became applicable either pursuant to its Article 12 or under the accession treaties for the Member States that subsequently joined the EU. Where relevant data is available, the evaluation covers Member States in the period before they joined the EU. The last implementation report covering 2020-2023 is being drafted alongside this evaluation. Where possible, the assessment covers data received from Member States in connection with this report.

The Nitrates Directive is implemented differently in different Member States, reflecting the local environmental and agricultural situation. This evaluation focuses on how the Directive has worked overall and made a difference at EU level. Where relevant for the analysis, data has been disaggregated to take account of different approaches in the Member States or to highlight specific examples. The evaluation will analyse the practice of granting Member States specific implementing decisions (also known as derogations) adopted under the directive's Annex III.2.2 and Article 9(2), and the impact of those

[3] Protecting waters from pollution caused by nitrates from agricultural sources - Evaluation

[4] https://environment.ec.europa.eu/events/implementation-dialogue-environmental-legislation-2026-02-18_en

[5] The Nitrates Expert Group brings together experts from national administrations responsible for the implementation of the Nitrates Directive (https://ec.europa.eu/transparency/expert-groups-register/screen/home?lang=en GROUP E03023)

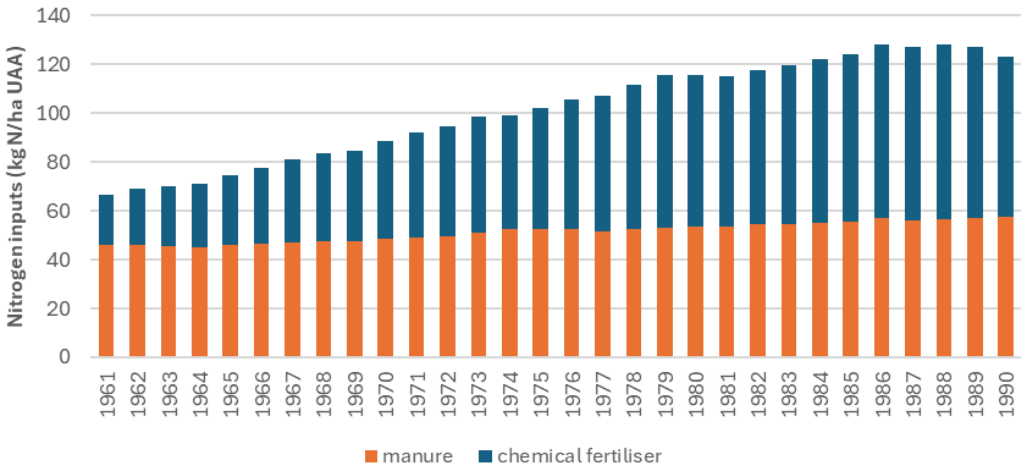
decisions on the Directive's implementation. A detailed explanation of the methodological aspects is provided in **Annex II** - *methodology and analytical models used*.

2. WHAT WAS THE EXPECTED OUTCOME OF THE INTERVENTION?

2.1 Description of the Nitrates Directive and its objectives (intervention logic)

The Nitrates Directive requires Member States to reduce and prevent the diffuse pollution of waters with nitrates from agriculture, as the spreading of livestock manure and chemical fertilisers results in losses to groundwater, rivers, lakes and coastal waters. Member States are required to promote good agricultural practices for the use of manure and other fertilisers for all farms and, in areas that are identified as polluted or at risk of pollution, enforce those practices for all farms in those areas through the implementation of action programmes with specific mandatory requirements to be implemented on farms. The societal objective is to protect drinking water resources and aquatic ecosystems. Its adoption in 1991 should be seen in the context of developments in European agriculture during the post-WWII years and the related environmental impacts of increasing fertiliser use. Figure 1 below shows the nitrogen[6] fertiliser inputs per hectare of agricultural land in EU12[7] since the early 1960s until the negotiation of the Nitrates Directive around 1990. Over this period, the use of chemical[8] nitrogen fertilisers increased by more than 300% and manure inputs rose by more than 20%. Total inputs almost doubled. This increase in nitrogen inputs was part of a global trend that resulted in an unprecedented increase in agricultural production. At the same time, however, it also brought about an increase in emissions of excess nitrogen with detrimental effects on the aquatic environment [17].

Figure 1[9] Nitrogen fertiliser inputs in the EU12, 1961 - 1990 (kg N/ha)



[6] Nitrogen (N) and phosphorus (P) are the two most important macronutrients besides potassium (Ka) that are applied in agriculture to promote crop growth. More importantly they are the main causes of negative environmental effects. Nitrate (NO_3) is a particular chemical form of nitrogen which is soluble in water and highly available for plants. Likewise, phosphates (PO_4) are soluble and highly plant available forms of phosphorus. Livestock manure includes both nitrogen and phosphorous in different forms and proportions depending on the type of livestock and production method.

[7] Member States when the directive was adopted in 1991: Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, United Kingdom.

[8] For the sake of simplicity, the term "chemical" fertilisers is used in this document as it corresponds to the term used in the Nitrates Directive. Sources commonly refer to the term "inorganic" fertilisers.

[9] Source: European Commission based on FAOSTAT data.

The rise in nitrate concentrations in fresh ground and surface waters creates problems for their potential use as drinking water resources, as a high concentration of nitrates is toxic for humans and makes freshwaters unsuitable for human consumption. UN World Health Organisation guidance has for decades set a limit of 50 mg nitrates per litre as the maximum allowable concentration in potable water[10], a limit that had also been adopted in European directives on drinking water quality and protection of surface waters. Nitrate pollution therefore creates costs for treatment of drinking water and may cause risks to human health if not treated, e.g. in local rural wells. An excess supply of nitrogen and phosphorus leads to the over-fertilisation ("eutrophication") of surface waters, resulting in reduced biodiversity and resilience of aquatic ecosystems. In more extreme cases eutrophication can take the form of topic algae blooms or oxygen depletion events in lakes or coastal seas, killing fish and other aquatic life, sometimes over large areas[11]. While the Nitrates Directive does not explicitly mention phosphorus, livestock manure is a significant source of both nitrogen and phosphorus, especially in regions with large animal concentrations. The Nitrates Directive was adopted in parallel with the Urban Wastewater Treatment Directive, which aimed to address the nutrient pollution from urban wastewaters, recognised as the most important source of phosphorus to the aquatic environment at the time[12]. For more background and context on the adoption of the Nitrates Directive see **Annex VII**.

The **intervention logic** of the Nitrates Directive can be generally depicted as in Figure 2 below, setting out the needs, objectives, inputs/activities, outputs, results, and impacts, corresponding to the language and concepts currently used by the Commission's better regulation guidelines.

The **societal needs** that the Nitrates Directive was designed to address stand out clearly from the recitals of the directive, which note that the nitrate content of water in some Member States was increasing and was already high compared with standards laid down in existing legislation on waters intended for human consumption, and that there was a need for the protection of the North Sea and other waters in the Community. To protect human health, living resources and aquatic ecosystems and to safeguard other uses of water, it was therefore necessary to reduce water pollution caused or induced by nitrates from agricultural sources and to prevent further such pollution. On this background, the Fourth Environmental Action Programme [19] had indicated in 1987 that the Commission intended to present a proposal on the control and reduction of water pollution resulting from the spreading or discharge of livestock effluents and the excessive use of fertilisers[13].

[10] WHO guidelines for drinking water quality (GDWQ)

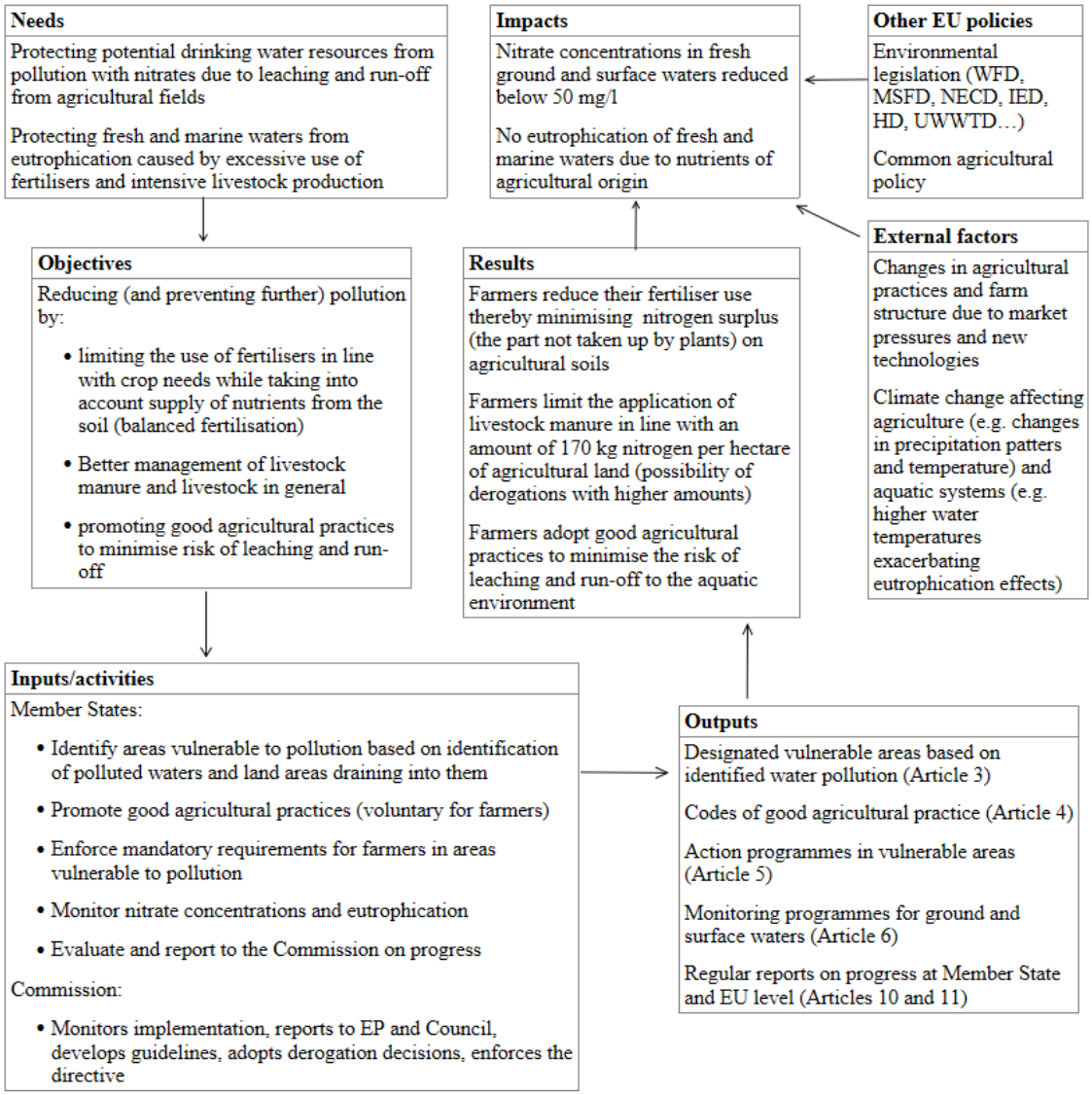
[11] While nitrogen tends to be the most important factor in the eutrophication of marine waters, phosphorus tends to be more important in freshwater systems. However, in practice the interplay between the two is complex and varies according to local circumstances.

[12] In 2001, based on the assessments by international sea conventions during the 1990s and on earlier literature and measurements since 1985, the EEA concluded "that eutrophication of marine waters caused by excess load with nitrogen and phosphorus nutrients from human activities is a major problem in many European coastal areas. [18]

[13] The Nitrates Directive contributes to the achievement of several UN Sustainable Development Goals (SDG). It contributes to achieving SDG 6 (Clean Water and Sanitation) and SDG 14 (Life below water) by preventing and reducing eutrophication and harm of aquatic life. The Directive also contributes to the achievement of SDG 12 (Responsible Consumption and Production) by encouraging the adoption of sustainable agriculture practices and to SDG 13 (Climate Action) by promoting more efficient use of nitrogen fertilizers. Finally, it

Article 1 of the Nitrates Directive defines its **objectives** in general terms as "reducing water pollution caused or induced by nitrates from agricultural sources and preventing further such pollution". Pollution is defined in terms of nitrate concentrations in fresh ground and surface waters exceeding the drinking water standard of 50 mg nitrates per litre or the eutrophication of surface waters (Annex I of the directive). Specific objectives include limiting fertiliser use ("balanced fertilisation"), limiting livestock manure application, and promoting good agricultural practices. The recitals of the directive refer to the need to address "excessive use of fertilisers" and to "control the problem arising from intensive livestock production", where high livestock numbers in some regions have made it difficult to dispose of the resulting livestock manure without a negative impact on the environment.

Figure 2 Intervention logic of the Nitrates Directive.



In operational terms, the directive envisages several **activities** to be carried out. Member States should put in place monitoring to identify waters affected by pollution. On this basis, they either designate the land areas contributing to the pollution as "nitrate vulnerable

can also help to the achievement of SDG 2 (Zero Hunger) by promoting sustainable food production via practices that reduce nitrate pollution and maintain soil fertility.

zones" (NVZ) and enforce mandatory measures for farms within these areas, or they decide to apply mandatory measures across their entire territory[14]. The directive leaves wide discretion to Member States to design the measures in line with local circumstances, setting out only the main types of measures to be included (for details, see box 1). A key measure is the application of "balanced fertilisation". This means that when applying fertilisers to a crop, account should be taken of the nitrogen needs of the crop as well as of other sources of nitrogen to the crop, such as the nitrogen available in the soil at the start of the growing season, nitrogen being made available from the mineralisation of organic nitrogen reserves in the soil, and the addition of nitrogen compounds from livestock manure. Compared to chemical fertilisers, livestock manure is associated with higher risks of nitrogen losses due to a more unpredictable release of nitrogen to the soil[15], a high risk of ammonia emissions[16], and as a result, lower overall ***nutrient use efficiency***[17]. The fact that livestock manure is continuously available and needs to be disposed of regardless of crop needs further increases the risks. Manure, as already mentioned, is also a major source of phosphorus. The directive therefore limits the application of livestock manure in vulnerable zones to the equivalent of 170 kg of nitrogen per hectare per year, broadly corresponding to a livestock density of 2 livestock units (LSU) per hectare[18]. The directive provides flexibility to set a higher amount where justified[19]. Apart from these quantitative limitations on the use of fertilisers and manure, the directive identifies good practices for the handling of fertilisers and manure on farms to minimise the risk of losses. A set of core practices should always be included in the national implementation. Others are indicated as optional.

Member States should also continue to monitor the state of their waters in terms of nitrate concentrations and eutrophication and report on progress every four years. The European Commission in turn is charged with ensuring overall implementation, reporting to the European Parliament and Council, developing guidance, adopting derogations from the livestock manure limit, and enforcing the directive through cooperation and dialogue with Member States and if needed infringement procedures.

[14] Member States are also required to promote good practices through training and information for farms.

[15] A large share of the nitrogen in manure comes in organic form and is released slowly over several years.

[16] Ammonia emissions to the air later result in the deposition of nitrogen from the air, which can provide a significant additional contribution to the nitrogen balance in agricultural soils. In natural areas, lakes and coastal seas this can result in the eutrophication of natural ecosystems.

[17] Nutrient use efficiency refers to the share of nutrient contained in a fertiliser that is taken up in the crop. This varies depending on crop, application method, fertiliser type and other factors. For the EU as a whole, overall nitrogen use efficiency has been estimated to around 60 % [20], meaning that around 40% of nitrogen is lost in the environment. The losses are higher for organic fertilisers such as manure. When planning the application of fertilisers, the use of organic fertilisers (such as manure) is typically counted based on their relative efficiency in comparison with mineral fertiliser, based on the share of nitrogen that is expected to be available to the crop in the course of the growing season. This fertiliser replacement value (or equivalency) can vary significantly, with examples of first year equivalencies ranging from around 20-40% for solid manures to 30-70% for slurries, translating into significantly higher losses than for mineral nitrogen fertilisers. Repeated applications over several years increases the long-term fertiliser replacement value of manure due to a build-up of organic nitrogen in the soil [21].

[18] The original Commission proposal referred to a requirement for Member States to ensure that the amount of livestock manure applied to the soil would not exceed the amount produced by 2 dairy cows or by the equivalent number of other animal types [22].

[19] For the first four-year action programme, Member States could decide to apply a limit of 210 kg, roughly corresponding to 2 ½ LSU/ha. After this first programming period, the directive requires any derogations to be approved by the Commission and the Member States via a comitology procedure.

Box 1: Annex II and III of the Nitrates Directive specify the types of measures that Member States should require farms to take in vulnerable zones. They are listed below with a brief explanation of how they reduce pollution risks. The measures are further discussed in section 4 and detailed explanations can be found in Annex XI.

The measures that Member States should always include in their action programmes concern:

- ***periods when the land application of different types of fertilisers is prohibited***: autumn and winter application of fertilisers (including manure) increases the risk of nitrate leaching, because crop nitrogen uptake during the autumn/winter period is generally low and there is sufficient over-winter rainfall to transport manure derived nitrate beyond crop rooting depth. Bare land also creates higher risks of runoff. The rules are set by national authorities, taking account of local climatic and other conditions.

- ***land application on water-saturated, flooded, frozen or snow-covered ground***: Soils that are frozen or covered in water or snow tend to have a high risk of overland flow and run-off. It is therefore a basic precaution to avoid spreading fertilisers or manure under such conditions. In the absence of rules, farmers may be tempted to spread manure on frozen soils in early spring, as these can better withstand heavy machinery, or they may be tempted to bring manures out on wet or snow-covered soils if their manure storages are full.

- ***the capacity of storage vessels for livestock manure, which must exceed that required for storage throughout the prohibition period***: storage in autumn and winter allows farms to valorise livestock manure as fertiliser in spring. This enhances overall nitrogen use efficiency on the farm, reduces the need for chemical fertilisers, and mitigates the risk of leaching and run-off. Insufficient storage capacity can lead to the untimely spreading of manure during winter or early spring. The capacity requirements are set by the national authorities.

- ***limitation of the land application of fertilisers based on a balance between the foreseeable nitrogen requirement of the crops and the nitrogen supply from all sources (balanced fertilisation)***: setting the right amount of fertiliser for the crop is one of the most important factors in limiting the leaching of excess nitrates. Leaching can be minimised through carefully estimating expected yields and available nitrogen in the soil and by taking into account soil characteristics and climate. Rules or limits are set by national authorities in line with local conditions and scientific evidence. The absence of rules or explicit limits can push farms to apply more than a precautionary approach would suggest.

- ***the amount of livestock manure that can be applied to the land each year (maximum 170 kg nitrogen per hectare, or higher amounts in the case of derogations)***: livestock manures are associated with specific risks, due to their organic nature and the need for farms to dispose of them regardless of crop needs. The 170 kg limit is a precautionary measure meant to mitigate these risks. Derogations can be granted to Member States via a comitology procedure where it can be justified that a higher amount would not undermine the objectives of the directive.

- ***land application on steeply sloping ground***: slopes increase the risk of soil erosion and run-off from agricultural fields, which can result in the concentration of nutrients in low-lying areas or in watercourses. The risks can be mitigated by the choice of crop and other agricultural practices, including restrictions on fertiliser use.

- ***the conditions for land application of fertiliser near water courses***: restricting the spreading of fertilisers within a buffer strip along watercourses can reduce the risk of runoff, leaching and direct deposition of fertiliser on the water. The width of the buffer strip needed can depend on a variety of factors including the type of fertiliser, slope of the land, cropping and tillage practices, the use of precision techniques and equipment, and whether the buffer has a permanent plant cover such as grasses, shrubs or trees.

Member States may also include additional measures, notably in relation to:

- ***land use management, including crop rotations and share of permanent crops***: agricultural crops have different risk profiles when it comes to nitrate leaching and run-off. Examples of risky crops are maize, potatoes and vegetables. Risks can be reduced by including a rest crops (grass, alfalfa) or set-aside requirement in the crop rotation. Grass is associated with lower risk due to a longer growing season. Derogations from the manure application limit are generally conditioned on having a minimum share of grassland on the farm.

- ***minimum vegetation cover during sensitive periods***: Cover/catch crops cover the soil between two main crops, catching the residual nitrate in the soil and retaining it during winter, releasing it again in spring. In this way, cover/catch crops reduce nitrate leaching and increase the transfer of nitrogen to the subsequent crop.

- ***fertiliser planning and record keeping***: this measure complements the balanced fertilisation requirement, as fertiliser planning is one of the steps contributing to this and record keeping can facilitate compliance checks by public authorities. Most Member States have implemented these requirements in some form or another.

- ***irrigation systems***: while increasing crop yield and nutrient uptake, irrigation also increases the water content in soils, increasing the risk of leaching and runoff. Good irrigation management can help manage these risks.

The concrete **outputs** of these activities are set out in the provisions of the directive. NVZ should be designated by the Member States based on the identification of polluted waters (Article 3). Codes of good agricultural practice should be established, implemented by farms on a voluntary basis, and promoted through training and information for farms (Article 4). Action programmes should be established and enforced in NVZ with mandatory measures applicable to farms in those areas (Article 5). Monitoring of waters should be established and implemented (Article 6). The Member States should prepare reports to the Commission every four years (Article 10) on the basis of which the Commission should report to the European Parliament and Council (Article 11).

The expected **results** of the intervention can be broadly defined in terms of addressing the three specific objectives set out. Fertiliser use in all Member States should be limited in line with crop needs and available nitrogen in the soil (balanced fertilisation). Management of livestock should be improved by limiting the application of livestock manure to 170 kg nitrogen per hectare per year on farm level (or the derogation amount) in NVZ. Agricultural practices should be put in place and be mandatory for farms in the NVZ minimising the risk of water pollution due to leaching and run-off from fields. A key result indicator is the so-called ***nitrogen balance***, which compares the inputs of nitrogen from fertilisers (including manure) and other sources (deposition from air, biological fixation in soil) with the removals in the form of nitrogen contained in the crop harvested[20]. The balance is an indicator of the degree to which farms have achieved the objective of balanced fertilisation. It is also a good indicator of the risk of nitrogen losses in the form of nitrate and ammonia emissions from the farm.

The expected **impacts** relate to the overall policy needs identified. Elevated nitrate concentrations in surface and groundwaters stemming from agricultural sources should eventually be reduced throughout the EU to ensure compliance with health standards for drinking water (50 mg/l) and address eutrophication of fresh and marine surface waters caused by agricultural nutrients. The causal links between fertiliser use and water quality are illustrated in Figure 3 and Figure 4 below. Figure 3 shows how the nitrogen in fertilisers and manure passes through different states in the soil as it is processed by plants and microorganisms. It ultimately leaves the soil through either harvesting of crops, gaseous emissions to air, soil erosion and runoff to surface waters, or leaching to groundwater. Figure 4 shows in schematic form how the increase in fertiliser use in the latter part of the 20th century was reflected over time in higher nitrate concentrations within shallow and deep groundwaters as well as in groundwater discharge to surface waters, illustrating the direct causal link between fertiliser use and nitrates concentrations in water.

Agriculture is the main contributor of nitrates to groundwaters and the main diffuse source of nitrates in surface waters. Deep groundwaters act as a long-term sink for nitrates, which can build up and stay for a very long time. Shallow groundwaters react more quickly to changes in the level of inputs over time. Surface waters (streams and lakes etc.) in turn react with different time-lags depending on the surrounding geohydrological conditions and the relative share of the water that is supplied through respectively overland flow and discharge from shallow or deeper groundwaters. Where discharge from deeper groundwater is more important, nitrate concentrations in surface water react more slowly.

[20] Glossary:Gross nitrogen balance - Statistics Explained - Eurostat

Nitrates – together with phosphates[21] - cause eutrophication in surface waters. The level of nutrients in surface water depends not only on agricultural contributions but also on background flows as well as discharge of wastewaters from urban areas, emissions from scattered housing not connected to the sewage network, deposition from the air etc. Nutrients also build up in sediments with the result that eutrophication effects can continue for a long time after the original source of the pollution has been reduced.

Figure 3 The flow of nitrogen from fertilisers and manure through the soil[22]

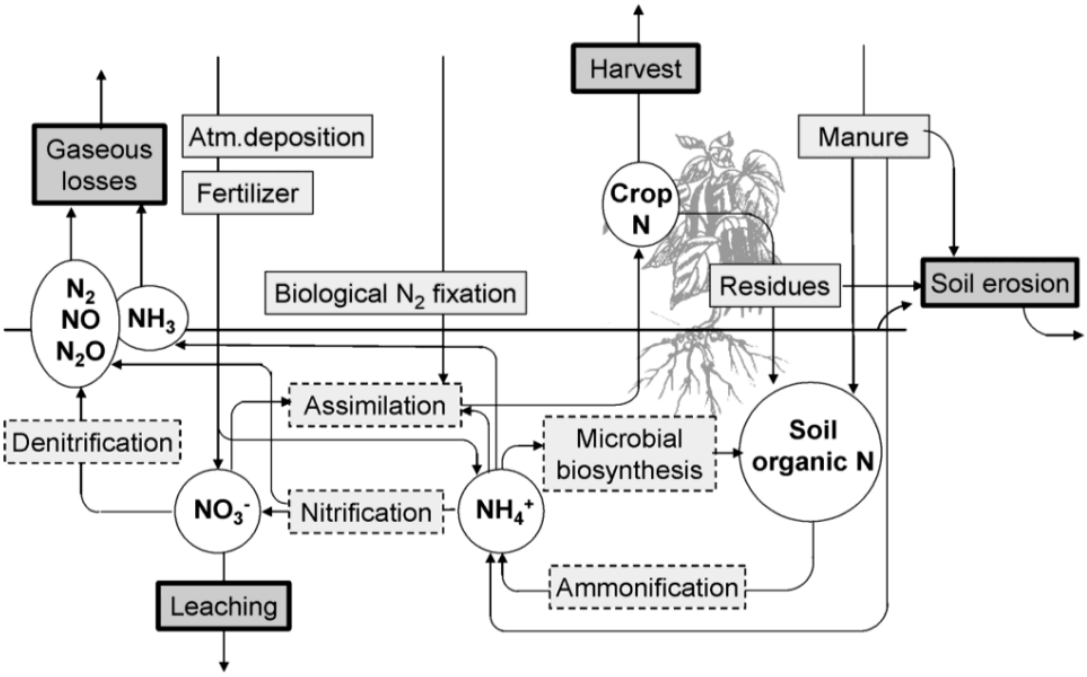
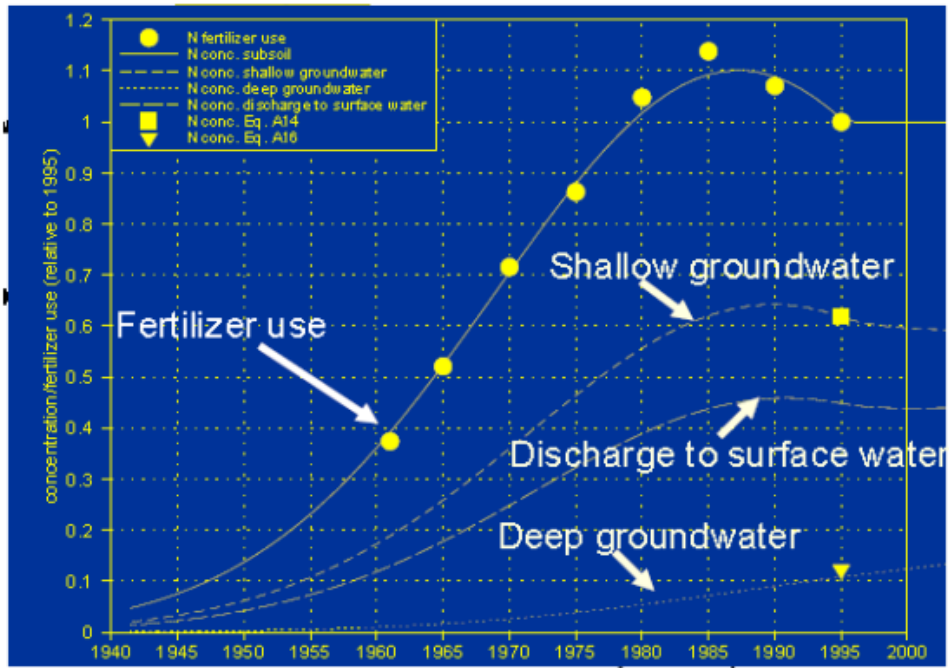


Figure 4 Evolution in fertiliser use and nitrate concentrations in groundwaters[23]



[21] Phosphorus is typically the limiting factor in rivers and lakes and nitrogen is important in coastal waters.
[22] Source: Recommendation for establishing action programmes PART C (2011), p. 22. [21]
[23] Source: Recommendation for establishing action programmes PART C (2011). p. 53. [21]

Box 2: eutrophication

The Nitrates Directive defines eutrophication as "the enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned". In practice, eutrophication is the result of a complex interaction of both nitrogen (N) and phosphorus (P) in the aquatic environment. Both nutrients are necessary for plant growth. Their abundance varies across aquatic systems (rivers, lakes, estuaries, coastal and marine waters), and these systems have adapted to this (relative) abundance. Freshwater systems tend to be P limited whereas saline systems tend to be N limited.

An increase in the abundance of the limiting nutrient brings the system out of balance by accelerating plant growth beyond the normal level. The main causes of such an overabundance of nutrients include the leaching and runoff of nutrients from agriculture, urban and industrial wastewater discharges, and atmospheric deposition due to air pollution (especially for marine systems).

The concrete manifestations of eutrophication include the occurrence of harmful algal blooms (e.g. cyanobacteria), a general overabundance of algae and plant growth, lack of transparency in the water column, incidences of hypoxia (lack of oxygen) in bottom waters, resulting in dead zones and fish kills. Longer term effects include a reduction in biodiversity with the possible spread of opportunistic species at the detriment of more vulnerable species that are native to the ecosystem as well as a general impoverishment of the system.

The assessment of eutrophication is closely related to the assessment of ecological status under the Water Framework Directive (CIS Guidance Document No 23, EC 2009). The assessment is based on biological and physico-chemical criteria as set out in the table below. The assessment also includes supporting elements such as nutrient status, i.e. the relative abundance of N and/or P. Generally, water bodies are considered to be affected by eutrophication if they are in less than good status.

Ecological Status	WFD normative definition	Primary impacts (e.g. phytoplankton biomass)	Secondary impacts (e.g. O_2 deficiency)
High	Nearly undisturbed conditions	None	None
Good	Slight change in abundance, composition or biomass for relevant biological quality elements	Slight	None or only slight
Moderate	Moderate change in composition or biomass for relevant biological quality elements	Change in biomass, abundance and composition begins to be environmentally significant, i.e. pollution tolerant species more common.	Occasional impacts from increased biomass
Poor	Major change in biological communities	Pollution sensitive species no longer common. Persistent blooms of pollution tolerant species	Secondary impacts common and occasionally severe
Bad	Severe change in biological comm.	Totally dominated by pollution tolerant species	Severe impacts common

Eutrophication is a complex phenomenon, which is not always straight forward to measure with a high level of certainty. More importantly, some of its effects can be long-term and can interact with other factors, such as physical or chemical impacts. While nitrate concentrations provide a clear indicator of the potability of ground and surface waters, the eutrophication assessment cannot be pinned down to a single variable in the same way.

Various methodologies have been developed to estimate the nutrient threshold associated with conditions supporting good status in different types of water bodies. Once these thresholds are reached it is then assumed that the system may adjust over time and ultimately recover its good ecological status, but the process can take a very long time to fully play out. Once certain species have disappeared from an ecosystem, they take time to come back.

While reaching the necessary reduction in nutrient flows may already be a major challenge in and of itself, the challenge is further aggravated by the fact that nutrients can continue to linger in the environment for long periods after they have been released. This is particularly the case for phosphorus, which accumulates in soils and sediments, from where it can be released slowly over time. Nitrogen is less persistent, as it can be released to the atmosphere through denitrification, but it can also stay around for an extended period embedded in organic material. As a result, once nutrient flows have been reduced, it will take time for nutrient levels to adjust downwards as well.

2.2 Points of comparison

When the Nitrates Directive was adopted in 1991 it did not undergo a formal impact assessment. It is therefore not possible to compare with the original scenario of how the achievement of the directive's objectives was intended to play out. It is evident that the aim of the directive was to satisfy the quality standards for waters corresponding to the **impact indicators** in the intervention logic above: reducing concentrations in freshwaters below 50 mg nitrate per litre and addressing agriculture's contribution to the eutrophication of fresh and marine surface waters. However, the directive does not define a timeline for the attainment of its objectives[24]. The recitals to the directive explicitly recognise that the hydrogeology in certain Member States is such that it may be many years before measures lead to improvements in water quality. Indeed, groundwater aquifers and natural ecosystems may respond to a reduction in inputs over the course of many years, even decades in some cases, before fully reflecting the lower input. For groundwaters, this is due to the residence time of groundwater in different parts of the soil profile. For eutrophication, long lag times can be due to retention of organic material in bottom sediments of rivers, lakes and coastal seas and the retention of phosphorus in riparian soils, meaning that initial inputs from agriculture can continue to have residual impacts over several decades. In addition to this comes the complex dynamics of ecosystems, which may take a long time to recover from significant disturbances. The directive is based on a clear recognition of the long-term nature of the challenges to be addressed. The directive therefore does not require that Member States ensure immediate compliance with the water quality standards set out in the directive, which would indeed be impossible, but that they put in place effective measures to prevent further deterioration and to reduce the pollution already accumulated, which would allow waters to reach quality standards within a reasonable timeframe. As a result, the impact indicators may take a long time to properly reflect improvements resulting from the intervention under the Nitrates Directive. For this reason, it is also relevant to look at the evolution of intermediate indicators for agricultural inputs, corresponding to the **result indicators** in the intervention logic: manure and fertiliser inputs, nitrogen balances and the implementation of good agricultural practices. These variables should provide an idea of how the directive has been able to reduce the agricultural pressures ultimately affecting the level of pollution.

It should also be recognised that the Nitrates Directive is not alone in addressing nutrient pollution of waters and that various **other EU policies as well as external factors** have played a role in affecting outcomes. Relevant EU policies include the broader water acquis, which has evolved significantly since the adoption of the Nitrates Directive. The Urban Wastewater Treatment Directive (UWWTD)[25], also originally adopted in 1991, can be regarded as a sister directive to the Nitrates Directive, addressing nitrogen and phosphorus in effluents from urban wastewater discharge, the main source of eutrophication of surface waters besides agriculture. In 2000 the Water Framework Directive (WFD) introduced an overarching legal framework for water policy in the EU, with comprehensive water quality objectives and deadlines, significantly changing the policy context for the Nitrates Directive's implementation. In particular, the WFD set a deadline by the end of 2027 for Member States to ensure that all ground and surface water bodies in the EU reach at least 'good' status in line with certain conditions. In 2008 the Marine Strategy Framework

[24] Article 1 rather sets an open-ended objective to "reduce" and "prevent" pollution.

[25] References to all EU legislation cited in this evaluation can be found at the back of this document.

Directive (MSFD) set out a general framework to improve the state of marine waters, including on eutrophication. Relevant EU legislation also includes the National Emission reduction Commitments Directive (NECD), which aims to reduce emissions of certain air pollutants including ammonia, and the Industrial Emissions Directive (IED), introducing requirements for industrial permitting for large pig and poultry farms to reduce their environmental impacts. Finally, the Common Agricultural Policy (CAP) plays a key role in defining the framework conditions and public interventions for the agricultural sector in the EU, and the successive CAP reforms have played an important role in the implementation of the Nitrates Directive. Apart from policy interventions, other external factors also have had an impact on outcomes, such as global and regional markets within which the agricultural sector functions, the evolution of agricultural practices and technologies, consolidation and specialisation of farms. Climate change also affects outcomes by making the management of nutrient losses on farms more challenging, and by directly impacting the response of the aquatic environment to nutrients, exacerbating eutrophication. The analysis below will cover these factors more thoroughly.

All in all, the context is a complex one and it is not always straightforward to fully separate the impacts of the Nitrates Directive from those of the various other factors.

Section 3 will provide data on the evolution in the various indicators, including water quality, fertiliser and manure inputs, as well as nitrogen balances. Section 3 will also highlight the external factors that have had an impact on the evolution of these indicators. See Annex II for a further discussion of the methodological approach to this aspect.

3. HAS THE SITUATION EVOLVED OVER THE EVALUATION PERIOD?

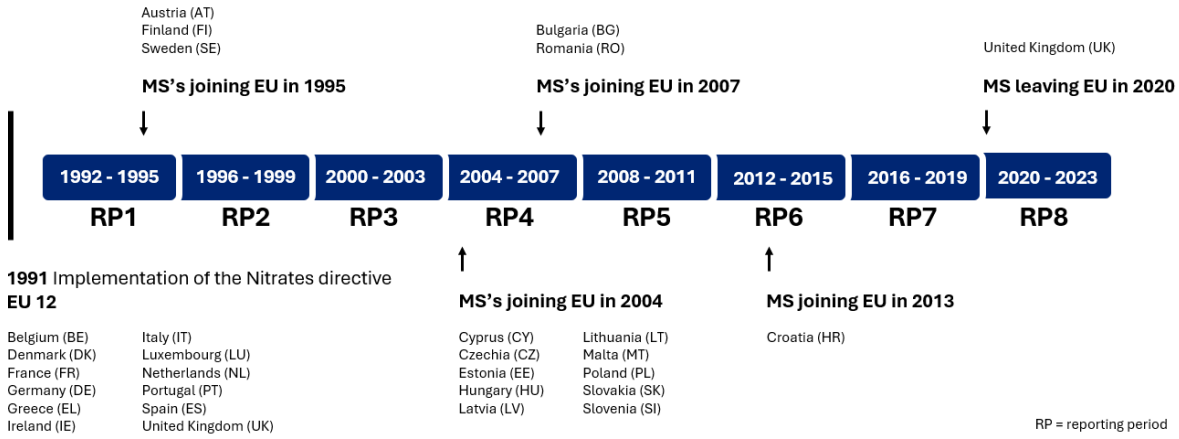
3.1 Implementation of the Nitrates Directive

The Nitrates Directive is based on a four-year implementation cycle (Figure 5). Based on reports received from the Member States, the Commission presents an overview of progress in an implementation report to the European Parliament and the Council every four years[26]. Each reporting period (RP) comprises a cycle of obligations to be implemented under the Nitrates Directive, as Member States are required to monitor waters and identify polluted waters, review their NVZ and action programmes every four years, and to revise them where needed. In this way, the directive set out a coherent policy cycle to be reiterated every four years up until today (Figure 6). The transposition and implementation of the Nitrates Directive since 1991 is described further in Annex VIII.

Figure 5 Implementation cycle of the Nitrates Directive

[26] Nitrates - European Commission

Figure 6 Graphic representation of implementation cycles and enlargements



In the majority of Member States, the responsibility for the implementation of the Directive is coordinated through several ministries, primarily ministries responsible for water protection and agriculture.

The initial transposition and implementation in the Member States showed significant delays and transposition issues. The 2012 Fitness Check of EU Freshwater Policy [23] found that the implementation of the Nitrates Directive had been slow overall and that problems persisted, mainly in relation to insufficient designation of NVZ and non-conformity of action programmes. During the next cycles, Member States kept reviewing their action programmes and designation of NVZ, with the Commission promoting full implementation of the various obligations under the Directive, with the development of guidelines, exchanges of good practices and through infringement procedures (see Annex VIII).

The overall cycle of the Nitrates Directive is now well established, with Member States making use of their flexibility in approaching the review and revision of NVZ and action programmes. Experience shows that a four-year implementation cycle can be tight, as updating NVZ and reviewing action programmes, including assessments and consultation requirements, takes time. The implementation of the Nitrates Directive in the Member States has seen an increasing involvement of stakeholders in the various steps of the process. In 2012, the CJEU confirmed that the SEA Directive also applies to the adoption of nitrates action programmes, including an obligation of public consultation. Many Member States have established working groups with farm organisations to consult on the design of their action programmes. Some Member States have involved civil society (nature organisations) or drinking water companies in these groups.

3.1.1 Establishing water monitoring networks and identifying polluted waters

The establishment of a comprehensive water monitoring framework using a network of stations is critical for the effective implementation of the Nitrates Directive, to identify polluted waters and designate Nitrate Vulnerable Zones (NVZs). Although initial development was slow, informal guidelines from the Nitrates Committee and the adoption of the Water Framework Directive (WFD) in 2000 significantly boosted the development of the monitoring networks, as the Member States increased the density of monitoring points in subsequent reporting periods (see Annex VIII for additional details).

With the establishment of the comprehensive networks, there was steady progress in the nitrate concentration monitoring and reporting. However, the complexity of assessing the trophic status of surface waters due to varied methodologies and lack of explicit thresholds for nitrates and phosphorus concerning eutrophication delayed its effective monitoring. Guidance in 2009 [24] aimed to address these challenges, yet subsequent Commission implementation reports still highlighted difficulties in evaluating trophic status.

Since 2016, the Commission has encouraged methodologies developed by the ECOSTAT working group and to use the corresponding assessments of ecological status under the WFD. Whereas an increasing number of Member states are using the WFD assessments, the recent RP7 and RP8 reports reveal ongoing variability in approaches among Member States. (Additional information on monitoring networks is included in Annex VIII and on interactions between the monitoring under the Nitrates Directive and the WFD in Annex XV).

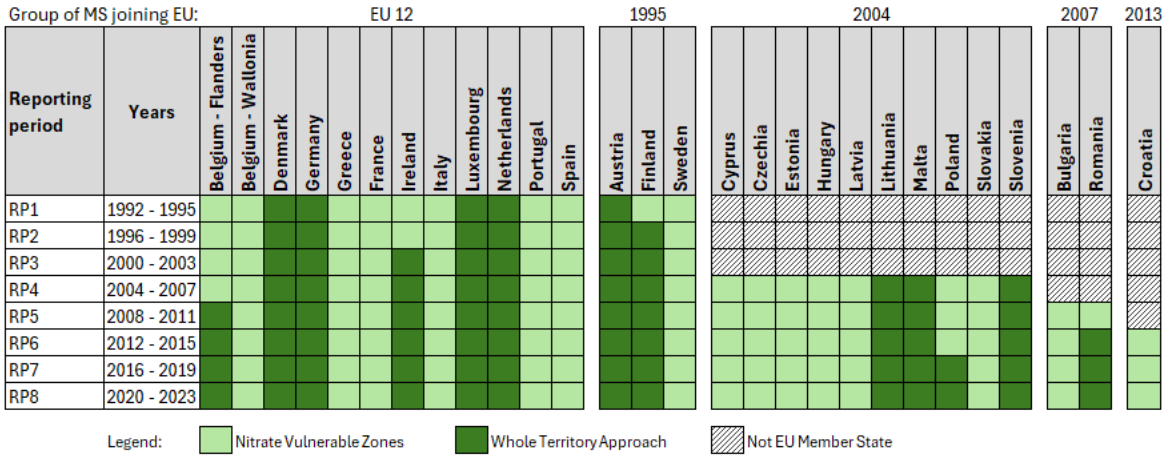
3.1.2 Designating nitrate vulnerable zones (NVZ)

Once polluted waters have been identified, Member States designate the land areas draining into these waters as NVZ, unless they implement an action programme throughout their entire national territory (whole territory approach). The designation of NVZ was initially slow. In the first three reporting cycles, the Commission noted that the designation was insufficient or that some Member States had failed to fulfil this obligation. Factors for the slow designation included the insufficiency of monitoring networks, difficulties in identifying the origin of the pollution (agriculture or urban wastewater) as well as the sensitivity of imposing mandatory measures on farms. Over the years the Commission has opened infringement proceedings due to failure to designate areas where water is polluted or at risk of being polluted or which drain into marine waters. (see Annex IX on the enforcement by the European Commission and national courts).

The whole territory approach gives Member States flexibility to dispense with the designation of NVZ, which can be complex and politically sensitive. It also gives a more equal treatment of farms across the entire country and a stronger preventive impact by enforcing good practices everywhere. It does not prevent a targeted approach, as it leaves flexibility for Member States to vary requirements geographically in line with the nitrate pollution or eutrophication challenges in different regions[27]. Figure 7 shows the use of the whole territory approach over time.

[27] Such approaches have been introduced in several Member States, including Germany, Denmark, Belgium and the Netherlands.

Figure 7 Approach adopted by Member States on designation of NVZ



The geographic extent of NVZ and Member States applying the whole territory approach in 2024 is shown in Figure 8, based on the latest reporting by Member States and covers more than two thirds of agricultural land in the EU.

Figure 8 Nitrate vulnerable zones and whole territory approaches (2024)

3.1.3 Establishing nitrates action programmes

For NVZ or in the whole territory approach, the Nitrates Directive lists the types of measures to be included in the nitrates action programmes in annexes II and III to the

Directive (see box 1). The measures aim to enforce good agricultural practices for the application of fertilisers and livestock manure to reduce the risks of pollution[28]. It is the responsibility of Member States to adapt the design of the measures according to local conditions and to the level of pollution. In several Member States, there are regional nitrates action programmes, sometimes complementing a common national programme.

In 1997, the RP1 implementation report [9] noted that few Member States had adopted an action programme. Whereas some Member States already had measures in place before the adoption of the directive, reflecting national policies, most had to develop their programmes. By the time of the RP2 implementation report [10], most Member States had adopted nitrates action programme, but the Commission concluded that several Member States still failed to implement all the required measures. After several implementation cycles the action programmes were successively strengthened, partly spurred on by infringement proceedings (See Annex IX). Cross-compliance, linking CAP payments to basic environmental requirements, introduced as part of the 2003 reform of the CAP (see Annex XVI), further strengthened the enforcement of action programmes. The RP7 implementation report [15] found that the measures listed in Annex II and Annex III of the Directive were implemented in all Member States.

As mentioned, the directive's annexes outline the type of measures that national action programs (NAPs) should include, but Member States have scope to tailor and build upon these to account for national and regional circumstances. This flexibility is crucial for tailoring measures to local circumstances such as climate, soil characteristics, and farming practices to optimize pollution reduction effectiveness. Consequently, there is a very high variability in the 76 different NAPs identified, on how the mandatory measures are implemented. Yet, the assessment of the compiled information on NAPs confirms that mandatory requirements from Annexes II and III are implemented in all MS and voluntary requirements from Annex II B in nearly all of them. There are many additional measures beyond the main requirements with variable presence in the national or regional implementations (e.g. soil sampling, design guidance for manure storage, conditions for field manure heaps). Thus, the degree of flexibility provided by the directive has not impeded the application of mandatory measures, nor the implementation of additional and stricter ones depending on the local circumstances. The directive set up a minimal common denominator on the basis of the type of measures that are valid and required in all relevant areas. Member States have also implemented additional voluntary measures under the WFD and CAP to address agricultural phosphorus loss. The measures in Annex II B of the directive are optional for the Member States, including requirements on fertiliser planning and record keeping, minimum soil cover, and crop rotation, but are widely included in the NAPs. Almost all Member States require fertiliser planning and record keeping, as it seen as facilitating implementation and control of the balanced fertilisation requirement. Moreover, most Member States applying the NVZ approach have also implemented at least some mandatory measures outside NVZ[29], further contributing to a general trend in the direction of extending mandatory measures to address pollution effectively (see also section 3.1.2 above). Annex XII of this report provides an extensive analysis of the existing

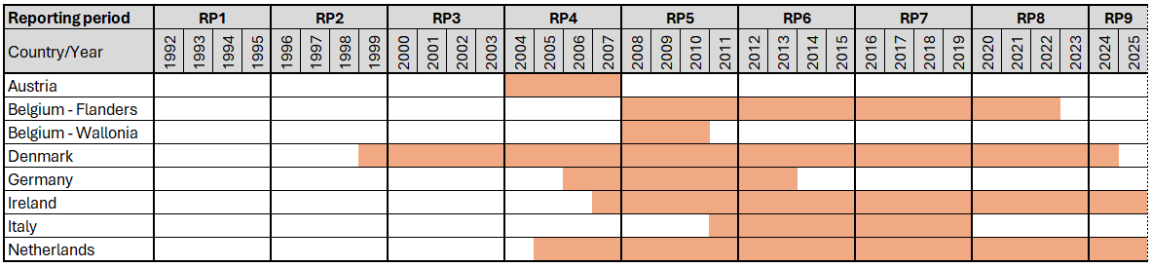
[28] Section 4 will look further into the effectiveness of the measures.

[29] Member state experts also pointed out that outside NVZs they implement measures such as buffer strips, crop rotation and minimum soil cover as part of the GAECs under the CAP.

measures across NAPs, assesses their variation and effectiveness, and provides examples of specific measures assessments.

The obligation to limit the manure application on farms inside the NVZ to 170 kg of nitrogen per hectare, is the most specifically defined measure in the directive. The limit aims to address the specific risks associated with livestock manure due to its organic nature and need for the farm to dispose of it all year round regardless of crop needs, which increases the risk of leaching and run-off. During the legislative procedure, a provision was included for derogations allowing Member States to fix different limits above 170 kg, provided these amounts are fixed so as not to prejudice the achievement of the objectives of the directive and are justified on the basis of objective criteria (e.g. long growing seasons, crops with high nitrogen uptake, high precipitation and soils with exceptional denitrification capacity etc.)[30]. While derogation requests began to be submitted already in the mid- 1990s, these were controversial with other Member States in the Nitrates Committee, and the first decision was adopted only in 2002. Figure 9 shows the evolution of derogations, reaching a peak between 2008 and 2013, where 6 Member States had derogations. In recent years, several derogations were phased out due to infringement proceedings and concerns over water quality.

Figure 9 Overview of derogations granted to Member States[31]



3.1.4 Enforcement action by the European Commission and national courts

Over the years, the Commission has taken enforcement action to ensure the correct implementation of key obligations under the directive and to ensure the effectiveness of national measures. It has included dialogue with Member States, investigation procedures[32], and where solutions could not be found at this stage, infringement cases were opened, some of them leading to rulings at the CJEU. The four-yearly implementation reports have been an important tool to keep track of progress in the Member States.

Most infringement cases that have dealt with issues related to non-conformity transposition of the directive into the Member States' national laws took place in the initial reporting periods or soon after the accession of candidate countries into the EU. Later cases dealt primarily with insufficient designation of NVZ, and more recently cases addressed the need of additional measures or reinforced actions to address water pollution identified (articles 3, 4 and 5, and Annexes II and III of the directive) (see Annex IX for an assessment on the different infringement procedures that have taken place at EU level, as well as the

[30] Also, during the first four-year action programme, a transitional limit of 210 kg was allowed, so that Member States with high livestock density and manure production had a transition period.

[31] The graph shows the currently approved derogations. Both the Irish and the Dutch derogations expire at the end of 2025.

[32] As of 2008 also through the EU Pilot mechanism.

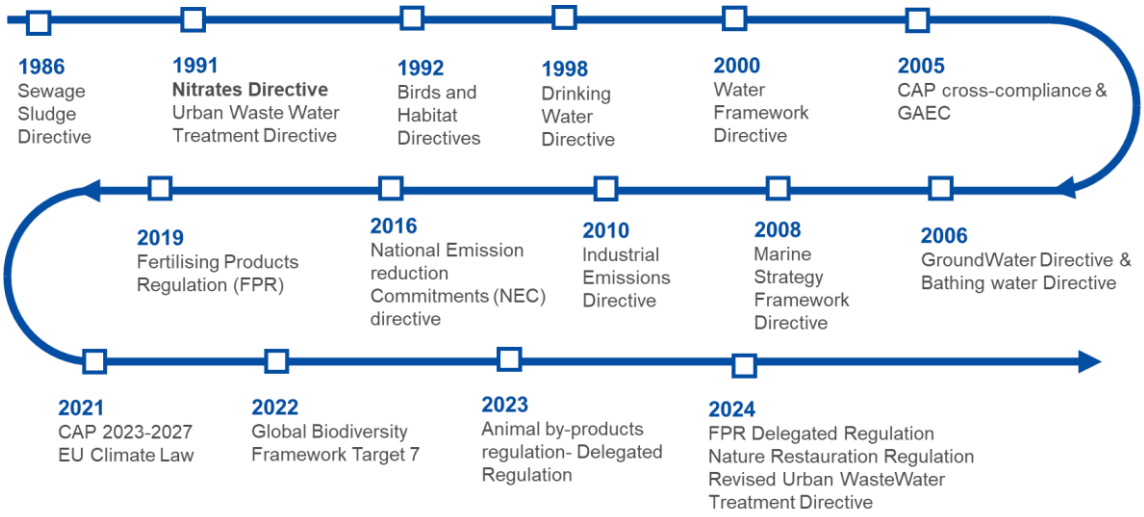
resulting court rulings). In the period 1998 to 2024 the Court issued more than 20 rulings on infringement cases brought by the Commission [26].

The enforcement actions have been essential to improve and strengthen the national implementation. Some of the rulings of the Court, also in cases referred by national courts, have provided important interpretations for the implementation of the directive and of the directive's relationship with other environmental legislation. More details on the history of legal enforcement and jurisprudence around the directive is included in Annex IX.

3.1.5 Evolution of the legal context.

The development of the EU legal framework on water, nutrients and agriculture since the adoption of the Nitrates Directive in 1991 has had a major impact on the policy context of the Nitrates Directive and on its implementation at EU and national level. Figure 10 illustrates this development. An overview of the evolution of legal context is included in **Annex X** and the interaction with other legislation is further explored in sections 3.2, 3,3 on results and impacts, and section 4 on coherence.

Figure 10 Evolution of EU legal context for the Nitrates Directive



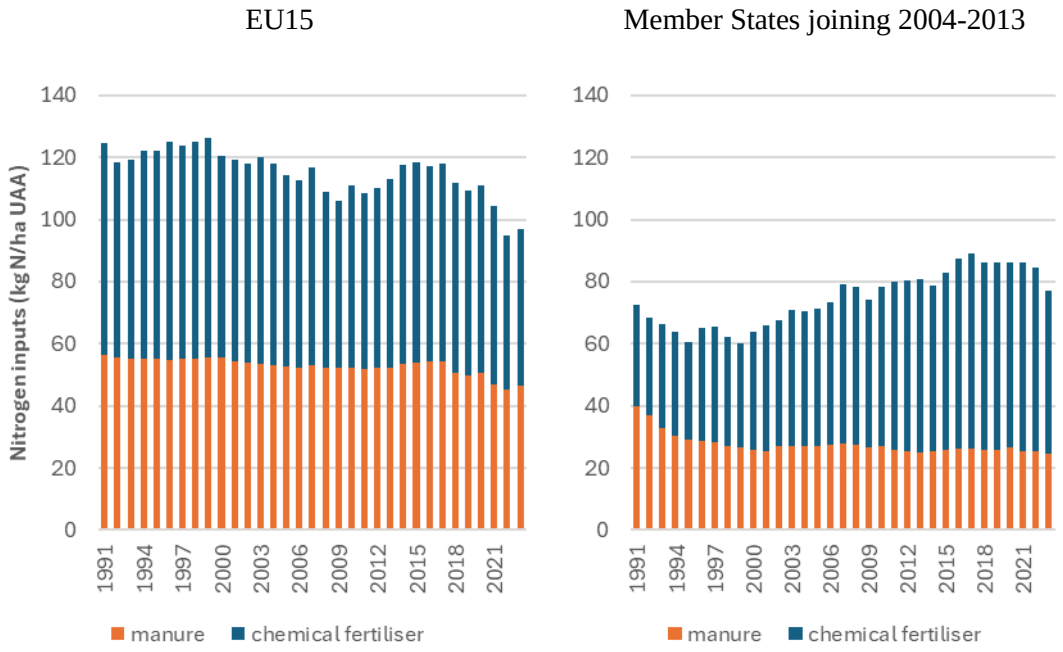
3.2 Results: Evolution in fertiliser use, livestock manure and nitrogen balances

3.2.1 Fertilisers and livestock manure

It is important to note how the use of fertilisers has evolved in the EU compared to other regions worldwide. Over the recent decades, as global food production and fertiliser use have grown, the EU's environmental laws have curtailed the use of fertilizers on farms but without affecting production. Before these regulations, chemical fertiliser use surged in the former EU28 from 1961 to the 1980s, but the increase slowed around the 1990s, stabilizing until the 2010s. During this period, farms began using nitrogen more efficiently, boosting yields and reducing nitrogen waste. Research indicates that many Member States maintained or increased crop yield while using less fertiliser, thanks to EU regulations like the Nitrates Directive that ensure balanced fertilization. Unlike Europe, countries like the USA, China, India and Brazil continued increasing their nitrogen fertiliser use. (See Annex XII section 4.1 on the implementation of measures with specific graphs on trends in nitrogen use efficiency of world cropping systems.)

Figure 1 in section 2 above showed how the nitrogen fertiliser inputs per hectare of agricultural land in the EU12 increased significantly in the decades before the adoption of the Nitrates Directive. Figure 11 below shows the evolution of nitrogen fertiliser inputs after the adoption of the Nitrates Directive for Member States that had joined by the mid-1990s and for Member States joining from 2004 onwards.

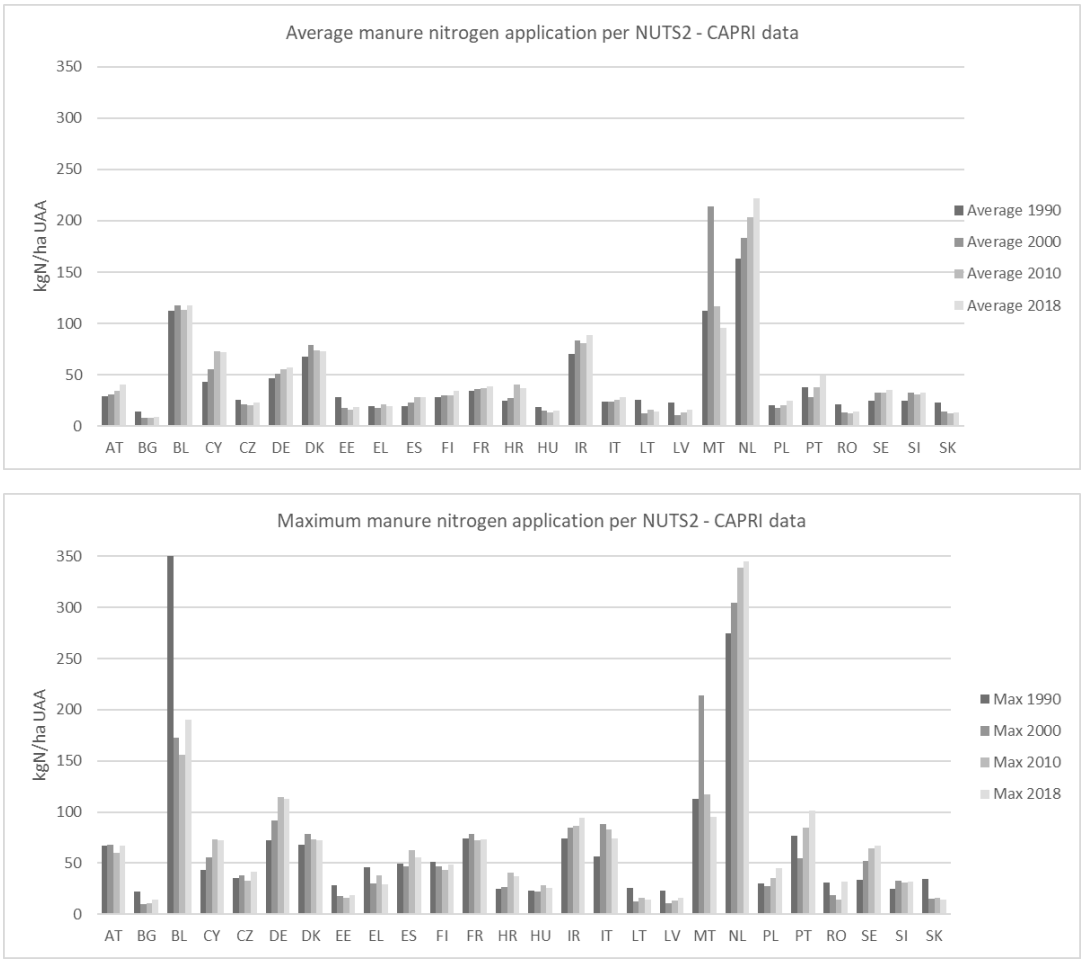
Figure 11 Nitrogen fertiliser inputs in the period 1991-2023 (kg N/ha)[33]



The graph shows a 15% reduction in the EU15[34] between 1991 and 2009, followed by a temporary increase in the 2010s after which the inputs level off again, [35]. The aggregate data for Member States joining the EU since 2004 show a drop in inputs in the early 1990s due to the reduction in the use of manure[36] followed by sustained increases of chemical inputs since the 1990s, with total inputs remaining below those in the EU15[37]. For all Member States, the main driver of short-term fluctuations over time is the input from chemical fertilisers. Manure input, dependent on livestock production levels, has generally been more stable but with a downward trend, except for a temporary spike in the mid-2010s in the older Member States followed by a renewed reduction in recent years. The level of manure input per hectare differs significantly between Member States and between individual regions within Member States. Figure 12 depicts the evolution in average nitrogen inputs from manure per hectare in EU Member States since 1990 for each Member State as a whole and for the NUTS2 regions with the highest manure application rate in each Member State. Annex XII provides further data on the temporal evolution of manure production.

[33] Based on FAOSTAT data.
[34] The EU12 plus Finland, Sweden and Austria who joined in 1995.
[35] The additional drop in 2022 and 2023 should be seen in the context of the Ukraine war and the related spike in fertiliser prices.
[36] This likely reflects the disruption connected with the economic transition of Central and Eastern European countries in the 1990s.
[37] Again, the reduction for chemical fertilisers in 2022 and 2023 is likely due to the extraordinary increase in fertiliser prices those years.

Figure 12 Manure nitrogen application rates per hectare of utilised agricultural area in EU27, according to CAPRI model data: average rates (top) and maximum rates (bottom) by NUTS2 region. *BL: BE and LU. (*Source: JRC* [8])



The Nitrates Directive does not set limits to the application of phosphorus in fertilisers [38]. In practice, however, the limit on livestock manure expressed in relation to nitrogen plays an important role in this respect, as livestock manure is a significant source of phosphorus in regions with high livestock concentrations. The phosphorus content varies depending on the animal type, but generally the 170 kg limit for nitrogen tends to result in an amount of phosphorus that exceeds crop needs in most cases, especially in regions with high legacy phosphorus content in agricultural soils. Due to the role of phosphorus in eutrophication, more than half of the Member States set specific limits for the amount of phosphorus applied to agricultural land[39] and have specific fertiliser rules on it. Some also put limits on animal production based on the phosphorus content in the livestock manure produced[40]. Annex XII provides further detail on existing measures on phosphorus across the Member States.

[38] Phosphorus inputs differ significantly cross the EU and many areas continue to have significant annual surpluses as well as phosphorus built up over many years in soils [8]

[39] In the Member States around the Baltic Sea such limits are for example promoted by HELCOM under which guidance exists that livestock manure application should be limited to 170 kg nitrogen and 25 kg phosphorus per hectare per year (Helsinki Convention, Annex III, point 8).

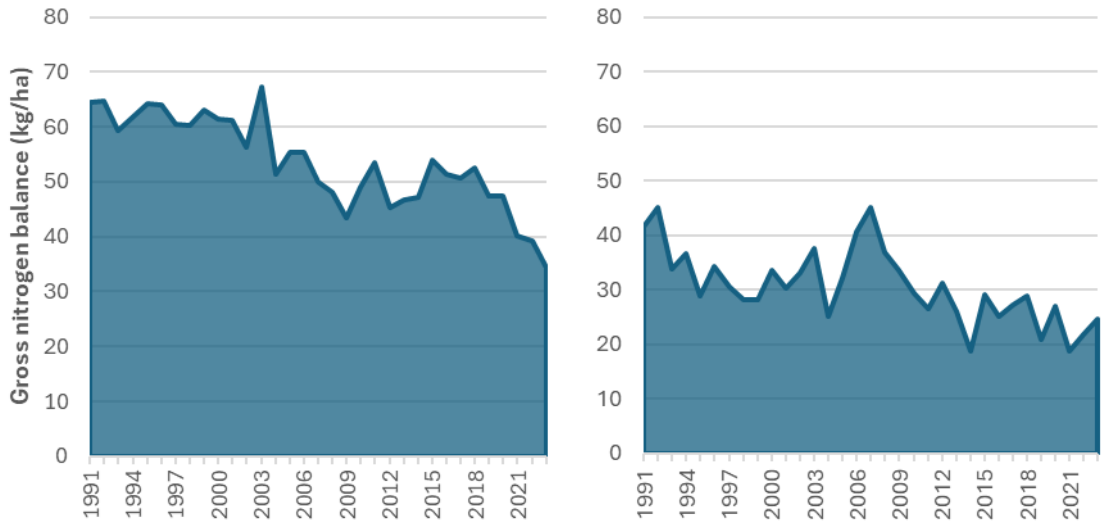
[40] For example, the Netherlands.

3.2.2 Nitrogen balances

The nitrogen balance per hectare of agricultural land is a key indicator of the success that farms have had in implementing balanced fertilisation, in reducing the resulting nutrient pressure from agriculture, and in reducing the risk of nitrogen losses to water and air[41]. Eurostat keeps a data series of balances going back to the 1980s based on data reported by Member States[42]. Figure 13 shows the evolution 1991-2023 in Member States for which data are available for the whole period[43]. The graph on the left shows the evolution in seven Member States that were members already in the 1990s. It shows a significant reduction of the average between 1991 and 2009, after which there was a temporary increase, followed by a renewed reduction. This is coherent with the evolution of inputs shown in Figure 11. The graph on the right shows the evolution for seven Member Stats that joined since 2004. Here there has been a downward trend since the early 1990s[44]. The evolution in balances for each Member State since the start of the Nitrates Directive implementation is shown in Figure 14 below. It shows a general downward trend in most of the Member States, but with significant variations in the overall amounts and the temporal evolution. Understandably, the decrease is less pronounced in Member States with low nitrogen balance from the start.

Figure 13 Evolution of the gross nitrogen balance since 1991 (based on Eurostat data)

7 Member States since the 1990s (EU15)[45] 7 Member States joining since 2004[46]



[41] It has been estimated that on average near 40% of nitrogen added to agricultural soils is lost, mainly in the form of ammonia emissions, nitrogen runoff and nitrate leaching. See [20].

[42] The gross nitrogen balance, see Statistics | Eurostat. The coverage varies among the Member States with significant data gaps over the years, including after 2014. DG ESTAT launched a voluntary exercise with Member States to fill in data gaps on nutrient balances with improved comparability. The collection of data on nutrients balances will become mandatory as of 2026 under regulation EU/2022/2379.

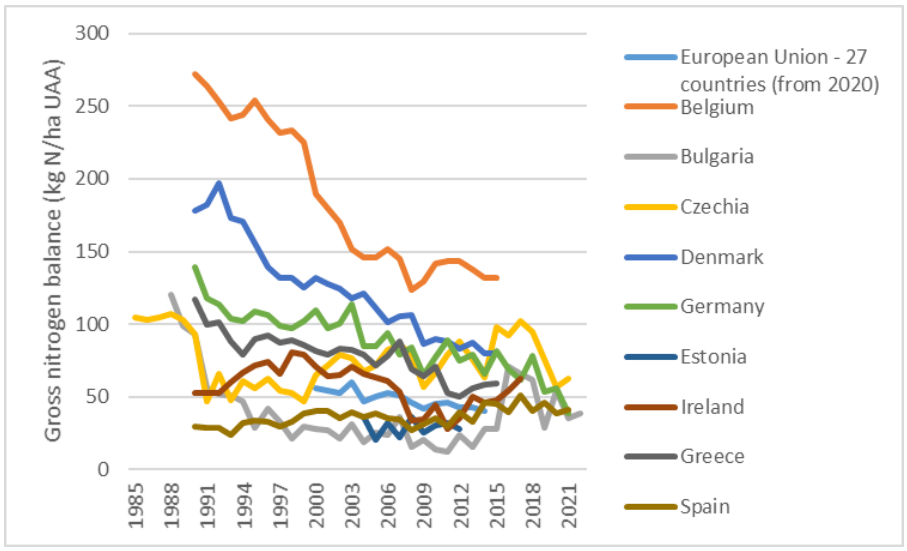
[43] These Member States cover the large majority of agriculture in the EU, even if some significant producer countries are missing (e.g. Belgium and Denmark are not included due to incomplete data).

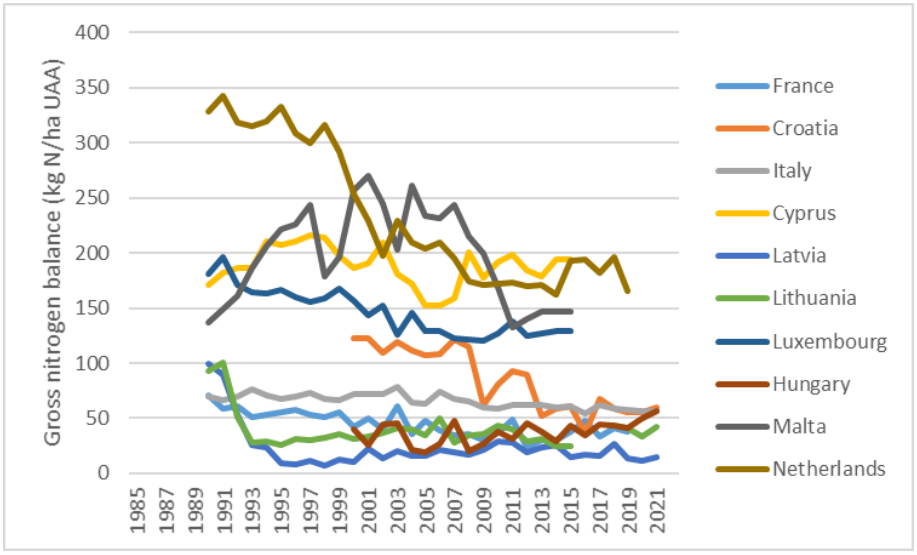
[44] The parallel increase in inputs and reduction in the balance is likely explained by an increase in agricultural productivity in these Member States, with most of the added inputs being reflected in higher yields, which was possible due to relatively low agricultural productivity at the start of the period.

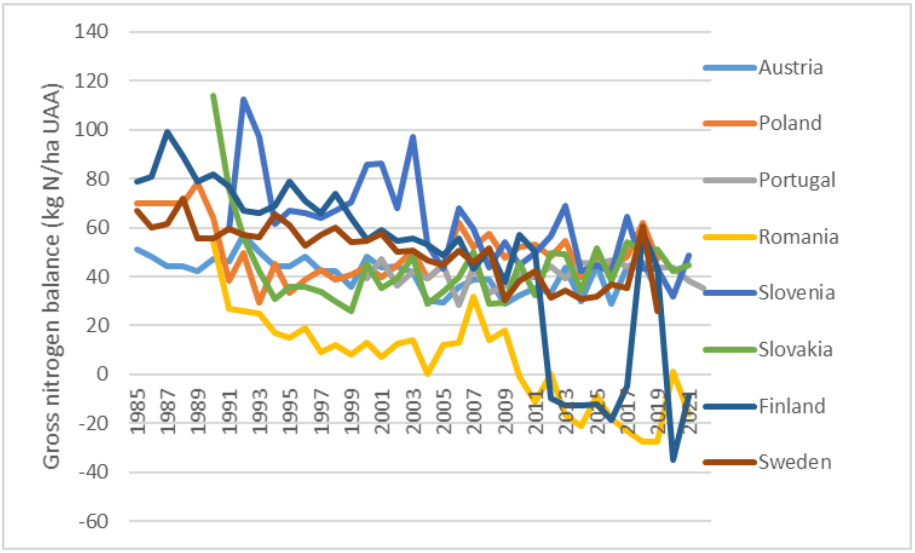
[45] Germany, Spain, France, Italy, Netherlands, Austria, Finland. Note that there were no data for 2020-2021 for Netherlands and Austria, so an average value of 2019 and 2022 used to bridge the gap.

[46] Bulgaria, Czechia, Latvia, Poland, Romania, Slovenia and Slovakia

Figure 14 Evolution of gross nitrogen balance per hectare of utilised agricultural area (UAA) between 1985 and 2021 in EU27 countries [note different scales]. (*Source: JRC* [8])

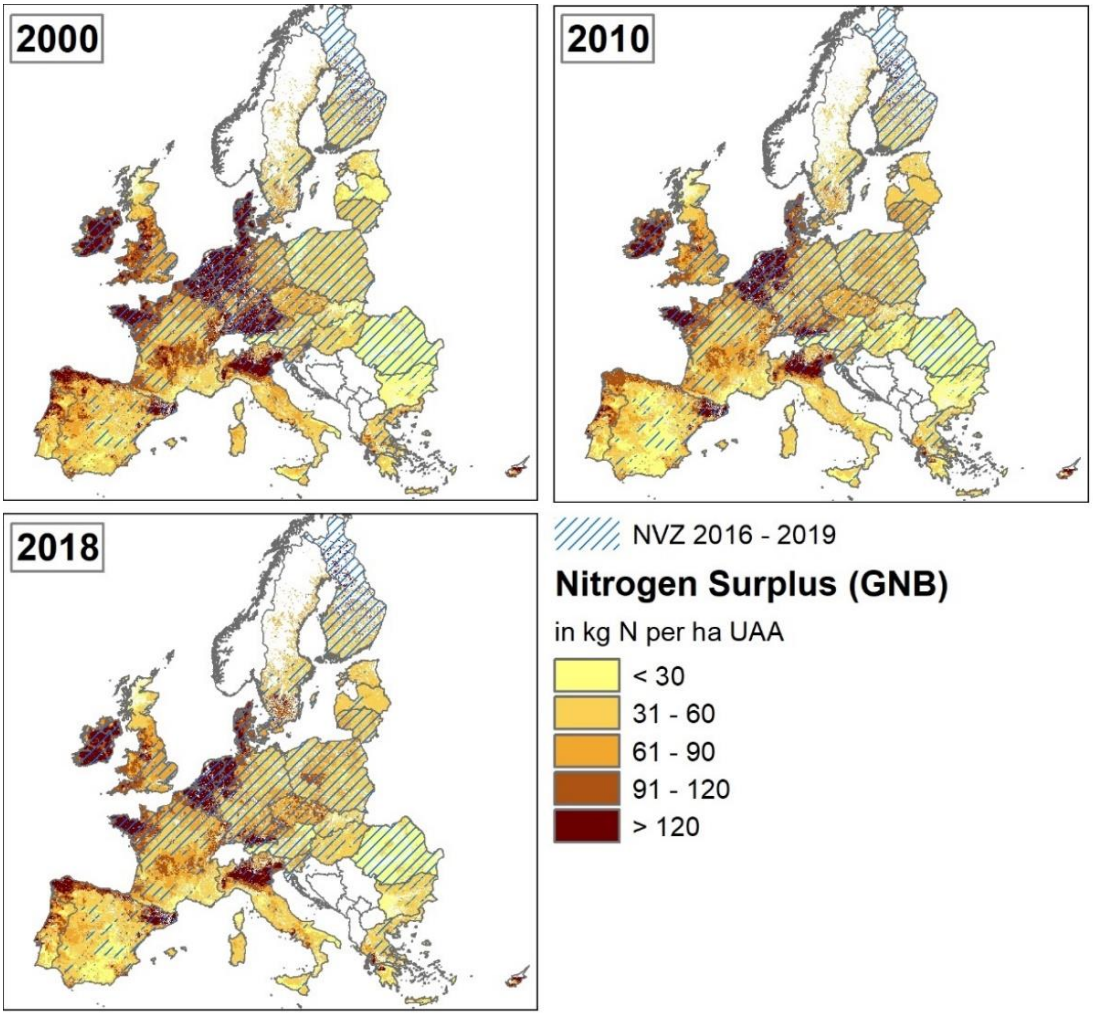






The graphs indicate that since 1991 the nitrogen balances have fallen significantly in Belgium, Denmark, Germany, Greece, Luxemburg, Netherlands and Romania. For other Member States, the evolution appears more even. Most of the decrease took place between 1990 and 2010 and in some Member States the surpluses remain significantly above the mean[47]. Figure **15** shows maps for the spatial distribution of gross nutrient balances across the EU in 2000, 2010 and 2018 based on disaggregated data from the CAPRI model [8]. From the maps it can be seen that the nitrogen surplus has decreased in large areas between 2000 and 2010 but has remained more stable in most areas since 2010, with significant remaining surpluses in hotspot regions with high livestock density (see section 3.2.4).

Figure 15 Gross Nitrogen Balance 2000, 2010 and 2018 (source: JRC, [8])



3.2.3 CAP influence on the Nitrates Directive implementation

The Common Agricultural Policy (CAP) and the Nitrates Directive are closely interconnected, and several elements of the CAP have influenced the implementation of the directive.

[47] Note that this graph does not cover 2022 and 2023 where balanced reduced further. However, this additional reduction was to a large extent the result of high fertiliser prices.

Through major reforms since the adoption of the Nitrates Directive, the CAP has decoupled payments from production and fostered synergies and cross-compliance by requiring farms to adhere to environmental standards, including those of the Nitrates Directive, to receive financial support. CAP's evolving frameworks have shaped how Member States and farmers address nutrient management, with recent reforms further strengthening environmental commitments, advisory services and strategic planning.

The 1992 MacSharry Reform led to a major change in the CAP as the policy shifted from a market support system to direct income support for farmers. It has gradually reduced the incentive for increased production and thereby opened the way for a more balanced use of fertilisers promoted by the Nitrates Directive as it aligned with the economic interests of the farmers. With direct support on the number of livestock maintained, there was however little incentive to reduce manure production which but continued to increase in most of EU15 Member States after 1992.

The introduction of cross-compliance in 2003 linked CAP payments to adherence to environmental, health and animal welfare legislation, bringing environmental objectives to the agricultural policy. Compliance with the Nitrates Directive was one of obligations and it led to major improvements in the implementation as it promoted compliance at farm level. Cross-compliance was extended to all CAP payments in 2007. The subsequent greening of CAP in 2013 further strengthened the focus on environmental objectives of the subsidies, both in the first and second pillar. Cross-compliance with the WFD on phosphorus measures was introduced in the CAP regulation from 2014. While positive effects from these reforms are evident, challenges remain, particularly regarding livestock intensity and concentration and market pressures that often conflict with environmental goals. The abolition of the Milk Quota in 2015 brought additional challenges by allowing for an increase in dairy production in some Member States, with larger dairy herds being stocked at the same place resulting in an increased spatial nutrient concentration and regional nutrient imbalances.

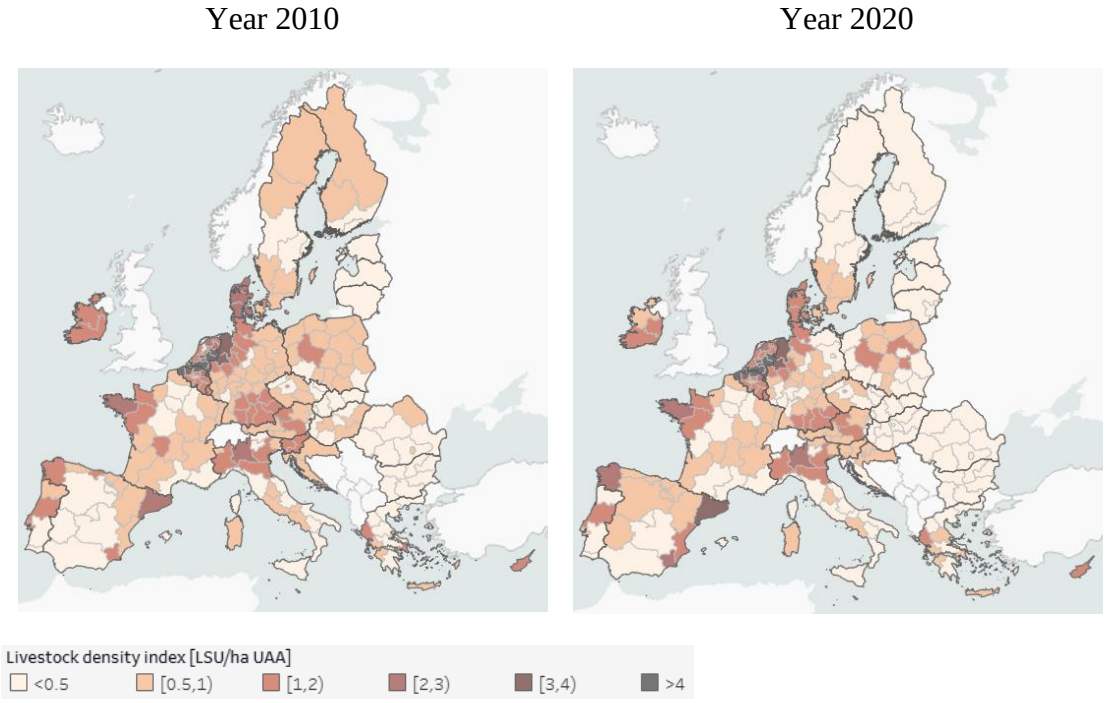
The 2023 CAP reform introduced a new delivery model based on national CAP strategic plans incorporating stricter environmental criteria and objectives, maintaining conditionality and emphasising nutrient loss reduction, water protection, and soil preservation and increased attention to farm advisory or digital support services. Various studies have highlighted how, despite occasional overlaps and varying commitments, the CAP as a policy continues to support progress in nutrient management and water quality improvement and to increase awareness and cooperation between countries, thereby supporting the Nitrates Directive and influencing its implementation.

As a result of the successive reforms, the integration and synergy between the CAP Regulation and the Nitrates Directive have grown over time. Today these two legal instruments are intricately linked, supporting each other in the achievement of their respective objectives, highlighting their mutual dependability in implementing good agriculture practices for sustainable farming and environmental protection throughout the EU. (Annex XVI further analyses the interlinkages between the Nitrates Directive and the CAP Regulation and describes in detail how the different CAP reforms have influenced the Nitrates Directive implementation).

3.2.4 Agriculture intensification and markets

Agricultural market pressures mediated by policy changes, increasing population and global competition have had an impact on the implementation of the Nitrates Directive**,** driving fertiliser use and livestock production. Figure 16 shows the livestock density in terms of livestock units per hectare (LSU/ha UAA) at NUTS 2 level in 2010 and 2020, indicating that intensive livestock production persisted in several regions over the last decade.[48] When the manure production is higher than the amounts that can be put on land in the region within the limits of the Nitrates Directive, the compliance with the directive and other environmental legislation becomes more complicated, as it is difficult to dispose of the excess livestock manure without a negative impact on the environment. Data show a clear geographic correlation between livestock density and nitrogen surpluses, both at the level of Member States and in specific regions.

Figure 16 Livestock density index LSU/ha UAA at NUTS2 level

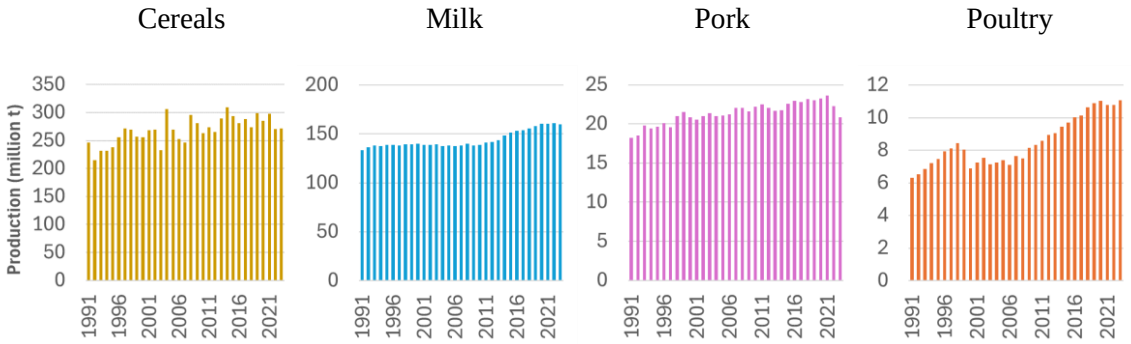


Source: EC based on Eurostat data

The continuous pressure to increase the intensity of agricultural production is further shown in Figure 17 illustrating the evolution of production in the EU27 since 1990 for cereals, milk, poultry and pork meat. While the trend has levelled off somewhat compared to the earlier decades after the Second-World War, the graphs show that production has continued to increase over the last three decades. Note the temporary interruption of this trend for poultry meat following first major outbreaks of bird flu in the late 1990s and the relative stability of milk production until the abolition of the milk quotas in the mid-2010s.

[48] Latest data (up to 2025) from Eurostat indicate reductions of herd numbers in many Member States. See also upcoming report on the implementation of the Nitrates Directive.

Figure 17 Evolution in production in the EU27 between 1991 – 2023 (million tonnes)



Source: Estimation based on FAOSTAT data.

There are many possible factors behind the increase in production since 1991, but it underlines the steady pressure from the market for agricultural intensification. Fertiliser use for maximizing yields leads to a higher risk of nitrogen losses and an increase in meat production is associated with increased manure production. As explained in Annex XI on balanced fertilisation, the take-up of nitrogen by crops is not linear, there are also strong annual and regional variations, and the fertiliser application standard will have a direct effect on the amount of leaching. The application standards are ideally based on a dose response curve. The economically optimal rate is strongly dependent on the economic situation (including the market prices of fertilisers and crops), can be highly variable, is not known at the beginning of the season, and does not necessarily coincide with agriculturally optimal dose. When fertilisers are cheap there is little incentive to use less fertilisers and increase nitrogen use efficiency so as to coincide with the agricultural optimal dose. As long as fertiliser prices remain low and the market price for the crop is sustained, the economic optimum for the farm will tend to be equal or higher than the agronomic optimum, as the economic losses due to over-fertilisation in one year would be compensated by high yields in another. However, high application standards based on unrealistically high yield figures will result in nutrient losses and have a negative effect on the environment. On the other hand, when fertilisers are expensive, there is a strong incentive to adjust the standard to the agriculturally optimal dose (higher nitrogen use efficiency). Very high fertiliser prices can also reduce fertiliser application and in some cases it can have undesirable effects on production volumes and quality. On the other hand, the last thirty years also saw the development of sustainable farming practices aiming at reconciling farming and environmental limits. The Organic Farming Regulation, providing a framework for organic farming throughout the EU, reproduces some of the key requirements from the Nitrates Directive, facilitating compliance with the measures of the Nitrates Directive. While Organic farming is supported by the CAP, and the organically farmed area made up 10.5 % of total EU agricultural land in 2022 compared to 5.9 % in 2012 [28], the increase remains slow in many Member States.

3.3 Impacts: Evolution in water quality

3.3.1 Nitrates pollution in groundwaters

Nitrates pollution in groundwaters was a major and increasing issue when the directive was adopted. The situation can be illustrated by data on nitrate concentrations in groundwater from the Nitrates Directive monitoring network in the early 1990s. Figure 18 shows the situation in the six EU Member States that had reported data for the first monitoring period (1992-1995). The data show that 572 monitoring stations corresponding to 15.8% of the total at the time reported concentrations above the pollution threshold (50 mg/l). Of these, 139 stations or 3.8% of the total reported concentrations above 100 mg/l. Figure 19 shows the evolution over the subsequent monitoring periods up until today. Since Reporting Period 4 (RP4), where the monitoring networks have been relatively more stable[49], less than 15% of monitoring points have reported nitrate concentrations of 50 mg/l or higher, with RP6 to RP8 showing a rate slightly above 13%. While the data indicate an overall stabilisation in nitrate concentrations across the EU, pollution remains significant many places, and the averages hide many geographic differences (see Annex XIII on the distribution of nitrates concentrations and trophic status of waters in Member States from 1992 to 2023).

Figure 18 Distribution of nitrates concentrations in groundwater 1992 – 1995 from 6 Member States[50]

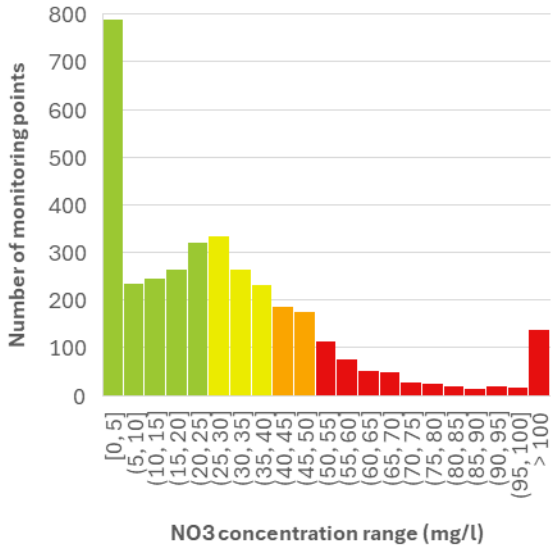
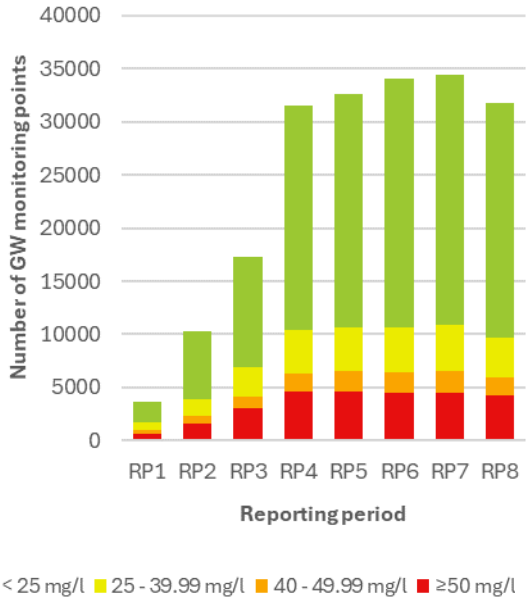


Figure 19 Evolution in nitrate concentration classes 1992 – 2023 (number of Member States covered depends on RP)



[49] Overall, it remains difficult to directly compare the distribution of the average nitrate concentrations across different reporting periods (RPs). The groundwater monitoring network matured through the initial reporting periods and subsequently stabilised in total numbers in the EU, showing relative stability since Reporting Period 4 (RP4), but changes continued within national monitoring networks.

[50] Belgium, Denmark, Finland, France, Netherlands, Portugal

Figure 20 Annual average nitrate concentrations in groundwater at the NUTS2 level for the reporting period 2020-2023

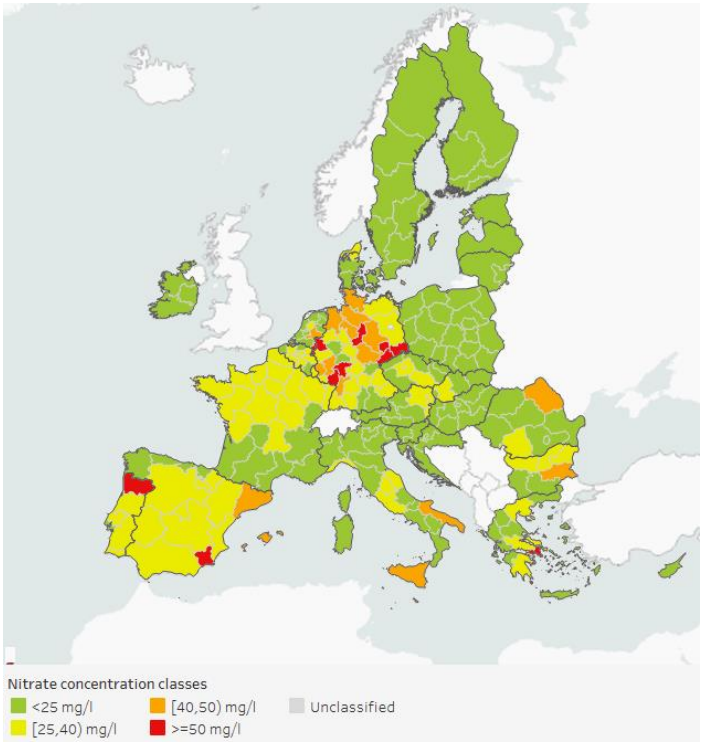
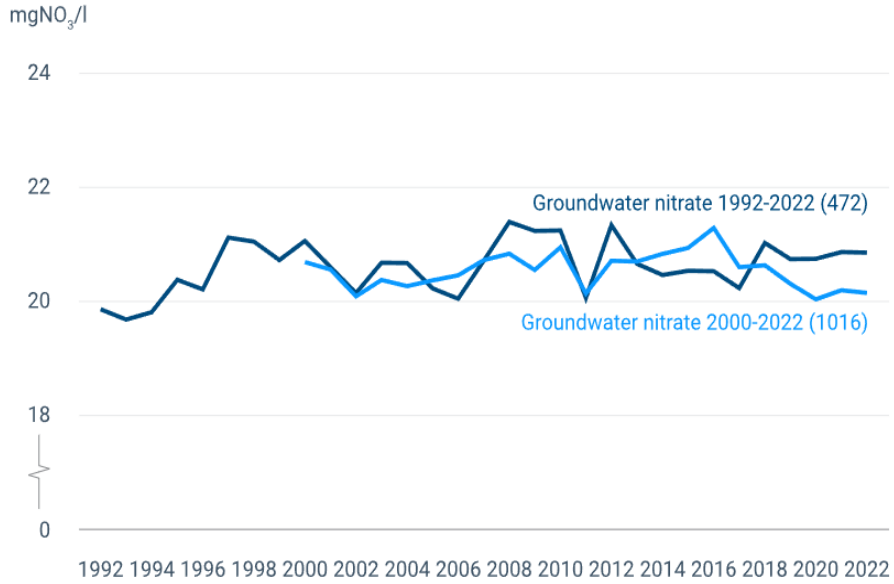


Figure 21 shows data from the European Environmental Agency (EEA) [29] which has followed the evolution in selected monitoring stations across EU since the early 1990s. In 2000, a slightly more extensive data sample was introduced. These samples are more limited than what we get from the national networks under the Nitrates Directive[51]. On the other hand, the advantage is that they have remained stable over a longer period of time.

Figure 21 Average nitrate concentration in groundwater (source EEA)



[51] In effect, this is a small sample of monitoring stations to give an indication of the evolution at EU level. It cannot reflect the different situations at Member State and local levels.

The data from the sample going back to 1992 indicates a stabilisation of the average nitrate concentrations around 21 mg/l across Europe from the mid-1990s and onwards. The more extensive data series established in 2000 seems to indicate an increasing trend until the mid-2010s after which a reversal may have taken place, resulting in a decreasing trend in the most recent years, with average nitrate concentrations around 20 mg/l across Europe.

The overall stabilisation of the groundwater nitrate concentrations shows the effects of the preventive measures under the Nitrates Directive. As regards the reduction of pollution already accumulated, an important factor to consider is that there is generally a variable time lag between the changes in agricultural practices and how this shows up in the nitrate concentrations of groundwaters. The lag can be very different depending on the groundwaters concerned ranging from a few years to several decades, depending on a number of factors including geology, hydrology, presence of oxygen and other factors relevant for denitrification, as well as depth of the groundwaters. Pollution can also be very localised so that broad averages do not necessary tell the whole story. Therefore, the pace of reduction of nitrate pollution in groundwater will vary considerably from one Member State or even one region to another. Nevertheless, the monitoring networks under the Nitrates Directive have been set up to monitor progress and should in principle be responsive to broad changes in agricultural practices over time[52].

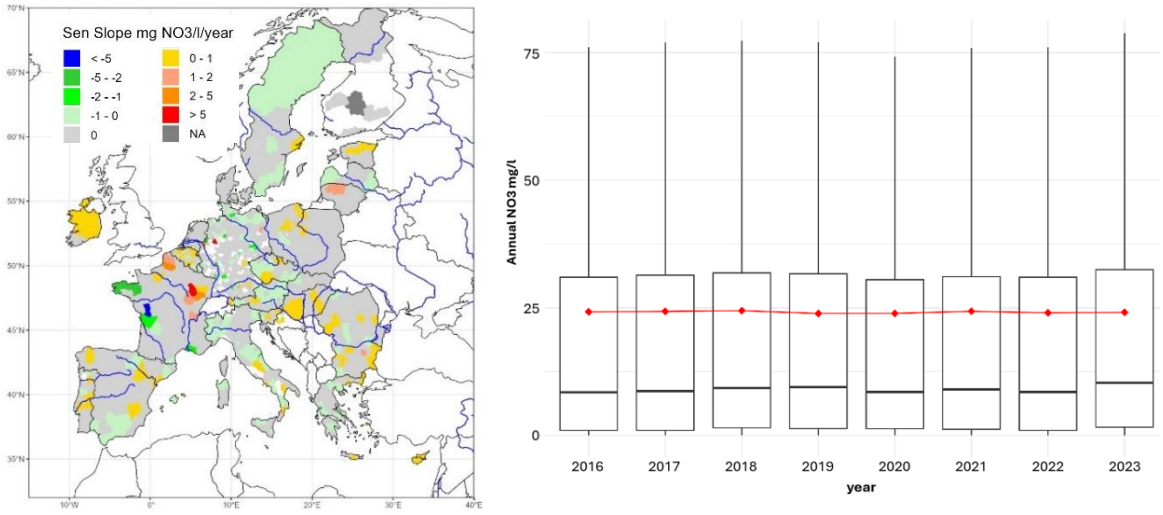
Analysis from Member States show clearly how the level of pollution in groundwater responds to fertiliser inputs. Annex XIV illustrates this with relevant examples in several Member States, notably the parallel evolution of nitrogen balance and nitrate concentrations over a long time period and the effect of measures taken under the directive in terms of the evolution of nitrates concentrations in the root zone and upper groundwater layer over the whole period of implementation of the directive.

Finally, Figure 22 presents some data on the most recent evolution in groundwater nitrate concentrations, based on the monitoring points under the Nitrates Directive where Member States have provided data in both RP7 and RP8[53]. The map on the left shows NUTS3 regions where significant trends can be identified over the eight years 2016-2023. The graph on the right shows the evolution in the average concentration across the entire sample (red line) as well as box plots with the median and quartile values in the sample. The data indicate that while significant trends can be seen in various regions across the EU with differences between Member States, the aggregate picture shows a stable situation over the period. Despite the overall average stagnation of results at EU level from 2016 to 2023, Annex XIV shows examples in Member States with continued reduction of nitrates concentrations in the most polluted monitoring points between 2008 and 2023, illustrating a continued response of pollution in groundwater to the measures of the Nitrates Directive.

[52] Some Member States have also set up dedicated networks, with more detailed monitoring of nitrate concentrations in leaching waters from selected agricultural fields to monitor the effect of changing practices.

[53] While this is based on a sub-set of all monitoring points, the total number of monitoring points is significantly higher than the EEA sample presented above and should therefore be rather more representative. Moreover, since only common points are included, the results are not affected by changes in the monitoring networks. See also Annex XIII.

Figure 22 Spatial distribution of trends in EU between 2016-2023 (left) and box plot of EU annual nitrates concentrations in groundwater (right) (Source: JRC [8])



3.3.2 Nitrates pollution in surface waters

When the Directive was adopted, nitrates pollution in surface waters was an important and increasing problem in many Member States, including in coastal and marine waters, but the availability of data at EU level was limited. Overall nitrates concentrations tend to be lower in surface waters than in groundwaters because there is less accumulation in flowing freshwaters, however nitrates will converge to the seas.[54]

Figure 23 shows the nitrates concentration values in surface water monitoring stations under the Nitrates Directive in the period 1992-1995 from 6 Member States that had reported data for the first monitoring period. 58 monitoring stations (2.8%) show values above the drinking water threshold of 50 mg/l and a large majority of reporting values not compatible with good trophic status[55]. Figure 24 shows the data since 2004 for all Member States that reported in each period[56]. There are still some surface waters showing nitrate concentrations above the drinking water limit of 50 mg/l, and a percentage of waters with concentrations high enough to contribute to eutrophication of lakes, coastal and marine waters. Importantly, the aggregated EU view hides the national variations, including positive evolutions shown in many regions and Member States (see Annex XIII on the distribution of nitrates concentrations and trophic status of waters in Member States from 1992 to 2023).

[54] The Nitrates Directive requires Member States to monitor nitrates concentrations in surface waters. Also here, the drinking water limit of 50 mg/l is used for the identification of polluted waters. However, another aspect considered under the directive is eutrophication, which can be caused by much lower concentrations of nitrates. In fresh and brackish waters phosphorous also plays a key role.

[55] The thresholds for nitrate concentrations compatible with good ecological status depend on the water bodies concerned and differ across the Member States but annual average nitrate concentrations above 10 mg/l will generally have exceeded the relevant thresholds in many cases.

[56] The percentage of stations reporting nitrogen concentrations above 50 mg/l has remained below 2.7% since RP4 (2004-2007). The drop in RP8 reflects the exit of the United Kingdom of the EU. When comparing only EU27 countries there is almost no difference between RP7 and RP8.

Figure 23 Distribution of average nitrate concentrations in surface waters 1992-1995 for 6 Member States[57]

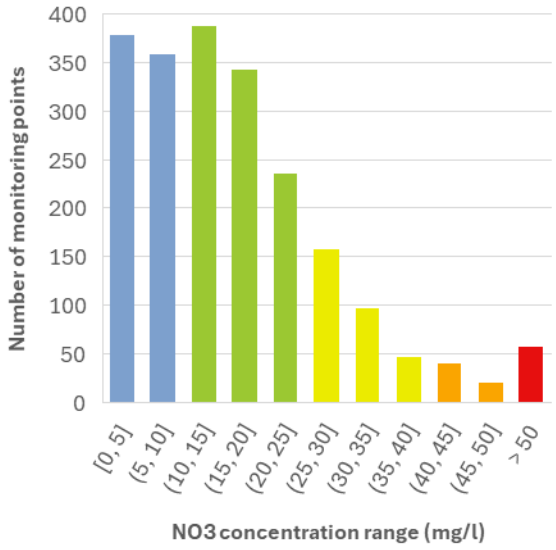
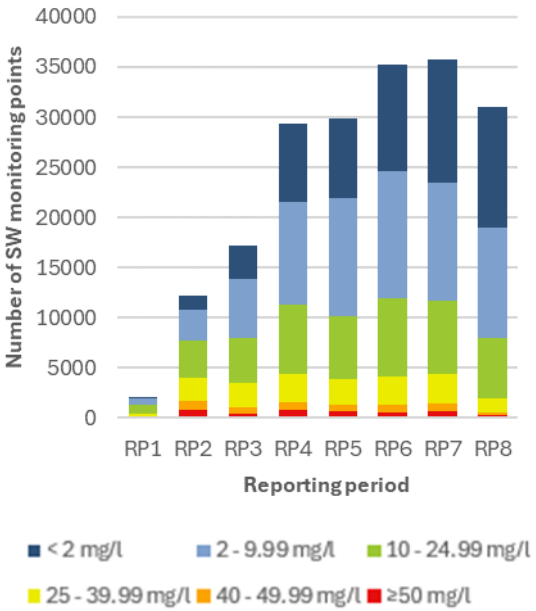


Figure 24 Evolution of distribution of average nitrate concentrations in surface waters (1992 – 2023)



The EEA has followed average nitrate concentrations in surface water monitoring stations since the early 1990s, just like they have done for groundwaters. Figure 25 shows the evolution of the average nitrate concentration in European rivers using the EEA data. In this case, both samples show average nitrate concentrations decreasing significantly during the period up until the late 2010s. In the most recent years, the data seem to indicate a certain stagnation or even a possible reversal of this downward trend[58].

Nitrate concentrations in surface waters generally tend to reflect the changes of agricultural practices more quickly than for groundwaters, with a time lag of only a few years. The data on surface waters therefore generally tend to reflect more promptly the effects of nitrates directive measures than data on groundwaters. The temporal evolution of surface water nitrate concentration at EU level therefore clearly shows not only the preventive effect but also the reduction of nitrate pollution since the start of the implementation of the directive. Annex XIV further shows relevant examples in several Member States on the effects of the measures on the reduction of nitrates concentrations in surface water and the lag times[59].

[57] Belgium, Finland, France, Ireland, Netherlands, Portugal

[58] The same caveats apply as for the EEA's groundwater network with respect to the limited extent of the network compared to the networks established under the Nitrates Directive.

[59] See e.g. the support study prepared by the JRC [8] for analysis showing estimated response times in French river nitrate concentrations ranging from 1-10 years, with the highest correlation around 6-7 years following the reduction in agricultural inputs.

Figure 25 Nitrate concentration in European rivers (EEA)

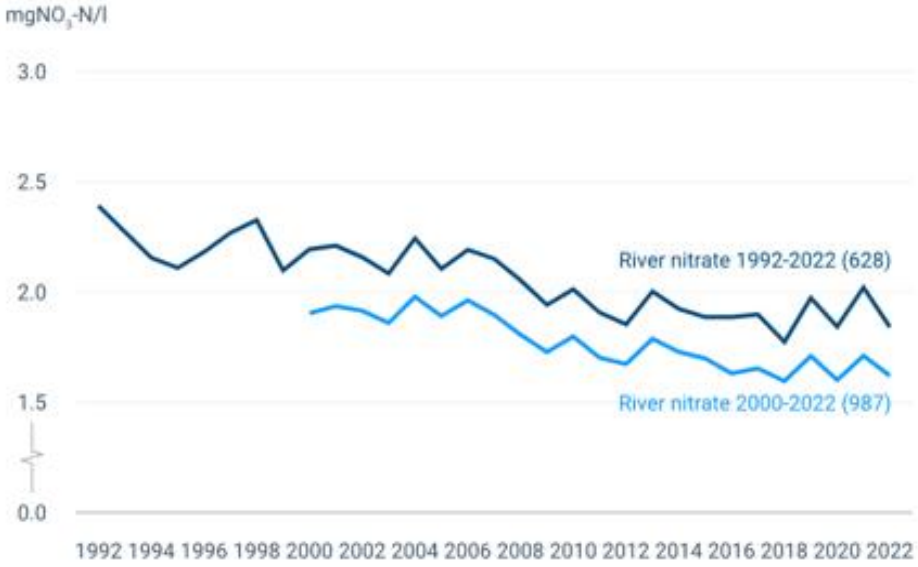


Figure 26 below indicates the geographic distribution of nitrate trends in surface waters during 2016-2023 based on data reported by Member States under the Nitrates Directive[60]. As for the groundwaters, we are also here presenting data on the most recent evolution in surface water nitrate concentrations, based on the monitoring points where Member States have provided data in both RP7 and RP8. Again, the map on the left shows NUTS3 regions where significant trends can be identified over the eight years 2016-2023.

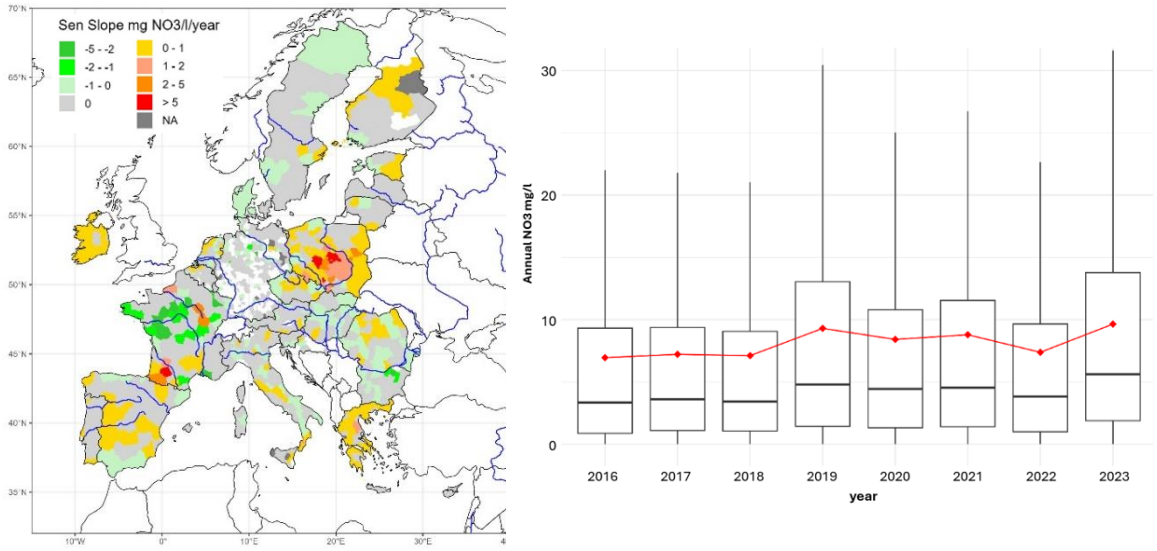
The graph on the right shows the evolution in the average concentration across the entire sample (red line) as well as box plots with the median and quartile values in the sample. In the case of surface waters, the data clearly show an upward movement in concentrations over the period, indicating that the direction of travel in recent years has been contrary to the overall objective of the Nitrates Directive[61]. Some of this may be due to climatic factors (exceptional droughts may have increased nitrate concentrations) but some part is also likely to reflect the increases in fertiliser inputs and surpluses in the mid-2010s shown earlier, which would be reflected in surface waters with a few years of delay.

It should be noted again that these are overall aggregate trends at EU level, whereas developments differ at national, regional and local level. Annex XIV shows examples in Member States with continued reduction of nitrates concentrations in the most polluted monitoring points between 2008 and 2023, illustrating a continued response of pollution in surface waters to the measures of the Nitrates Directive. The overall and continued reduction of surface water nitrate concentrations below 50 mg/l is also a key factor of progress in addressing eutrophication, as the nitrate concentration thresholds for eutrophication are significantly lower.

[60] Annual nitrate concentration in surface water was reported for 34430 stations in the RP7 and for 30828 stations in the RP8. Matching between the RP7 and RP8 monitoring networks resulted in 21918 common stations. Each station was assigned to its corresponding NUTS3 region and a regional Mann-Kendall test was used for calculating the trend in each NUTS3 region [8]. See also Annex XIII.

[61] As for groundwaters, this picture masks important differences between Member States and regions, where there were also continued improvement in many places (see examples in annex XIV).

Figure 26 Spatial distribution of trends in EU NUTS3 regions between 2016-2023 (left) and box plot of EU annual nitrates concentrations in surface waters (right) (Source: JRC [8])



3.3.3 Eutrophication

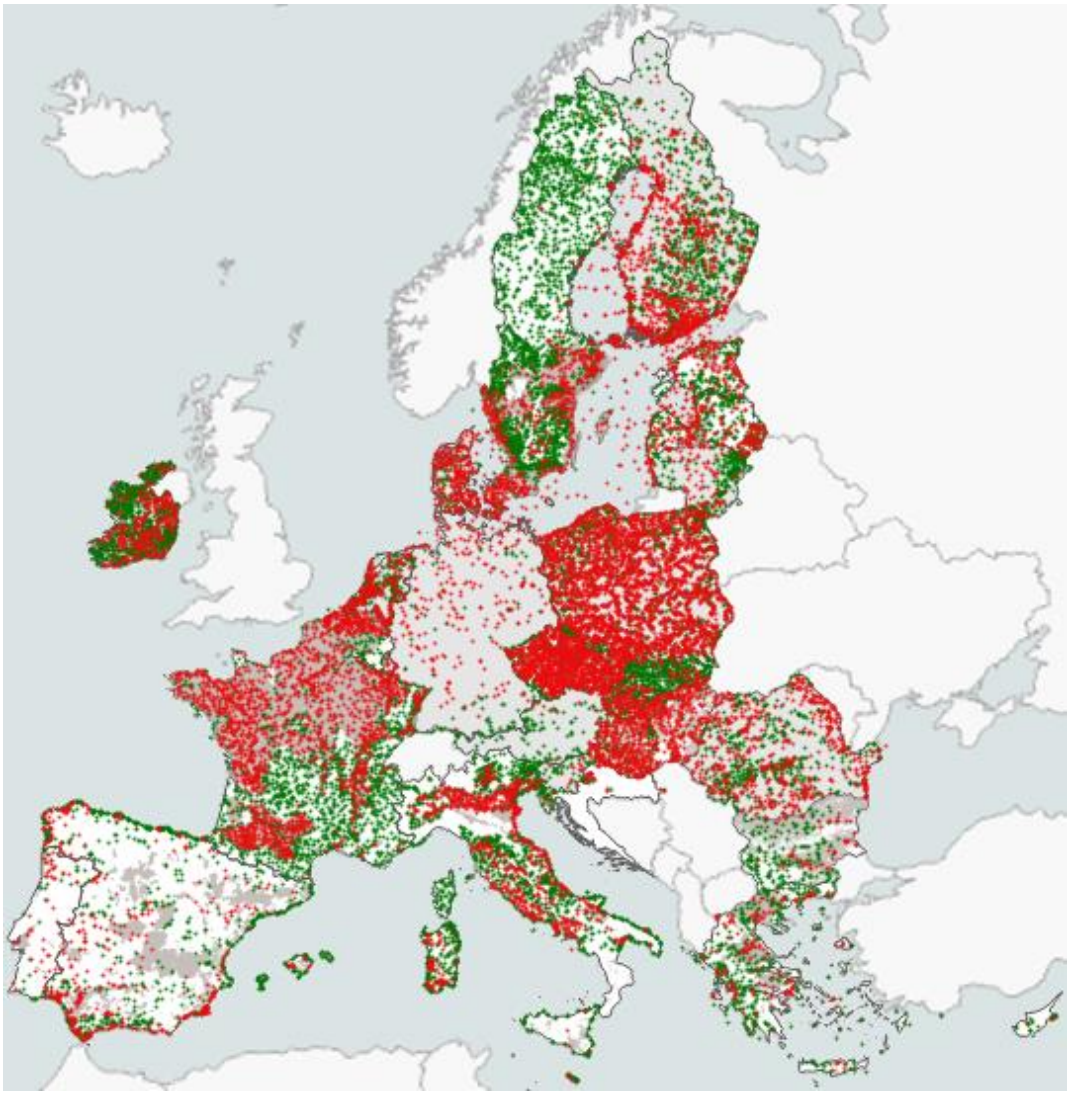
As mentioned in section 2, eutrophication was found to be a major issue when the Directive was adopted. In the period 1985 to 2000 extensive eutrophication had been reported in the Baltic Sea and the North Sea, and to a lesser extent in the Mediterranean Sea. Data reported under the Nitrates Directive has shown that eutrophication remains a major problem for all types of surface waters, including inland, transitional, coastal and marine water. In the implementation report for 2016-2019 [15], 36% of rivers and 32% of lakes, 31% of coastal and 32% of transitional water and 81% of marine waters were reported as eutrophic. This picture is also confirmed by a recent assessment under the WFD [30], which concludes that, although considerable improvements have been observed compared to the 1990s and most Member States and farms have made significant efforts to reduce nutrient losses in waters, current measures are still not sufficient to reach the water quality objectives. For more eutrophication data for individual Member States under the Nitrates Directive, see Annex XIII.

Box 2: The Mar Menor lagoon in Spain has suffered in the latest years the consequences of excess of nutrients from intensive agriculture and other sources. After decades of nutrient inputs, mainly nitrogen, the oligotrophic status of this lagoon changed to eutrophic status. In 2016, an algal bloom had severe effects on macroalgae and marine plants in the lagoon. In 2019 and 2021, hypoxia conditions resulted in the mortality of marine fauna. In a ruling from 2024, the CJEU considered that Spain had failed to fulfil its obligations, inter alia by failing to take the additional measures or reinforced actions required with regard to nitrate pollution in several regions, including the region of Murcia, where the Mar Menor lagoon is located. While the Spanish authorities have started taking measures, the lagoon still shows eutrophication in the 2020-2023 period.

The Baltic Sea is the marine region with the highest proportion of coastal waters where nutrient conditions is a problem. Eutrophication also occurs in the southern North Sea, along the north-western coast of France and near riverine outflows in the Mediterranean Sea. Widespread oxygen-depletion can be regularly observed in the Baltic Sea and the Black Sea, caused by eutrophication in combination with natural conditions and higher water temperatures due to climate change. A recent assessment under the MSFD [31] also

highlights continued challenges in European Sea basins. There have also been areas of progress when seen over a longer time perspective. Notably, with regard to the North Sea, assessments from OSPAR since the 1990s show a gradual decrease in the surface areas that do not achieve "Good" status[62]. In the Baltic Sea, the situation remains more serious. However, input loads of both nitrogen and phosphorus have been reduced significantly since the 1980s and the situation would likely have been much worse without these reductions [32]. Figure 27 shows the geographic distribution of eutrophic monitoring points as reported under the Nitrates Directive in RP8 [16]. Note that the density of the monitoring network differs across the Member States, which should be taken into account when interpreting the map. The continued challenges in the Baltic Sea clearly stand out. Eutrophication remains a challenge across the EU, but this does not mean that no progress was achieved. As shown in the previous sections, the measures of the Nitrates Directive have contributed to the reduction of nitrogen loads to surface water and to the steady reduction of nitrate concentrations throughout the EU, which are necessary steps to reduce eutrophication and achieve good ecological status (as defined under the WFD).

Figure 27 Monitoring points under the Nitrates Directive reported as eutrophic/may become eutrophic (red) and as non-eutrophic (green) in RP8



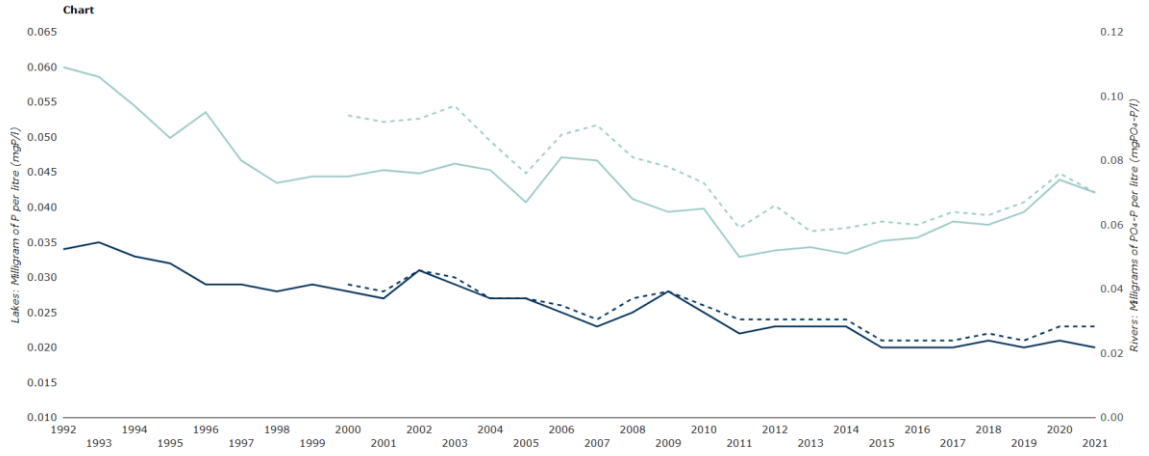
[62] OSPAR eutrophication thematic assessment, see here.

3.3.4 Urban wastewater treatment

When looking at the impact of the Nitrates Directive on nitrate concentrations in surface waters and on eutrophication, it is important to keep in mind other factors that affect these outcomes. Urban wastewaters are a key factor in this regard – and by extension the Urban Waste Water Treatment Directive, which over the years has contributed to a significant reduction in point source emissions to rivers and coastal waters. Although less important than agriculture overall[63], urban wastewater contributes significantly to nitrogen concentrations in the aquatic environment. More importantly, it is a major contributor of phosphorus emissions[64], even if it has diminished over the years.

Figure 28 below shows the evolution of phosphorus concentrations in a sample of monitoring stations in EU rivers (light blue) and lakes (dark blue) that has been monitored by the EEA since the early 1990. The overall reduction in phosphorus concentrations likely reflects the implementation of the Urban Wastewater Treatment Directive to a large extent, in addition to a change to phosphate-free detergents. It is notable that concentrations in rivers have started increasing again since the early 2010s. A contributor in this regard could be agricultural soils, where erosion, runoff and leaching into water courses from fields reflects the overall level of phosphorus accumulation in the soils as well as ongoing manure spreading. Annex XIV illustrates the interplay between the Nitrates Directive and the UWWTD in the Danube River between 1996 and 2021. It shows the rapid improvements resulting from the UWWTD implementation especially in P reductions, and the effects, albeit slower and less significant, of the Nitrates Directive in continuous reduction of nitrate concentrations.

Figure 28 Evolution in phosphate concentrations in EU rivers and lakes (EEA[65])



3.3.5 Water Framework Directive

The Water Framework Directive (WFD) adopted in 2000 provides a comprehensive legal and scientific framework for achieving water quality objectives in the EU by 2027. It has profoundly changed the approach to water management across the EU and, by incorporating the Nitrates Directive as a fundamental part of its Programmes of Measures

[63] Wastewater discharges can have significant local effects, even if their overall contribution is lower than that of agriculture.

[64] See **Annex II** for more details on the relative inputs of nitrogen and phosphorus from different sources.

[65] Phosphorus in lakes and rivers - Nutrients in European water bodies | European Environment Agency's home page

to reduce nutrient pollution from agriculture, it has significantly influenced the implementation of the Nitrates Directive. By setting broader water protection goals, the WFD supports the Nitrates Directive's specific objective of mitigating nutrient pollution, particularly from agricultural sources, thereby helping to meet environmental targets for both surface and groundwater quality. The impact of the WFD on the Nitrates Directive's implementation and results can be understood through several dimensions such as integrated approach, synergies in monitoring and environmental objectives, enhanced stakeholder engagement, reinforced legal and institutional framework as well as focus on achieving good status and its deadlines.

The WFD promotes an integrated approach to water management across entire river basins, which has enhanced the implementation of the Nitrates Directive by ensuring that agricultural nutrient pollution is considered within the broader context of water management. This holistic approach encourages coordination among different policy measures and stakeholders and should lead to more effective planning and targeted actions. This complementary role is crucial in overcoming challenges like eutrophication, as several sectors can contribute to the pollution.

The WFD has introduced comprehensive monitoring and assessment requirements, which have improved the monitoring networks, data collection and analysis related to water quality, including nitrate levels and eutrophication. This enhanced understanding has helped in identifying pollution sources more accurately and in evaluating the effectiveness of measures taken under the Nitrates Directive. The development of scientific criteria for eutrophication under the WFD in 2009 [24] has been a major progress for the monitoring of eutrophication under the Nitrates Directive. By encouraging the integration of various environmental policies, the WFD has helped align the objectives of the ND with other environmental goals, such as those related to biodiversity and ecosystem health. This alignment has led to more cohesive strategies that address multiple environmental challenges simultaneously.

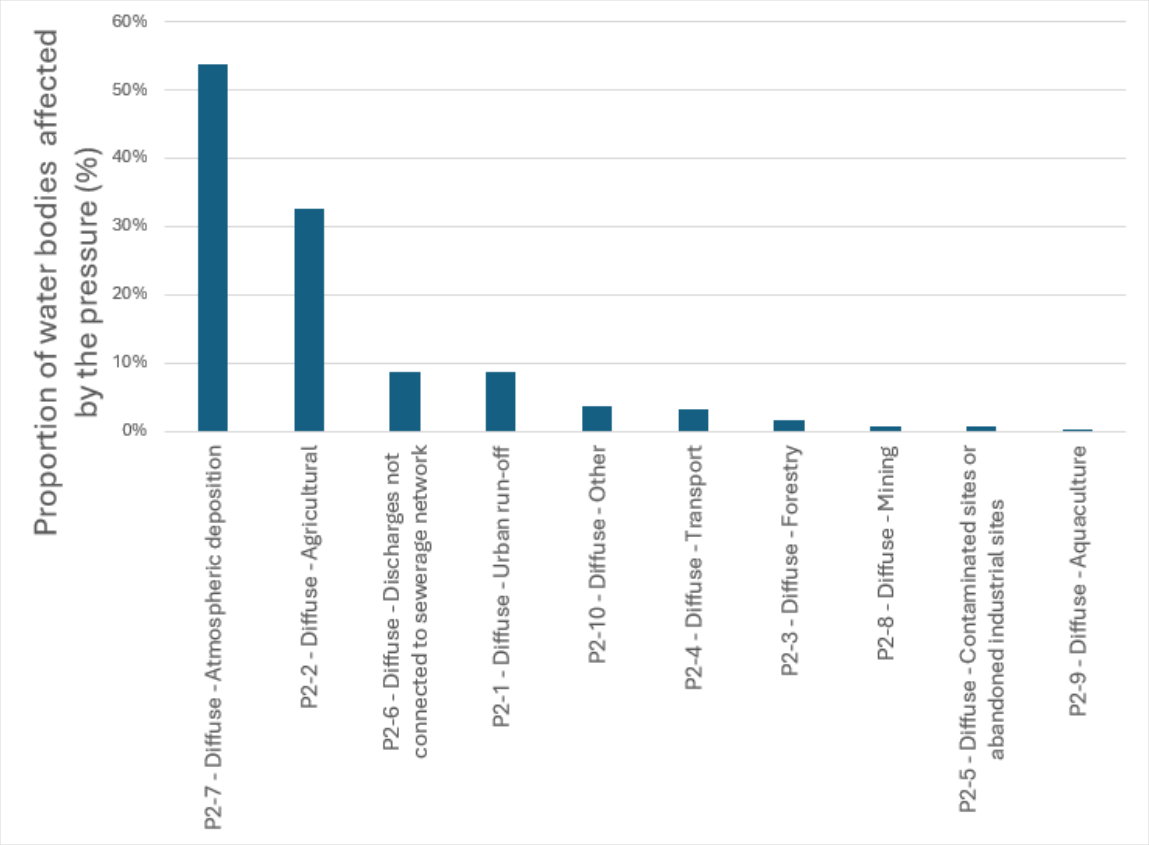
Moreover, the WFD emphasises public participation and stakeholder involvement, which has led to greater awareness and cooperation among stakeholders regarding nitrate pollution. This increased engagement is essential for the successful implementation of measures. The WFD has also reinforced the legal and institutional framework for water protection in the EU, providing additional support for the implementation of the Nitrates Directive. This has included more stringent reporting and compliance mechanisms, which have further encouraged Member States to effectively implement action programs to control nitrate pollution from agriculture. In addition, the WFD’s goal of achieving good status for all waters has provided a clear water quality objective and target that complements the Nitrates Directive’s aim of reducing water pollution from nitrates and eutrophication, but under the ND, there are no specific deadlines as in the WFD. The WFD's aim was to achieve the water quality objectives by 2015. Extensions were allowed up to **2027** under certain conditions, including technical feasibility, disproportionate costs, or natural conditions that require more time for recovery after all the relevant measures had been taken. This is the deadline set by the directive for all EU water bodies to achieve good ecological and chemical status[66]. Therefore, when designing their nitrates action

[66] The only possibility of extending the WFD deadline beyond 2027 is in the case where natural conditions still require additional time for recovery after all relevant measures have been taken

programmes Member States must also consider the objectives of the WFD, thus ensuring a cohesive approach to managing nutrient pollution. Annex XV describes in detail the interlinks between the Nitrates Directive and the WFD.

The role of the Nitrates Directive in achieving WFD objectives is critical. In the 7th WFD Implementation report [30], the Commission pointed out that diffuse pollution from agriculture is one of the main pollution pressures on EU water bodies identified by all reporting Member States in almost all river basin districts and affects both surface and groundwater bodies. This is illustrated in Figure 29 below as the reporting data under the WFD allows to have a broader picture on the different pressures impacting water bodies and the sources of diffuse pollution. Furthermore, the same report states, that nitrates are the biggest pollutant in groundwater bodies, and they also cause surface water bodies to become eutrophic. This is consistent with the findings on the nutrient loads across EU marine regions that show that for all regions, except the Black Sea, the largest source of nitrogen in the sea comes from agriculture.

Figure 29 Proportion of surface water bodies in the EU affected by diffuse pollution pressures. Data reported by Members Sates under the third River Basin Management Plans.



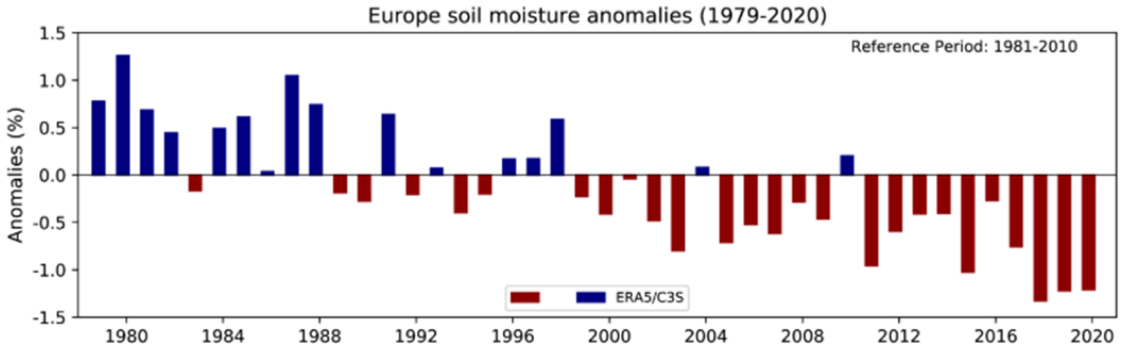
Source: WISE dashboards, 2024.

3.3.6 Climate change.

Another external factor with increasing impact on the implementation of the Nitrates Directive has been climate change. Meteorological factors affect yields, as precipitation

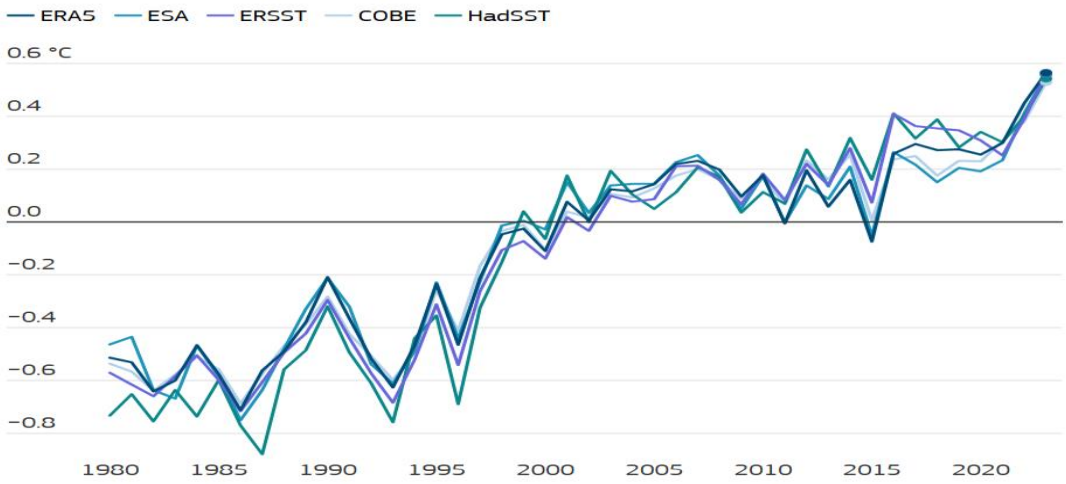
and temperature can induce water and heat stress in crops. The increased weather variability, especially heat and droughts, reduces crop productivity and, thus, nutrient use efficiency, leading to greater nutrient losses than what would have been the case with climatic conditions thirty years ago. As noted in the 2021 RP7 implementation report [15], the unexpected dry conditions across Europe in 2018 resulted in reduced crop yields and increased nitrogen pollution. There have also been severe droughts in 2022 and 2023. Figure 30 shows a more general worsening trend in soil moisture since the 1970s.

Figure 30 Annual European soil moisture anomalies (%) from 1979 to 2020 relative to the annual average for the 1981–2010 reference period [33]



Higher water temperatures also exacerbate the effects of eutrophication due to nitrogen or phosphorus, as warm waters spur additional algae growth, resulting in an increased occurrence of hypoxic events. Figure 31 shows the evolution in average sea surface temperatures in the seas around the EU since 1900.

Figure 31 Annual average sea surface temperature anomalies (°C), relative to the average for the 1991–2020 reference period, for the European ocean domain [34]



The effects of climate change on nutrient pollution are increasingly visible, with unexpected dry conditions affecting crops and increasing nutrient pollution and higher temperatures in worsening eutrophication effects in European rivers and seas. Without additional measures to reduce nutrient losses to water, there is an important risk that climate change offsets the improvements in water quality achieved in the last 30 years.

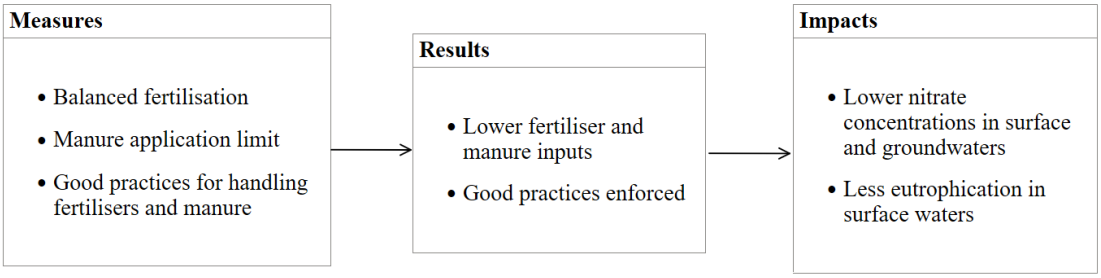
4. EVALUATION FINDINGS

4.1 To what extent has the Nitrates Directive been successful and why?

4.1.1 Effectiveness

This section asks whether the Nitrates Directive has been effective in reaching its objectives. The effectiveness is examined from three perspectives: (1) whether Member States and farms have implemented the measures and how effective the implementation is (2) how the main result indicators related to agricultural pressures (use of fertilisers and manure, nutrient balances) have evolved, and (3) how the main impact indicators related to the quality of waters (nitrates concentrations in surface and groundwaters, eutrophication of aquatic ecosystems) have evolved. Section 3 above has presented the temporal evolution of the implementation of the directive to date, with a focus on ***result indicators*** related to agricultural pressures (use of fertilisers and manure, nutrient balances) and ***impact indicators*** related to the quality of waters (nitrates concentrations in surface and groundwaters, eutrophication of aquatic ecosystems). Figure 32 below shows the basic causal chain of the Nitrates Directive (based on the intervention logic in section 2).

Figure 32 ND causal chain from measures over results to impacts



Looking first at the result indicators, the 1990s saw a clear reversal of the previous, increasing trend in fertiliser inputs that had characterised the 1960s-1980s[67], reflecting the increased acceptance and awareness of the concept of balanced fertilisation. The reduction was not uniform but the trend over the next two decades after the start of the implementation of the Nitrates Directive was generally in a downward direction, except in the Member States joining from 2004 where there was a process of convergence towards the level of chemical fertiliser use in the old Member States, although still at a lower level. The application of livestock manure has also seen a downward trend. The mid-2010s saw a stagnation in these positive trends and even a partial reversal, with fertiliser and manure inputs increasing for a few years in the old Member States, although below the earlier levels of the 1990s, before resuming a downward trend (Figure 11). The reduction in fertiliser inputs in the early years resulted in an improvement in the average nitrogen balances across the EU with lower surpluses up until the late 2000s. Later, the temporary increase in inputs in the 2010s was reflected in a temporary increase in the overall nitrogen balance, followed by a renewed reduction (Figure 13). To summarise, the overall picture appears to be one of significant progress until around 2010, followed by a temporary setback in the 2010s, and a return to improving trends in the most recent years.

[67] See section 2 and 3. It should be noted that the averages disguise significant variations among the Member States, but they produce a basis for assessing overall trends.

High fertiliser prices resulting from the Ukraine war had a significant impact on chemical fertiliser inputs and the overall balance in 2022 and 2023. It is too early to tell how much of this effect will be permanent.

As regards the enforcement of good practices, more than two-thirds of the utilised agricultural area of the EU is now designated as NVZ or under a whole territory approach and thereby covered by mandatory measures under the Nitrates Directive. Over the years, moreover, an increasing number of Member States have implemented whole territory approaches, as described in section 3. Furthermore, a significant number of the Member States apply at least some mandatory measures outside the designed vulnerable zones, even though the directive does not require it. It should also be remembered that the directive requires Member States to define and promote good agricultural practices through training and information across their territory, both inside and outside vulnerable zones. As described in section 2, the measures enforced under the Nitrates Directive in NVZ include a set good agricultural practices including the balanced fertilisation requirement and the manure application limit, designed to reduce the risks inherent to the use of fertilisers and spreading of manure on farms. The effectiveness of the measures is discussed further below.

In terms of impact indicators, aggregate data at EU level show a stabilisation of nitrate pollution in groundwaters, after years of increasing pollution until the 1990s. As shown in section 3, the share of monitoring points with nitrate concentrations above the drinking water standard (50 mg/l) has remained around 13-15 % since 2012 (see Figure 19). These are aggregate figures at EU level, but more detailed Member State data presented in Annex XIII shows clearer pictures of reduction of nitrate concentrations in many Member States. The prevention of further increases in pollution is an important result of the implementation of the directive. The fact that pollution overall has not been increasing since the 1990s, following years of steady increase, shows the effectiveness of the directive in its objective of preventing pollution. Member State's analysis and scientific studies referred to in Section 3 and in annex XIV show clear evidence of the impact of the directive's measures on reducing nitrate concentrations. It should also be noted that groundwater concentrations can be subject to long lag times with renewal of groundwater reservoirs taking place over years to decades, depending on the hydrogeological conditions. Even if concentrations diminish at a regular pace, it may take time for concentrations in a polluted location to reach the 50 mg/l limit value, as sometimes the starting point can be very high. As already mentioned in section 2, the directive therefore does not require that Member States ensure immediate compliance with the water quality standards set out in the directive, but that they put in place effective measures to prevent further deterioration and to reduce the pollution already accumulated, ensuring eventual compliance with the water quality standards. Data on the evolution in groundwater nitrate concentrations in the most recent years do not yet show a clear downward trend at the aggregate level (Figure 22). Nevertheless, more detailed analysis in the Member States has confirmed the positive impact of reduced fertiliser inputs on groundwater concentrations over time (see Annex XIV for concrete examples). Persistent policy implementation and enforcement over a longer period will be required to eventually reach the objectives. In this context, it is also important to point out, as already mentioned, that the directive not only aims to reduce existing pollution but also to prevent further pollution.

As regards surface waters, aggregate data at EU level shown in section 3 show an overall downward trend in nitrates concentrations starting in the 1990s. Nitrate concentrations in surface waters generally tend to reflect the changes of agricultural practices and the effect of the Nitrates Directive more quickly than for groundwaters, with a time lag of only a few years. The reduction of nitrate pollution at EU level since the start of the implementation of the directive in figures 24 and 25 in Section 3 clearly shows the effectiveness of the directive. Annex XIV further shows relevant examples in several Member States on the effects of the directive's measures on the reduction of nitrates concentrations in surface water and the lag times[68]. However, progress has stagnated after 2010 and concentrations appear to be increasing in recent years. Trends over the most recent years seem to confirm that concentrations are increasing again (Figure 26), which is likely to reflect a combination of higher fertiliser inputs and nitrogen surpluses in the mid-2010s (see above) and the intensifying impact of climatic extremes (droughts, heavy rains) resulting in higher losses to surface waters. It is possible that more recent reductions in the overall nitrogen balance observed after 2020 could revert this deteriorating trend in the coming years (with a few years of delay), although the impact of climate change is likely to only get worse over time. It should be noted again that these are overall aggregate trends at EU level, whereas developments differ at national, regional and local level. Annex XIV shows examples in Member States with continued reduction of nitrates concentrations in the most polluted monitoring points between 2008 and 2023, illustrating a continued response of pollution in surface waters to the measures of the Nitrates Directive.

The measures under the directive provide a sustainable approach to the protection of drinking water resources from nitrate pollution. The fact that nitrate concentrations remain well below the 50 mg/l drinking water threshold in a large part of the EU ground and surface waters is reassuring as regards the protection of drinking water resources. The enforcement of mandatory measures under the Nitrates Directive in more than two thirds of the agricultural land in the EU plays a key role and ensures a continued and long-term protection, necessary for water resilience. In some parts of Germany and France, drinking water companies pay farmers for implementing good practices and reducing fertiliser use near drinking water extraction points. Nevertheless, it is notable that more than 30 years after the adoption of the directive, nitrates concentrations exceeding the standard for drinking water can still be found in more than 10% of groundwaters and in a small share of surface water monitoring stations across the EU (Figure 24) and that occurrences of excess nitrate in drinking water, making it improper for human consumption, have continued to take place in recent years, showing examples where prevention has failed.[69]

Measures under the directive have contributed to reducing and preventing eutrophication but it is not sufficient. Section 2 explained how to assess success in addressing eutrophication and section 3 has shown relevant data and provided references to reports showing how and where the directive has contributed. In particular, the significant reductions in both nitrogen and phosphorus loads to the aquatic environment as

[68] See e.g. the support study prepared by the JRC [8] for analysis showing estimated response times in French river nitrate concentrations ranging from 1-10 years, with the highest correlation around 6-7 years following the reduction in agricultural inputs.

[69] An EU infringement procedure is on-going against France since 2024 because the drinking water in seven regions of France exceed the norms for nitrate concentration. 107 water supply zones do not comply with the norms. Problems with drinking water polluted by nitrates affecting several thousands of people have been reported in Spain in 2024 and 2026.

well as the stabilisation and continued reduction of surface and groundwater nitrate concentrations including in the ranges below 50 mg/l are key factors that have contributed to progress in addressing eutrophication. Section 3 further highlighted areas of progress such as in the North Sea, and in other places the situation could have been worse without a clear policy and mandatory measures to reduce nutrient emissions from agriculture. Nevertheless, eutrophication remains a widespread and serious issue. In the assessments under the WFD and the MSFD, eutrophication due to nutrients from agriculture is among the main challenges for reaching good ecological status for river, lake, transitional and coastal water bodies and good environmental status for marine waters.

Continued widespread eutrophication of surface waters reflects the complexity of aquatic ecosystems and the pressures affecting them, and the Nitrates Directive only acts on part of it. Eutrophication is an end-of-pipe phenomenon, and agriculture is not the only pressure, although it is the dominant pressure overall and it therefore remains essential to continue reducing nutrient loads from agriculture in the aquatic environment. It is also the case that the effects of eutrophication may persist for a long time, depending on physio-chemical factors and the fact that ecosystems can take a long time to recover from severe disturbances [35]. The quality of waters needs to improve over large areas by decreasing the excess nutrients causing eutrophication. Nutrients can also accumulate in groundwaters as well as in sediments of rivers, lakes and coastal water bodies with the result that effects of past pollution can continue to be felt over many decades. Phosphorus, the legacy of many years of wastewater discharge as well as the contribution from agricultural soils, tends in particular to stay in sediments for a long time. And finally, biological systems take time to reestablish themselves once severely disturbed. Another more practical issue is that the Nitrates Directive does not set out a specific methodology or thresholds to be applied for the eutrophication assessment[70], which may have delayed action at national level, as the focus of Member States has primarily been on drinking water standards. Thanks to the comprehensive framework and requirements provided by the WFD and the mutual efforts between the Commission and the Member States, there has been increased awareness and measures taken, and with it a better reporting from Member States. (See also Annex XV on coherence with the WFD.). In particular, Member States have improved the NVZ, the action programmes and the monitoring to tackle better eutrophication.

Effectiveness of the measures set out in the directive

As described in section 2, the measures under the Nitrates Directive aim to enforce good agricultural practices on the use of fertilisers and management of livestock manure[71]. Their relevance and effectiveness is well documented and recognised. Annex XI provides more background with reference to the scientific literature on the environmental effects of the measures set out in the annexes to the Nitrates Directive[72]. A key pillar of action under the directive is the limitation of excess fertiliser use on farms. The directive requires fertilisers to be apportioned in accordance with the foreseeable requirements of the crop and the nitrogen available in the soil, so as to limit the risk of

[70] Consultations with Member State experts have highlighted the Nitrates Directive's lack of standards regarding eutrophication, including on the role of phosphorus.

[71] The measures are briefly described in box 1.

[72] There is a large body of scientific analysis regarding the environmental effects of farming practices. See also Recommendations for establishing Action Programmes under Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources, part B [21].

losses. In practice, the fertiliser amounts tend to reflect a compromise between agronomic and environmental considerations. The requirement of balanced fertilisation, combined with the manure limit, is seen as a major contribution to the reduction of nitrogen and phosphorus surpluses, thereby reducing the risk of leaching. The directive also promotes an improved utilisation of livestock manure by restricting its application during the winter while promoting its positive use as an organic fertiliser during the growing season, hence reducing the need for chemical fertilisers and contributing to soil organic matter. Other critical measures aim to reduce the risk of leaching and run-off by restricting fertiliser and manure application along watercourses and on steep slopes or by requiring the main crops to be followed by catch crops to retain nitrogen in soils during the autumn and winter where the risk of leaching and run-off is the greatest.

The most effective measures include restrictions on the application of fertilisers in winterly or wet conditions and during rainy autumn and winter months, as well as the related minimum capacity for manure storage. This was pointed out by Member State experts consulted for the evaluation and is consistent with the scientific literature which indicates that restrictions on the spreading of fertilisers and manure during sensitive periods is a highly effective measure with relevance for all Member States[73]. The balanced fertilisation requirement, crop rotation and minimum land cover are also seen as very effective measures, followed by buffer strips. Industry organisations tended to stress precision farming as a cost-effective strategy to manage nutrients and reduce environmental impacts. Such practices can indeed support the objective of complying with the balanced fertilisation requirement. As mentioned in section 2, certain measures are optional for Member States, notably the requirements on fertiliser planning and record keeping, land cover and crop rotation. These measures are nevertheless widely implemented in the Member States and are generally recognised as relevant and effective (see Annex XI and XII).

The limit on the application of manure is necessary to address the high risk of losses from livestock manure. Excessive application of livestock manure contributes to the risk of nitrogen losses due to slow mineralisation, ammonia emissions, and lower fertiliser use efficiency, as explained in section 2. Compared to chemical fertilisers, livestock manure is associated with higher risks of nitrogen losses due to a more unpredictable release of nitrogen to the soil, high ammonia emissions, low efficiency of uptake by crops, and the fact that livestock manure is continuously available. The limit of manure application not only limits nitrates emissions to water but also critically contributes to address other pathways and forms of emissions from manure (ammonia and phosphorus), which are key additional factors for eutrophication of surface waters[74]. Thirty-five years after the adoption of the Nitrates Directive, there is little doubt that limiting the amount of manure applied on agriculture land remains necessary and justified to control nitrogen and phosphorus emissions from manure and processed manure, including with regard to other EU environmental goals. Setting a common limit for the application of nitrogen from manure has served as a pivotal benchmark in curbing different pathways of nutrient pollution from manure, contributing positively to limiting nitrates pollution and eutrophication. The multi-pathway role of the limit is intrinsically linked to the cascading effect of nitrogen pollution and the policy objective to limit negative environmental effects of intensive

[73] See Annex XI and XII.

[74] As mentioned in section 3, some Member States have separate rules to regulate phosphorus inputs.

livestock production. This also explains why the limit equally applies to processed manure as it generally presents similar risks of emissions to air, water and soil as raw manure[75]. A large majority of national experts considered the manure limit effective in preventing and reducing water pollution and important for managing the impact of intensive livestock. In the public consultation most stakeholders also considered the manure limit to be either effective or somewhat effective. Further discussion on the relevance and added value of the manure application limit can be found in Sections 4.2 and 4.3. See also Annex XVII which examines the effectiveness and relevance of the manure limit.

While the practices and measures required under the directive are generally recognised as relevant and effective to address nutrient pollution, it does not necessarily mean that the national implementation has been sufficient to address the pollution. The implementation of the directive was initially slow and very gradual. The directive itself set out a gradual process of implementation of the four-year cycle and further allowed a higher manure nitrogen limit during the implementation of the initial action programmes. In addition, the Commission initially had to launch a high number of infringement procedures due to delays in the Member States' compliance with basic requirements under the Directive. (See details in Annex VIII and IX). As mentioned in Section 3 and detailed in Annex XII, the national or regional action programmes in 2020 include all the basic requirements set by the directive, but their implementation is not seen as equally effective across the measures or the Member States. Where assessments vary most between stakeholders is indeed with regard to whether the practices have been sufficiently well implemented and enforced. Among stakeholders, a widely held view of water supply companies and environmental NGOs was that the directive is lacking in implementation and proper enforcement, while farmers and industry tended to consider the directive as already sufficiently effective. A large majority of national experts consulted considered that the directive remained an effective legal instrument for achieving the objectives set out, and that it provided sufficient mechanisms and tools for both the Commission and the Member States to facilitate effective implementation and enforcement.

Over time the preventive approach of the directive has been strengthened in the national implementation. Data on groundwater and surface water quality show that the directive plays an important preventative role. For example, thanks to the implementation of a minimum common set of mandatory measures in NVZ or in Member States that apply the whole territory approach, which together include the most intensively farmed regions, the very large majority of groundwater and surface water nitrates concentrations have remained below the 50 mg/l threshold, despite further intensification of production in the last 30 years. As shown in section 2, there is a direct connection between the manure and fertilisers application and nitrate concentration in groundwater and surface waters, and the main objective and effect of the directive is to keep manure and fertilisers application in check, which is particularly important when the production intensifies. The fact that there are mandatory measures in at least two-thirds of agricultural area in the EU (NVZ and

[75] Processing may take many forms ranging from mechanical separation into solid and liquid part or storage and composting over anaerobic digestion in a biogas plant to advanced processing for the recovery of nutrients in forms that are similar to chemical fertilisers (RENURE). The associated environmental risks will vary depending on the process and needs to be checked on a case-by case basis so that adequate safeguards be provided.

whole territory approach) is a key factor in the prevention of pollution. Over time, Member States have enlarged this common basis of mandatory measures, either by moving to a whole territory approach where mandatory measures apply throughout the territory, or by enforcing some mandatory measures also outside NVZ confirming the importance of the preventive approach supported by a minimum set of mandatory measures rather than voluntary measures only. Today there are 12 Member States with a whole territory approach. Many of the Member States with NVZ informed that they are also applying mandatory measures outside NVZ as part of the implementation of the Nitrates Directive, further complemented by mandatory requirements under the CAP (such as the GAECS).

Over time, compliance with basic requirements has improved and the enforcement mechanisms have allowed to address shortcomings in the national implementation. The four yearly implementation report prepared by the Commission based on the data and reports from the Member States has been an important mechanism to take stock and address implementation issues. The evolving jurisprudence of the Court of Justice bolstered the implementation of the directive. The integration of the Nitrates Directive as basic measures in the Water Framework Directive was an important step in setting water quality objectives and deadlines, and helped to progress on the implementation, as explained in Section 3. Conditionality (or cross-compliance) under the Common Agriculture Policy introduced in 2003 was also an important factor in improving compliance and awareness with the Nitrates Directive measures at farm level and further supported the implementation of the directive (see Section 3). The continued dialogue between Member States and the Commission in the Nitrates Committee and Nitrates Expert Group has allowed developments of guidelines and exchange of best practices. Following this progress in implementation, in recent years, the focus of Commission's enforcement has increasingly moved on from compliance with basic requirements of the directive to the more complex question of whether the actual measures implemented in the Member States are sufficient to reach the objectives of the directive. In this context, in view of the water quality results, conditions for derogations to the manure limit were adjusted, or derogations were phased out. The enforcement mechanism eventually allows to address shortcomings in the effectiveness of measures, but there will always be a time lag, as the Commission's enforcement would primarily be based on absence or reversal of progress in water pollution.

Factors hampering effectiveness of the Nitrates Directive

The extensive flexibility of the directive in terms of its national implementation works in both directions and may limit effectiveness when faced with strong market pressure. The flexibility that the directive gives to Member States is important as it allows Member States to tailor the NVZ and action programmes to national and regional variations and design the most cost-effective measures for their national context and to react quickly and effectively to new challenges[76]. Annex II and III of the Directive specify the type of measure that is required, outlining the minimum measures to be included in NAPs, but it is up to the Member State to prescribe how each of the measures will be applied throughout its territory and to tailor and build upon these to account for national

[76] Member States have many years of experience with the implementation of measures under the directive and have therefore developed a broad knowledge base on the cost-effectiveness of measures in their different national contexts.

and regional circumstances[77]. This should also support acceptance by farmers unlike a one-size-fits-all, prescriptive approach. **The assessment of Member States' approaches to the implementation of the measures in Annex II and III of the directive has also focused on determining whether the flexibility linked to the national implementations influences its effectiveness.** Annex XII of this report gives an overview of how the measures of Annex II and III of the Nitrates Directive are implemented in the Member States in NVZ 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 and derogations. The conclusion is that high variation in designing measures does not necessarily correlate with variation in the risk of nitrate loss, as often the choice of measures is justified by the tailoring to regional circumstances. A specific assessment focused on the variation of closed periods, showing that the different approaches translated into tailored measures with high coverage of risk periods. However, the flexibility can also result in a lower capacity of Member States to implement necessary measures that are strongly resisted by the agricultural sector, in particular regarding limits on fertilisation or on manure production. Several Member States have relied on voluntary measures and incentives where the overall effectiveness seemed to have been reduced due to low take-up especially from the biggest polluters. Conversely, that is why the limit on manure application at EU level has been particularly relevant.

The discretion left for Member States can also make it more challenging for the Commission to enforce the directive when the issue concerns the level of ambition in measures rather than just the inclusion of the types of measures listed in the annexes to the directive. As reported in Annex XII, there are more than 75 NAPs for the 27 Member States with variations as national and regional circumstances are taken into account. These 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 water pollution and water quality objectives; (3) type of farming activity and level of intensity of farming.

Market pressures generally tend to result in higher fertiliser inputs and more intensive and concentrated livestock production and manure surpluses, thereby increasing the risk of nutrient pollution[78]. A key external factor influencing the implementation of the Directive has been the intensification of agriculture, also resulting in high spatial concentrations of livestock and manure production. Competitive pressure

[77] 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 water pollution and water quality objectives; (3) type of farming activity and level of intensity of farming.

[78] One example of this is evident in Northwestern Europe where infrastructure and port facilities give access to the global markets for feed imports and exports of animal-based products. Coupled with high land prices, this has created the basis for very intensive livestock production disconnected from available land on which manure could be spread, especially in the low countries where livestock densities are significantly higher than anywhere else in the EU, resulting in major manure surpluses.

felt by farms from competitors in other Member States and in global markets can result in a relaxation of the Nitrates Directive measures, as the directive leaves flexibility for the Member States to increase fertilisation limits and allow for higher livestock concentration and manure production, thereby increasing the risks of pollution especially if the manure and fertilisation application limits are not strictly enforced. Inherent mechanisms of the directive, notably Article 5.5 and 5.6, provide the tools and set the obligations for Member States to react rapidly and strengthen measures when necessary[79]. Furthermore, some of the market pressures have been mediated by the common agricultural policy of the EU such as the gradual 'decoupling' of agricultural support since the early 1990s. On the other hand, policy choices such as the abolition of the milk quotas in the mid-2010s may also have contributed to increasing the market pressures as farms reacted with intensification of dairy farming in some Member States in the number of animals or in the amount of milk produced per cow[80].

Strong market pressures also make it more difficult for authorities to enforce strict requirement and may have contributed to delays in the national implementation and in low levels of compliance. Even if the acceptance and compliance has increased, difficulties to step up national implementation necessary to reach water quality standards remain an issue. In the consultations with Member States experts, this was also referred to in the sense that the "low hanging fruits" have already been picked in the early years, making it increasingly difficult to further increase the impact and level of implementation in recent years. One manifestation of this has been a tendency of measures to become more complex in some cases as Member States strive to implement more flexible approaches in response to farmers' concerns over "one-size fits all" or immediately impactful restrictions. In this respect, some Member State experts have highlighted the existence of an inverse relationship between flexibility and simplicity in measures, with the demand for more flexibility for farms resulting in higher cost of implementation and enforcement due to the increased complexity of the various schemes.

In general, fundamental changes in agricultural practices, such as in the choice of crops[81] or reduction of fertiliser rates below the economic optimum, may be difficult to implement. The challenge for Member States to define and enforce stricter fertilisation limits under the balanced fertilisation is a good example. There may be cases where the fertiliser rate needs to be lower than the economically optimal rate to attain environmental objectives[82]. However, the limitation of fertiliser use below the economic optimum is strongly resisted by the sector, as such restrictions can affect the yield and quality of crops as well as the profitability of farms. The directive leaves it to Member States to set the specific fertilisation standards and, although there are exceptions where more restrictive

[79] Article 5.5 requests that Member States strengthen their NAP as soon as it becomes clear that measures are insufficient for achieving the objectives, and Article 5.6 that Member States establish suitable monitoring programmes to assess the effectiveness of the NAP.

[80] Eurostat: The EU dairy herd has been decreasing in recent years as the milk yield per cow has improved. In 2023 there were around 20 million cows in the EU, with an average of 7800 kg of milk produced per cow. In 2024, the EU produced 161.8 million tonnes of raw milk, 0.9 million tonnes more than in 2023. The average apparent milk yield per cow in the EU reached 8 120 kg in 2024.

[81] Apart from intensive livestock production, certain crops such as potatoes and maize are recognised as being associated with a higher risk of nitrate leaching.

[82] In welfare economic terms, such a lower rate could be economically efficient where externality effects that are not reflected in current market prices mean that the "social" optimum (for society) is different from the "private" optimum from the perspective of the farm [25].

limits have been set in some areas, there has been a tendency to rely on the economically optimal amounts. Examples described in Annex XII on variations of balanced fertilisation approaches show that Member States often set fertilisation application limits that exceed recommended fertilisation levels for low leaching risk areas and fail to adequately reduce limits in high and medium risk zones. The development of precision fertilisation techniques may help to alleviate some aspects of over-fertilisation, but do not address the issue of whether the limit is adequate from an environmental point of view.

Derogations to the manure limit may have limited the achievement of the objectives of the Directive. Member States can apply for derogations to apply manure above the 170 kg N/ha limit under specific conditions, such as long growing seasons, crops with high nitrogen uptake, high net precipitation and soils with exceptionally high denitrification capacity. A key basis of derogations is the recognition that the risk of leaching and runoff from grasslands in rainy climates is often lower than from arable crops such as maize (see Annex XVII), and derogation decisions have typically required a certain share of grassland to be maintained on derogation farms. The first derogation was granted in 2002, and the number has increased and reached 6 Member States in 2013. The amounts of manure authorised under the derogations typically varied between 220 and 250 kg N/ha per year. After 2013, the number of derogations has been steadily reduced following water quality concerns. Experience with the granting of derogations has shown that significant exceedance of the 170 kg/ha limit often results in increased pollution both at the level of water and air. While under favourable conditions, higher manure application limits on grassland may result in lower groundwater pollution than on arable crops, the risks of pollution and especially of eutrophication of surface waters significantly increase with many derogations in the same area. It should also be noted that the intensification of production allowed under derogations is often combined with significant application of chemical fertiliser on the farm, linked to the need for intensive production of feed. Indeed, high livestock density is a driver of agricultural intensification and nitrogen surpluses, as shown in section 3. Therefore, derogations to the manure limit have come under increased societal and legal scrutiny as there is increasing concern that the higher livestock concentration and manure production allowed by derogations have contributed to negative effects on water, soil, air quality and protected habitats in the Member States concerned (See also Annex XII and Annex XVII).

That is why derogation decisions have come with additional conditions, higher scrutiny as well as higher engagement of farmers and authorities. This kept in check the negative impacts of the additional manure allowed, but they have also created expectations and entrenched the derogated farms in high nutrient-output farming that may have led to an accumulation of impacts over time, and thus contributed to the stagnation in water quality improvement in the 2010s described in section 3 [36]. Very high levels of manure production concentrated in a few regions have consequences beyond the Nitrates Directive, as it is also responsible for high ammonia emissions, with negative consequences on human health and on nature[83], and a large number of Member State experts considered that derogations are affecting competition between agricultural producers within the internal market. The experience with derogations has clearly

[83] See on coherence below.

underscored the necessity of a coherent livestock policy at EU level that would consider the effects of high for livestock concentration[84].

Climate change also has an increasing impact on the implementation of the Nitrates Directive, exacerbating the impact of eutrophication of aquatic ecosystems and making the management of fertiliser use more challenging. Climate change has added further complexity to an already complex environment in which to implement the directive. For example, the increasing water temperatures tend to exacerbate the impact of eutrophication, increasing the risk of oxygen depletion in bottom waters[85]. Climate change also leads to new weather extremes with longer droughts, longer growing seasons, stronger rains and floods during different periods of the year, complicating fertilisation management in agriculture and increasing the risks of nutrient losses. The directive leaves wide margins of manoeuvre for Member States to consider climate change effects in the design of measures. Hence, policymakers may find it necessary to implement measures to effectively address these challenges, as warming waters and unpredictable weather extremes can reduce the effectiveness of their efforts. At the same time, climate change has resulted in large fluctuations in yields and difficulties to keep livestock in conditions of prolonged and repeated droughts, and the increased uncertainty is reflected in calls from farmers for greater flexibility in the implementation of rules such as closing periods for manure spreading or deadlines for sowing, harvesting, or for planting of catch crops, often phrased in terms of complaints over "calendar farming".

The impact of climate change has already become evident and may have contributed to the stagnation of progress in water quality in recent years. Moreover, it is likely to intensify in the coming years [37]**.** As climate change impacts worsen, it raises questions on the sustainability of agricultural practices with high inputs, as the risks of nutrient pollution increase. At the same time, it becomes more challenging to identify the correct level of ambition needed to reach the required improvements in the aquatic environment. Importantly, in terms of the measures set out under the directive, the inherent flexibility of the Nitrates Directive makes it possible for Member States to adapt their design to take account of such challenges, through more flexibility or more cautious approaches to fertiliser application and targeted advice and information actions for farmers. The fast-developing knowledge and technology would assist in these efforts.

4.1.2 Efficiency

To evaluate the efficiency (cost-effectiveness) of the directive, economic estimates have been calculated of the adjustment and administrative costs for farms and public authorities resulting from the implementation of the directive in the Member States[86]. This was complemented with estimates of the societal costs of nutrient pollution and of the benefits of the directive in reducing these societal costs. The benefits of the

[84] See for example the *Vision for EU Agriculture and Food* [3] which states that priority should be given to "addressing nutrient pollution hotspots and promoting integrated territorial approaches. A key aspect of this would be the management and control of nutrients from livestock farming to limit negative externalities, support extensification in regions with high livestock concentrations, and promote circularity which can help reduce the use of synthetic fertilisers."

[85] While the primary cause of oxygen depletion is nutrient input from agricultural fertilisers, which cause eutrophication, the effects of eutrophication are exacerbated by climate change, in particular increases in sea temperature and in water column stratification (see EEA Open ocean — ocean chemistry).

[86] The economic analysis was informed by consultations with stakeholders and with experts from national authorities. See also **Annexes II and IV**. For details see [25].

Nitrates Directive go to society as a whole and to all economic activities benefitting from clean waters, while the costs fall on public authorities tasked with implementing the directive as well as on farms (in line with the polluter pays principle). Farms can also derive benefits from some of the measures implemented under the directive and can receive public support in some cases[87]. Such benefits are not directly reflected in the estimates below.

In concrete terms the **benefits of the directive** include reduced costs for water purification for drinking water purposes, long-term protection of drinking water resources, and clean rivers, lakes and coastal waters. Benefits go to economic activities, in particular tourism, water utilities, fisheries, aquaculture and other food producers, as well as to recreational activities and citizens in general through general amenity value of nature and the avoidance of negative health risks from polluted drinking water wells, especially in rural areas. While the directive is primarily aimed at protecting the aquatic environment, in practice it also has some indirect effect on reducing ammonia emissions from livestock production, hence improving air quality and reducing deposition of nitrogen on terrestrial habitats, especially in regions with high livestock densities. The directive also indirectly reduces nitrous oxide emissions, a potent greenhouse gas, linked to the land application of chemical fertilisers and manure.

An essential part of the benefits of the directive are linked to protecting human health and the directive's preventive effect. For example, the benefits for protecting drinking water can be measured by comparing the cost of the measures under the directive to reduce nitrate concentrations and prevent their increasing and reaching unsafe levels against the cost of water treatment (or securing an alternative drinking water source) and the potential number of people affected when nitrate levels exceed the drinking water threshold. It may also be the case that the drinking water reservoir is affected by eutrophication, rendering the water equally unsafe to drink. Technical solutions to treat such waters require substantial capital and operational expenditure, while preventive measures to minimize nitrogen runoff offer a more sustainable and cost-efficient solution. The economic implications of these strategies vary significantly based on the scale of implementation and local conditions. A 2024 Danish study[88] estimated technical nitrate removal costs between €0.15 and €1.60 per m³, whereas preventive measures range from €0.02 to €0.26 per m³. In some Member States (for example Germany and France), drinking water companies reported that they pay farmers for implementing good practices and reducing fertiliser use near drinking water extraction points. These examples illustrate the benefits of the Nitrates Directive in maintaining potential drinking waters below the 50 mg/l threshold and in keeping drinking costs lower, including where nitrates levels are low. Finally, an assessment of the value of health benefits of the Nitrates Directive needs to include not only drinking water, but also the impacts of eutrophication and ammonia emissions. With regard to these aspects, the developing science relating to health impacts of nutrient pollution from agriculture such as evidence of carcinogenic effects of nitrates at much lower level than 50 mg/l, premature deaths caused by ammonia emissions or jurisprudence on compensations for the death of a person due to toxic algae blooms (green tides in

[87] Farms can benefit from improved soil quality due to cover crops etc. (see [55]) and receive support for some investments (e.g. in manure storage) under the CAP.

[88] https://doi.org/10.1016/j.scitotenv.2023.167368

Brittany)[89] should also be taken into account. The fact that the nitrate pollution is below the drinking water threshold in many areas underlines the importance of the directive's preventive approach for the protection of human health and it does not imply that the health benefits of the directive are insignificant.

To estimate the economic value accruing to society from the implementation of the directive, the starting point is to estimate the costs to society of nitrogen pollution from agricultural sources. Pioneering work carried out in 2011 and in 2013, as part the European Nitrogen Assessment project [38], estimated the total yearly cost to society of nitrogen pollution in the form of nitrates, ammonia, nitrous oxide and nitrogen oxides from agricultural sources amounted to EUR 35-230 billion in 2008 [25]. The European Nitrogen Assessment had highlighted that an important aspect of those costs is linked to the cascading effect of nitrogen flows and pollution in the environment [38]. The cost estimates of the European Nitrogen Assessment have become a key reference. For this evaluation this estimate was updated based on cost figures gathered from more recent literature as well as updating for inflation, and the new cost estimates have been compared with the European Nitrogen Assessment estimates. Annex II and IV and the underlying study offer further details on the methodological approach.

The costs to society of nitrogen pollution from agricultural sources was estimated to EUR 68-182 billion annually in 2023 prices[90]. The estimate covers all four forms of nitrogen emissions, but the main costs are associated with emissions of nitrates (EUR 48-102 billion) and ammonia (EUR 17-76 billion). Based on these updated societal costs and an estimate of the impact of the Nitrates Directive's impact on the reduction of nitrogen emissions [39], **the societal benefit from the implementation of the Nitrates Directive is estimated to EUR 10-22 billion annually.** As in the original studies, these estimates relate to 2008 nitrogen emission levels, as it has not been possible to repeat the analysis with more recent data. Given the evolution of nitrogen input parameters detailed in section 3 and the overall stagnation of implementation observed in the 2010s, the estimates for 2008 emission levels are considered to remain broadly representative in terms of their overall order of magnitude. The largest benefit is related to the reduction in nitrate emissions to water, which is what one would expect since the directive aims primarily to affect nitrate emissions, but there is also a significant contribution from reduction of ammonia emissions[91]. The estimated value is based on an assumed constant marginal cost of pollution, which means that the estimate is conservative and could be significantly

[89] https://nantes.cour-administrative-appel.fr/decisions-de-justice/dernieres-decisions/responsabilite-de-l-etat-du-fait-de-la-proliferation-des-algues-vertes-en-bretagne

[90] The lower bound figure corresponds to the median cost estimate in the reviewed literature, whereas the higher bound corresponds to the average of the cost estimates in the literature. This served to indicate different interpretations of what would account as the "central estimates" in a very diverse population of studies, covering many different types of situations and approaches, and aimed to exclude extreme outliers. The final estimates were within the range of the original estimates arrived at in the Nitrogen Assessment and related studies, which formed the basis for the analysis, supporting the results. Annex II and IV and the underlying study itself explain the method used for arriving at the range.

[91] The directive's impact nitrates emissions was estimated to 16% of the total emissions. The impact on ammonia emissions was estimated to 3% of total ammonia emissions.

higher in reality[92], as further detailed in the sensitivity analysis provided in Annex II and IV.

In general, it should be noted that these estimates are associated with significant uncertainty, **however, the estimates allow to indicate the general order of magnitude, which is sufficient to draw conclusions and comparing to the implementation costs.** The uncertainties are due to the difficulties involved in correctly measuring both the impact of the directive and the associated value to society. Nevertheless, the aim here is not to provide precise estimates of all benefits but simply to reach a broad estimate of the overall order of magnitude of the total benefit of the directive to society, as a basis for comparison with the estimated cost of implementation. In other words, the analysis should be sufficient to serve as a basis for assessing the overall efficiency of the directive in terms of a welfare economic calculus at the level of society as a whole[93]. Going beyond the goal and scope of this evaluation, more extensive national level studies on the costs of nutrient pollution and the benefits of the measures modulated on the specific national context and reflecting the diversity of situations could be crucial tools for Member States to draw conclusions supporting policy choices and discussions with stakeholders.[94]

As regards the costs associated with the implementation of the directive, these fall on farms in NVZ and in Member States applying mandatory measures on the whole territory, who need to comply with requirement to follow good agricultural practices and limitations on fertiliser use, as well as on public authorities, who are responsible for identifying and monitoring pollution, designating NVZ, designing action programmes, supporting farms in the implementation of the measures and enforcing the measures.

The net adjustment costs borne by farms in the EU are estimated to approximately EUR 1.5 billion. These costs correspond to approximately 0.4 % of standard output of the agricultural sector in the EU in 2023. The distribution of the costs across Member States and sectors are shown in the graphs below. Figure 33 shows the total cost per Member State, reflecting the variations in the size and nature of the agricultural sectors across the EU. Figure 34 shows the same amounts as a share of total agricultural standard output, which gives a better idea of the relative importance of the costs compared to the size of the agricultural sector as a whole within each Member State[95].

[92] As nitrogen pollution increases the first kilos of nitrogen are likely to have little impact whereas at a certain point the impact becomes more significant. When reducing pollution, the Nitrates Directive removes the kilos "at the top of the pile" which are likely to be associated with higher cost than the average.

[93] For further discussion of the methodological issues, see Annex II and IV.

[94] For example, a study published in October 2025 (using national cost estimates) estimated the cost of nitrogen and phosphorus pollution (air pollution and eutrophication) in the Netherlands alone to be EUR 7.3 billion annually, which as a general order of magnitude seems consistent with the estimates provided in the evaluation study for the whole EU and the fact that costs of nutrient pollution in the Netherlands would be higher than average, due to the level of pollution, the population density and age distribution.

[95] As explained below these averages cover wide differences between different sectors. In particular, cost structure is very different between livestock farms and arable farms.

Figure 33 Adjustment costs for farms due to the Nitrates Directive for the EU-27 (€/year)

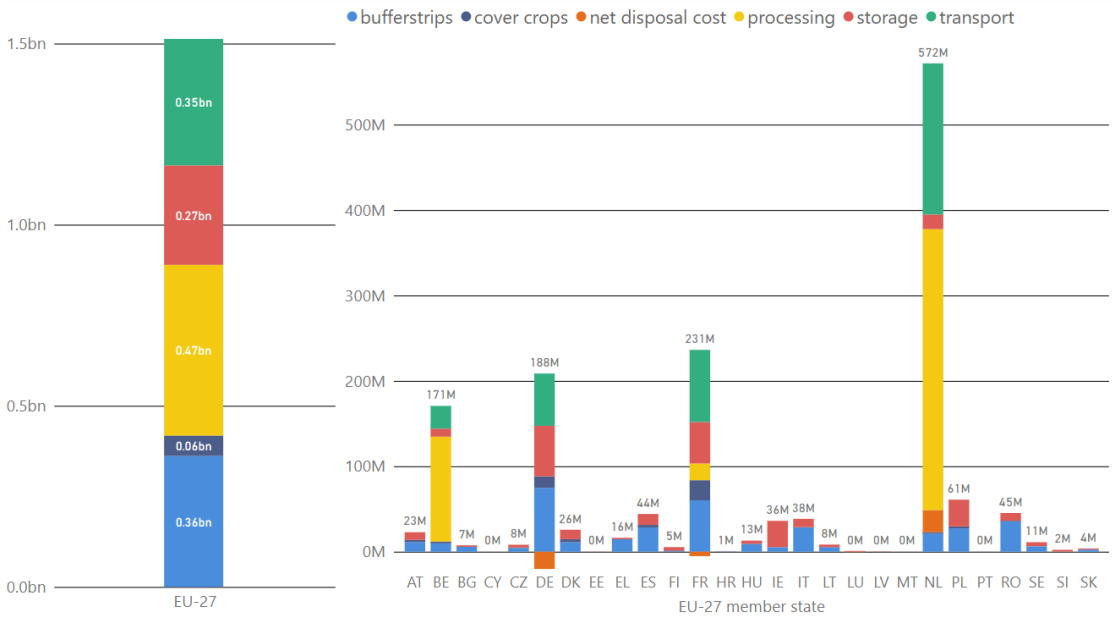
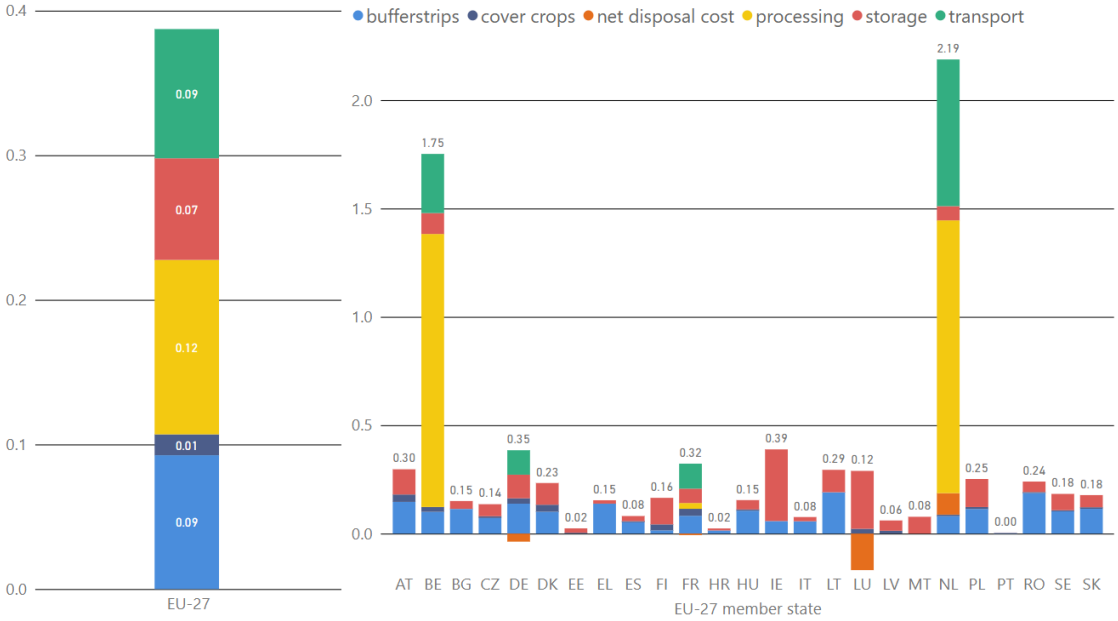


Figure 34 Adjustment costs for farms due to the Nitrates Directive for the EU-27 (percentage of standard output)



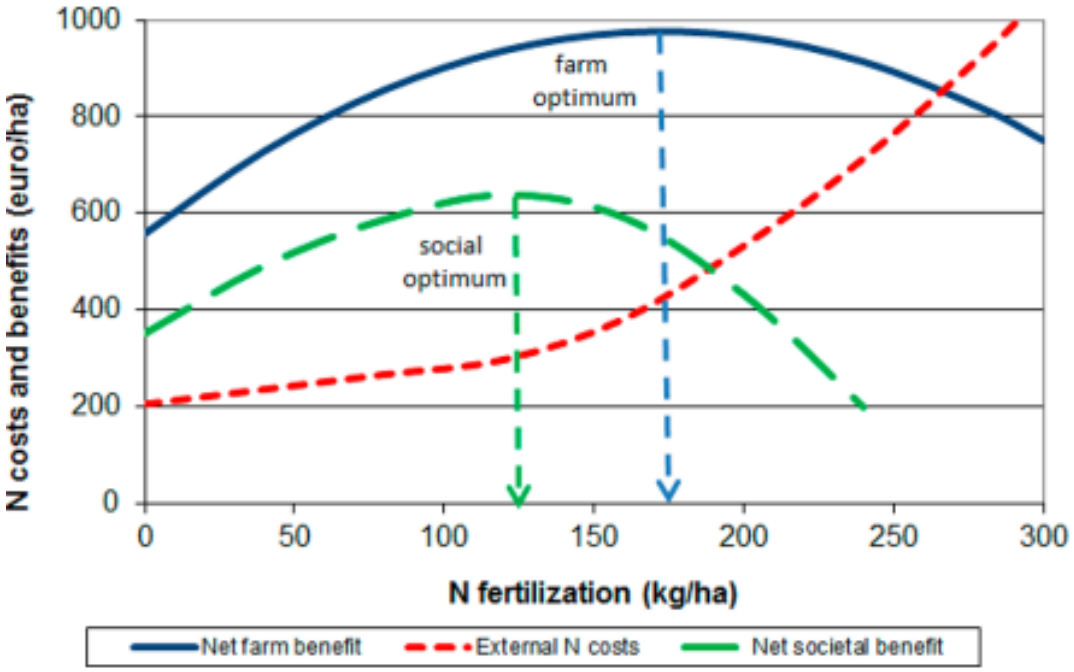
Around 55% of the overall costs are costs for livestock farms in a few Member States, associated with the processing, transport and disposal of excess manure[96] in regions with very high livestock density. The remaining 45% of the overall costs are more evenly distributed among farms in all Member States and are significantly lower as a share of output. These costs are generated by storage requirements stemming from the limitation of manure application during sensitive periods of the year, a significant investment cost for livestock farms across the EU, and

[96] This covers separation in solid and liquid fraction, composting and biological treatment (denitrification), transport to fields including exports to other farms and Member States, and payments to farms accepting the manure for spreading on their fields (the last point gives rise to negative costs in some Member States, due to payments from farms abroad).

by land management measures, where estimates have been developed for buffer strips along water courses and cover crops.

On the other hand, **the cost of balanced fertilisation which limits fertiliser application in function of the crop needs and the nitrogen present in the soil was found to be insignificant in terms of adjustment costs**, as they are generally not associated with a loss of agricultural yield[97]. As explained in Annex XI, the cost-efficiency of balanced fertilisation depends on the farm type, the standard for mineral or organic fertilisers and the economic situation. The fact that the cost of balanced fertilization is found to be insignificant, indicates that the fertilisation standards are usually close to the economic and agronomic optimum for the farmer. However there can be a further mismatch between the private economic optimum of the farmer on the one hand and the social economic optimum for society on the other, due to the externality costs associated with fertiliser use, which fall on society as a whole (see Figure 35).

Figure 35 Mismatch between the economic optimum for the farmer and for society (van Grinsven et al. (2013)



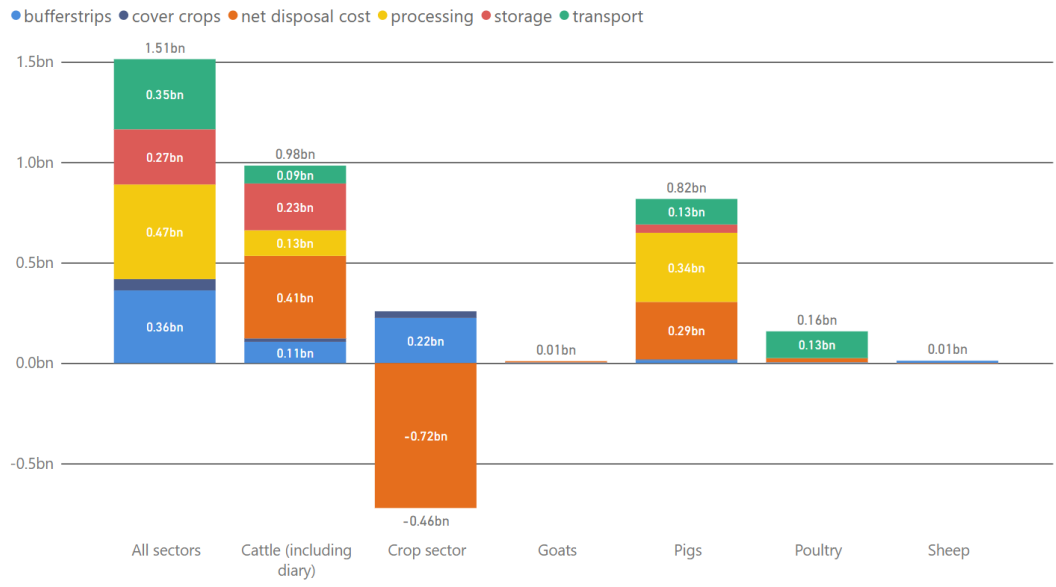
For arable farms without livestock production, the application standards will generally limit the input of chemical fertilisers, which reduces costs for the purchasing of such fertilisers. On livestock farms the application limit for manure applies in addition to the overall fertiliser application standards and can imply a need to export manure from the farm and replace it by chemical fertilisers, both of which involve costs for the farmer. Therefore, from the farmer's perspective, the incentive to apply livestock manure is evident. Using all the manure available on the farm is less costly as it reduces or removes the costs of storage, transport or processing of manure. Nevertheless, to reach an economic optimum through manure application, it would require application of very high amounts of total nitrogen, due to the generally lower efficiency of manure as a fertiliser (optimum

[97] They are however associated with administrative costs (see below).

agronomic fertilisation rates are based on the amount of nitrogen that is expected to be available to the crop during the growing season). In addition, the mismatch between the private economic optimum of the farmer and the social optimum becomes disproportionally high as the external costs for manure are linked to its high pollution risk, especially when concentrating all the manure application on the farm. Reducing societal costs of manure therefore calls for a redistribution of the manure between livestock and arable farms. Figure 36 below illustrates how the Nitrates Directive acts to redistribute and shows that it helps reducing costs for arable farmers. See also section 4.3 exploring how some forms of manure processing can reduce the environmental risks and allow for substitution of chemical fertilisers.

As shown in Figure 36, the overall adjustment costs are mostly concentrated in the livestock sector (EUR 2 billion in total) whereas the arable sector as a whole has a net negative cost (EUR 0.5 billion), as arable farms in and around intensive livestock regions benefit from by receiving a payment for allowing the use of their land for spreading excess manure. The intervention has the highest impact on cattle and pig farms, however, the high costs mainly reflect the specific situation in Belgium and the Netherlands, and outside these two Member States the overall cost is both much lower and more evenly balanced between arable and livestock farms. The significant cost increases are therefore concentrated in the regions with high excess of manure production. In regions where the manure production largely exceeds the amount of manure that can be applied on land within the limits of the directive (nutrient hotspots)(see Annex XII), the costs of disposal, processing and transport are significantly higher. But the excess of manure in these nutrient hotspots is also responsible for high nitrogen pollution in air and water (see section 3 figure 15 map on nitrogen surplus and section 4 figure 39 map on ammonia emissions).

Figure 36 Adjustment costs for farms due to the Nitrates Directive per sector (€/year)



The distribution of adjustment costs within each Member State and from one Member State to another in Figures 33 to 35 further illustrates how the flexibility in the implementation of measures may impact on their efficiency. The choice of the NL and BE to allow manure production far above the amounts that can be applied on land according to the directive has a very high impact on the costs for farms (and also on the overall effectiveness as discussed earlier). In other Member States where the difference

between the manure produced and the manure that can be applied on land is not as high overall, the costs for excess manure disposal, transport or processing are still a major part of the costs, but these are significantly lower. In those Member States nearby arable farms further benefit from the excess manure from nearby livestock farms and are able to reduce their costs. For Member states with a derogation (allowing more manure to be applied directly on land such as NL and IE), the costs of manure disposal and transport are lowered for part of the farmers. Manure storage is a key cost component for livestock farms and is influenced by the length of the closing periods (depending on climatic conditions), the type of farms and the extend of the NVZ. As explained in annexes XI and XII, closing periods are recognised as effective measures to limit the pollution from manure and it appears that the high flexibility in the implementations which has been used by all Member States to modulate the closing periods at national, regional or even crop level, has an overall positive impact on the effectiveness. As regards the costs, Figures 34 and 35 show that storage costs are more important for cattle farms (as these produce more manure) and may also be influenced by the climatic zone of the country, rather than other country specific flexibilities. For example, storage costs are overall more important in LU and IE with agriculture dominated by cattle and dairy farming, or proportionally dominant in Finland and Poland with long winter periods and mandatory measures covering the whole territory. Buffer strips along water courses are a much lower but non-negligeable part of the costs in all Member States. While there are large variations in the implementations of the buffer strips among the Member States (width and cover) which has a direct impact on their effectiveness (see Annex XI), it is not apparent that this flexibility has allowed for a more cost-effective implementation. While larger buffer strips with permanent cover are generally more effective, these are more commonly adopted in Member States with large agricultural parcels and where land prices are low, and found to be more strongly resisted in Member States with high land prices and high value crops, where buffer strips tend to be narrow and still allow crop production, making them generally less effective. Implementing cover crops is a choice of the Member State as it is not a mandatory measure under the directive. It is however recognised as an effective measure (see Annex XI), and its cost in percentage of standard output is relatively low in all Member States.

The administrative costs for farms have been estimated [26] **to approximately EUR 1.2-1.5 billion annually for the EU as a whole, or approximately 1.5-10.8 working days per year per affected farm.** The administrative costs are related to activities such as fertiliser planning and record keeping, controls by public authorities, and familiarisation with changing rules and restrictions. Table 1 sets out the average time estimates used for the calculation per activity and farm size. On average, administrative and enforcement costs under the Nitrates Directive are estimated to **EUR 350 to EUR 430 per year per farm across the EU, or 0.3% - 0,4% of standard output**. Farm size is an important factor as shown in the Table 2.

In contrast to the adjustment costs, the administrative costs are more evenly distributed across the EU, with the total cost per Member State being highest for France, Germany and Poland. Based on the lower bound estimates, the highest average cost estimates can be observed in northwestern Member States, such as Denmark, Luxembourg, France, Belgium, Sweden, Germany, Ireland and Netherlands, where the average cost tends to exceed EUR 600 per farm. By contrast, the average cost was estimated to less than EUR 200 per year per farm in nine Member States. **The cost estimates are likely to include a**

significant share of "business as usual" costs, as tasks such as fertiliser planning and record keeping would generally have been performed to a certain extent on most farms also in the absence of the Nitrates Directive[98].

Table 1 Lower and upper bound estimates of time spent by activity (in days)

Time spent on	*<10 ha*		*10 ha - 100 ha*		*>100 ha*	
	Lower	*Upper*	*Lower*	*Upper*	*Lower*	*Upper*
Familiarisation and training	0.5	0.5	0.5	1	0.5	1
Fertiliser planning	0.5	1.4	1	1.4	1.4	3
Record keeping	0.5	1	1.7	1.7	5.8	5.8
Controls	(*)	(*)	0.5	1	0.5	1
Total number of days	**1.5**	**2.9**	**3.7**	**5.1**	**8.2**	**10.8**

Table 2 Average costs by farm, year, and farm size

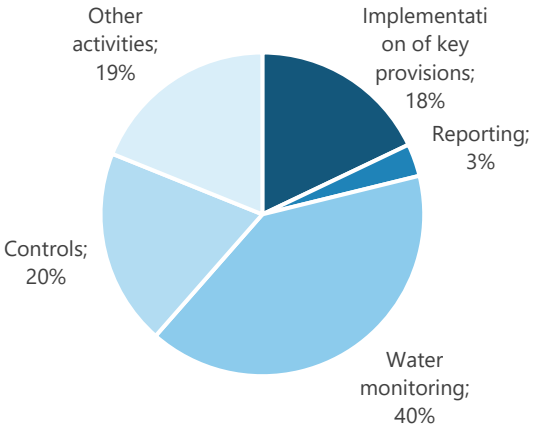
Farm size	< 10 ha (EUR)	10 ha - 100 ha (EUR)	>100 ha (EUR)
Lower bound estimate	138.93	461.48	1,465.42
Upper bound estimate	225.04	580.53	1,682.23

Overall, the adjustment and administrative costs for farms correspond to around to 0.8% of standard output of the agricultural sector in the EU. The simple average for the approximately 3.6 million affected farms[99] across the EU would be around EUR 780 to 860 per farm per year, although this amount would vary widely reflecting the broad diversity of farm types and sizes in the EU. Furthermore, considering the significant share of "business as usual" in the administrative costs and the impact of the high adjustment costs in the Netherlands and Belgium, the **effective burden would be significantly lower for most farms in the EU**.

The yearly administrative and enforcement costs borne by public authorities for the implementation of the directive have been estimated to EUR 120 million in total. This includes costs for coordination, designation of NVZ, design of action programmes and measures, monitoring water quality, reporting to the EU, and enforcement costs linked to inspections and controls. Around 40% of the public administrative costs are associated with the monitoring of water quality and 20% are linked to enforcement[100]. Reporting costs represent around 3% of the total administrative costs. The majority of the costs are concentrated in Member States with large farm populations or intensive livestock production[101].

[98] This was confirmed by farm associations which were consulted on the administrative cost estimates.
[99] This includes farms in vulnerable zones and in Member States with whole territory approach, excluding the very smallest farms (less than 2 hectares) considered not to be significantly affected by the directive.
[100] A significant part of the enforcement is done as part of the joint conditionality checks under the CAP, which helps increase efficiency.
[101] Belgium, Denmark, Germany, the Netherlands, Italy, France, Spain, Ireland, Poland, and Romania.

Figure 37 Composition of the Nitrates Directive implementation costs for authorities at EU level



In around half of the Member States public administrative costs linked to the implementation of the Nitrates Directive are below EUR 1 million per year. The cost to public authorities depends to a certain extent on national choices as the directive leaves wide discretion to Member States in its implementation[102], the exception being the 4-year cycle for the reporting and for the review of NVZ and action programmes.

Overall, as set out in Figure 38**,** the **burdens are generally proportionate and justifiable in light of the societal benefits due to the implementation of the directive.** In most of the Member States the adjustment costs are dominated by manure storage and area-based measures, while in a few Member States intensive livestock farms have particular costs linked to the disposal of excess manure. National measures implemented under the directive are associated with some administrative costs for farms, although this is likely to include a significant share of "business as usual" costs. Costs for public authorities are also reasonable overall and vary among the Member States in line with the size and nature of their agricultural sectors and implementation choices. While the overall costs are assessed as proportionate to the benefits, the evaluation nevertheless looked into the scope for simplification and burden reduction (see section 4.1.4 below).

For some livestock producers located in regions with *very* high livestock density and manure production, the cost of processing and transport of the excess manure means that the cost of complying with the limit on manure application is very significant. In these regions, mostly located in the Netherlands and Belgium[103], the livestock density and associated manure production in relation to the agricultural area typically goes far beyond levels corresponding to the manure application standard set out in the directive. **At the same time, the persistence of pollution due to excess nutrients from the high manure production exacerbate the societal costs of pollution in these regions**, affecting not only water quality but also air quality, nature and biodiversity[104]. This situation is thus in line

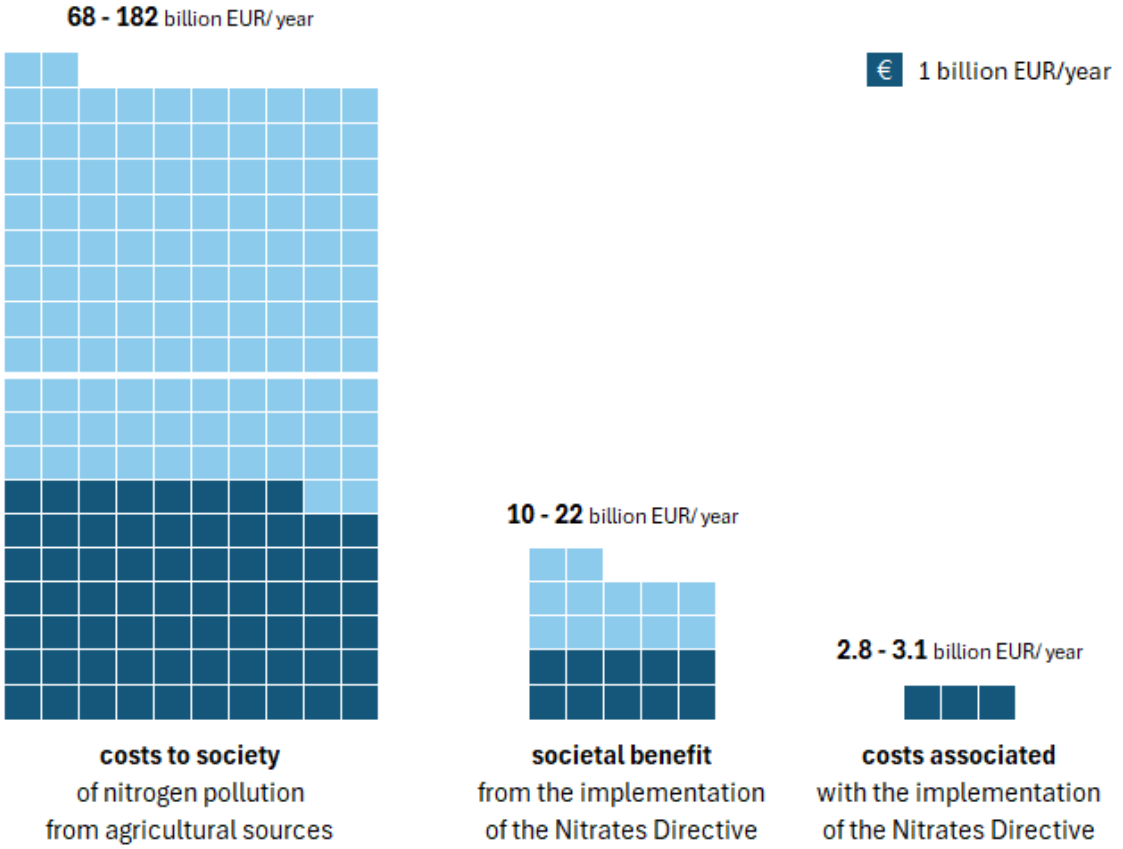
[102] Including whether to designate NVZ or apply a whole territory approach, or on the design of the water monitoring or the control programmes. Also, some Member States have developed complex and differentiated schemes for farms where others have generally applicable measures for all.

[103] Livestock concentrations are also high in certain other parts of the EU, such as in Brittany (France), Catalonia (Spain), Lombardi (Italy) and Lower Saxony (Germany). However, the concentrations are by far the highest in the Netherlands and Flanders.

[104] A study published in October 2025 after this analysis was performed estimated the cost of nitrogen and phosphorus pollution (air pollution and eutrophication) in the Netherlands alone to EUR 7.3 billion annually [40].

with polluter pays principle. In general, there would seem to be a good correlation between costs and level of pollution, as the directive generally imposes higher implementation costs in situations when pollution is more severe. In areas where there is no pollution risk, the implementation costs can be close to zero (outside NVZ), so the geographic distribution of costs and benefits of the directive would tend to be coherent in this sense.

Figure 38 Cost of nutrient pollution, benefits of the Nitrates Directive and implementation costs



The Nitrates Directive has in general not been a hindrance for the maintenance of a highly competitive agricultural sector in the EU. Considering regional specificities, the competitiveness of livestock farming remains generally unaffected by the Nitrates Directive. Even in Member States with *very* high livestock density, the livestock sector has successfully managed to retain its competitiveness despite the fact that costs of implementation of the Directive increase significantly. Indeed, economic analysis detailed in Annex XVIII[105] indicates that while the Nitrates Directive has increased costs for livestock farms in high-density regions, this has not generally been sufficient to reverse the territorial concentration of livestock activities. Other factors such as improvements in animal performance, technological progress, the consolidation of strategies between upstream and downstream sectors, and the pursuit of economies of scale and agglomeration have been the main drivers influencing developments in animal numbers in such regions. Economic efficiency has been improved through rationalisation of livestock management practices, technological advances, specialisation and farm consolidation, which facilitates economies of scale in the execution of specific operations. This conclusion is also supported by international competitiveness indicators, indicating that the relative share of the EU-27 plus the UK in the total global dairy product exports in 2025 is comparable to

[105] See Annex XVIII on the impact of the directive on the competitiveness of agriculture and [26].

the share in the 1990s. A dip in the mid-2000s for butter and skimmed milk powder can be explained by the fact that the dairy quota from the CAP kept the dairy industry from growing, resulting in a loss of market share. After the abolition of the dairy quota, the EU share for butter and skim milk powder returned to levels comparable to those of the 1990s, without the Nitrates Directive preventing this. Overall, these statistics suggest that other forces are significantly more influential in shaping the industry's development than the Nitrates Directive. Furthermore, the relative long-term stability of the export share of the EU livestock sector suggests that the impact of the Nitrates Directive on competitiveness has been limited. This conclusion is also supported by an econometric analysis of the impact of the Nitrates Directive on the evolution in agricultural costs, margins and incomes as well as in crop yields and livestock numbers across the EU, as detailed in Annex XVIII analysing the impact of the directive on the competitiveness of agriculture. For livestock farms, exposure to NVZ measures is associated with higher specific production costs and higher specific outputs. These effects offset each other at low livestock density levels, resulting in no significant change in livestock margins, whereas in Member States with higher livestock density, costs increase further, resulting in reduced livestock margins, consistent with the notion that higher-density regions incur greater costs. However, no statistically significant effect is observed at the level of farm net income. The effects found at the farm income level are consistent with those identified at the activity level, where the analysis provides no evidence of significant changes in animal numbers in regions impacted by the directive. For crop farms, no statistically significant effects are found for any of the variables. Only a weak negative association is observed for farm net income, which becomes positive in regions with higher livestock density.

4.1.3 Coherence

The Nitrates Directive forms part of a broader framework of EU environmental laws on water, air, nature and agriculture developed since its adoption, complementing and in some cases building on the directive. It should be noted at the outset that the Nitrates Directive is the only set of norms that regulate the management of manure at EU level in consideration of its pollution potential.

Coherence with EU water legislation

The Water Framework Directive (WFD) and the Nitrates Directive (ND) are intricately linked and work together to achieve water quality objectives in the EU. As explained in Annex XV, the WFD provides an overarching framework for water protection with water quality objectives[106], while the Nitrates Directive contributes to these objectives through its specific focus on reducing nutrient pollution from agriculture. As explained earlier in section 3, the WFD has had a generally positive impact on the implementation of the Nitrates Directive but has not made the Nitrates Directive redundant as the WFD is relying on it to reach its objectives. **The WFD does not replace the ND, rather it has integrated it, with measures under the ND recognised as a basic measures in the Programmes of measures of the RBMPs[107]. The ND is fundamental in reaching the WFD's objectives** as nitrates pollution and eutrophication remain significant obstacles to reaching water quality objectives. Similarly, the Groundwater Directive (GWD), which sets the detailed procedures for meeting the WFD's environmental objectives for

[106] Good ecological status or good potential for surface water and good chemical status for groundwater
[107] Article 11.3(a) and annex VI of the Water Framework Directive.

groundwater quality, complements the ND by defining additional thresholds but depends on the measures of the ND to reduce nitrates pollution from agriculture. **The measures under the ND are also essential to reduce the eutrophication of the coastal and marine environments, a key objective of the MSFD.** Eutrophication is one of the descriptors (No 5) that define the Good Environmental Status (GES) of marine waters and should be monitored in line with specifications and standardised methods defined under the MSFD.

The integration and synergy between these directives have grown over time, highlighting their mutual interdependence in achieving both overarching and specific water quality targets within the EU. Member States have had to take into account the objectives of the WFD in the design of their action programmes under the Nitrates Directive and adapt the measures and ambitions to the new requirements. In the River Basin Management Plans (RBMPs) under the WFD, the nitrate action programmes are a cornerstone with mandatory agriculture practices for addressing nutrient pollution from agriculture, complemented by additional voluntary or mandatory programmes. Some Member States differentiate measures or NVZ according to river catchments and basins. The results from the monitoring of nitrate concentrations under the Nitrates Directive are used to assess pressures and impacts in the context of the WFD and the other way around, as there has been an increasing reliance on the WFD to assess eutrophication. **Nevertheless, the integration of the ND and the WFD remains incomplete and uneven among Member States, especially in the preparation and design of national measures and objectives to be achieved, although awareness has been improving with the approaching 2027 deadline**. Incomplete integration may reduce the effectiveness and cost-efficiency of the national measures to achieve WFD objectives. The high flexibility under the ND and the WFD also creates important differences of approaches between Member States.

The water quality criteria and thresholds are generally coherent but there are overlaps and different approaches in the monitoring and reporting under the Nitrates Directive and the WFD. See also Annex XV for details. The flexibility provided to Member States under both directives allows adapting the implementation to local conditions. At the same time, this has also translated into discrepancies in monitoring networks, reporting data and status assessment. Differences and overlaps in the monitoring and reporting touch upon a number of aspects, including the monitoring networks themselves, the thresholds for pollution, standards and criteria for water quality, the way data is aggregated, the identification of starting points for trend reversal, the overall assessments and duration of the reporting cycle. While some of the differences follow legal requirements, most can be traced back to divergences in implementation. The quality standard for nitrates in groundwaters under the GWD and WFD (50 mg/l) is fully aligned with the Nitrates Directive, but the groundwater monitoring networks, the methodology for aggregation of data, for calculating trends in groundwater quality, the reporting cycles and the threshold to reverse deteriorating trends are different. As nitrates is only one of the pollutants examined under the GWD, reporting on the chemical status at groundwater body level can be difficult to reconcile with the geographical view of nitrates pollution under the Nitrates Directive. Similarly for surface waters, different approaches to the assessments of eutrophication under the Nitrates Directive and ecological status under the WFD can result in different results under the two directives [41]. Member States and the Commission have developed studies and guidelines to improve coherence (see text box 2), but experts consulted for the evaluation generally agreed that further integration would be desirable.

In 2025, collaboration between the relevant expert groups under both directives have been initiated to improve coordination, information exchange and streamlining of efforts among competent authorities dealing with the monitoring and reporting.

Stakeholders recognise the important contribution of the Nitrates Directive to the EU water quality objectives and find that it is generally coherent. In particular, a large majority of Member State experts considered that the directive supports the objectives of other environmental legislation. However, it was also found that the differences in monitoring and reporting between the Nitrates Directive and the WFD, as explained above, have made it more difficult to show a coherent picture on the nutrient pollution in water and its evolution. In turn this could make it more difficult to bring a clear message to policy makers and stakeholders on the extent of pollution and the efforts needed to reduce it, which would be necessary in helping farmers buying in on the measures and civil society in keeping decision makers accountable. In the consultations, some stakeholders reported that it could have contributed to delays or avoidance of policy decisions to address nutrient pollution from agriculture. It was also highlighted that the difference in duration of the policy cycles (4 years under the Nitrates Directive and 6 years under the Water Framework Directive) renders more challenging a coherent approach and can increase administrative burden (see also section 4.1.4 below).

The Nitrates Directive contributes critically to ensuring that Member States and water distribution companies can respect the standard for nitrate set out in the Drinking Water Directive (DWD)[108]. The Nitrates Directive has a clear objective of protecting human health and drinking water resources from diffuse pollution of nutrients from agriculture. This includes reducing nitrate concentrations in groundwaters and fresh surface waters, as well as avoiding eutrophication in all surface waters, including those used for abstraction of drinking water. The evaluation found [26] that there is some overlap in the water monitoring requirements regarding nitrate concentrations in waters abstracted for drinking water purposes under the Nitrates Directive and the DWD. However, it did not find that the monitoring under the Nitrates Directive was redundant, but rather that both were complementary, as the Nitrates Directive monitoring focuses on the areas affected by agriculture, whereas the Drinking Water Directive monitors extraction points for drinking water where overall pressures, including from agriculture, are generally low.

The Nitrates Directive is fully coherent and complementary with its "sister" Directive the UWWTD. The directives were adopted shortly after each other and both aim at reducing nutrient pollution in water, but each addressing one of the two main sources of nutrient pollution, agriculture and wastewaters respectively, and both contributing to reaching good status for surface waters, including by addressing eutrophication. While it can be challenging for Member States to decide on the source of nutrient pollution in downstream water and untangle the sources (agriculture vs wastewater), the CJEU has clarified that whenever agricultural sources are significant they require action under the Nitrates Directive. The WFD also provides a coherent framework for addressing all nutrient pollution, so that "ping-pong blame games" between different sources can be avoided. It is also the case that today agriculture tends in most cases to be responsible for

[108] Likewise, the directive contributes to the objectives of Directive 2009/54/EC on the exploitation and marketing of natural mineral waters, which requires that these waters need to be protected from all risk of pollution.

the majority of nutrient pollution in both of freshwaters and in the seas [42]. The recast UWWTD in force since 2024 reinforces complementarity between the directives by strengthening the standards for treatment of urban wastewaters and by promoting the recovery of the nutrients, allowing these to be safely reused in agriculture, enhancing circularity. (See also section 3)

Coherence with clean air directives[109] and Industrial Emissions Directive (IED)

The Nitrates Directive and the NECD are found to be overall coherent and complementary in tackling nitrogen pollution from agriculture. This was also highlighted in the evaluation of the NECD published in December 2025 [43] (See also Annex XV). The complementarity of the Nitrates Directive and the NECD can be seen as a positive development as there is always a risk of pollution swapping between nitrogen emissions in the air (ammonia - addressed under the NECD) and nitrogen emissions in water (nitrates - addressed under the Nitrates Directive) which could reduce the effectiveness of the measures under both directives. The risk of pollution swapping is particularly important for manure management measures under both directives, such as storage conditions and closed periods, and therefore many Member States have an integrated approach balancing priorities and risks in function of local circumstances. Over time, Member States have increasingly introduced mandatory measures that reduce ammonia emissions from manure management (in their nitrates action programmes or other laws), for example requiring a cover for manure storages, direct incorporation of manure or the use of low emission manure application techniques, ensuring a coherent approach at national level[110]. Some of the measures to address ammonia emissions are similar to requirements of the Nitrates Directive, though under the NECD the inclusion of many of these measures into the national air pollution control programmes is optional for Member States[111]. Given the flexibility provided by both directive, the overlaps and complementarities are generally positive, as they allow for synergies and tailoring at national and at farm level to address both objectives in an effective and proportionate manner[112].

Without the Nitrates Directive, it would be more difficult for the Member States to control ammonia emissions from agriculture, a source of air pollution. The measures under the Nitrates Directive, including the balanced fertilisation requirement and the limit on manure application, help Member States to reach their goals on reduction of ammonia emissions under the NECD, as the majority of ammonia emissions from agriculture originate from livestock manure – either from stables and storages or from application on the fields.

[109] https://environment.ec.europa.eu/topics/air_en

[110] See examples of AT, DK, IE provided in the NECD evaluation

[111] For example, according to Annex III of the NECD, Member States "may" promote the spreading of fertilisers and livestock manure in line with the foreseeable requirements of the receiving crop, which duplicates the balanced fertilisation requirement under the Nitrates Directive but only has the legal force of a recommendation to the Member States, whereas under the Nitrates Directive it is a mandatory measure in vulnerable zones. Likewise, the NECD recommends ensuring farms have sufficient manure storage capacity to spread manure only during periods that are suitable for crop growth, which is a mandatory measure under the Nitrates Directive.

[112] The evaluation of the NECD further found that the Nitrates Directive and the NECD are mostly coherent. Only a few marginal measures from either the Nitrates Directive or the NECD have been identified as having unintended negative effects on the other.

As shown in Figure 39, almost all ammonia emissions in the EU originate in agriculture and mainly from livestock. Figure 40 in turn shows the spatial distribution of agricultural ammonia emissions across the EU27, showing hotspots in darker colours. The link between the hotspots and livestock concentration is clear from a comparison with Figure 16 in section 3.2.3. Furthermore, the implementation of the measures under the Nitrates Directive can have an impact on the achievement of the objectives of the Ambient Air Quality Directives, as ammonia is an important precursor to particulate matter, an air pollutant for which the Ambient Air Quality Directive sets limit values.

Figure 39 Evolution in ammonia emissions since 1990 in the EU27[113]

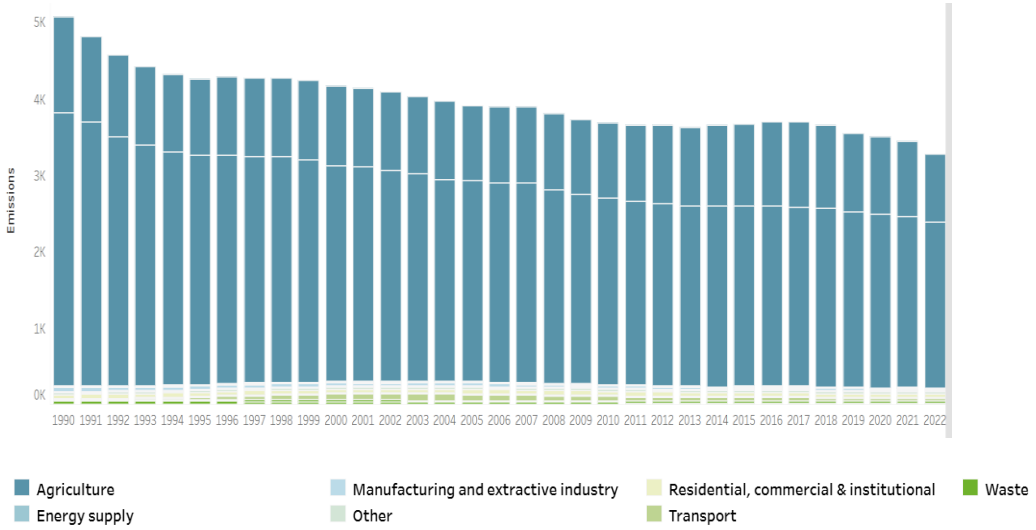
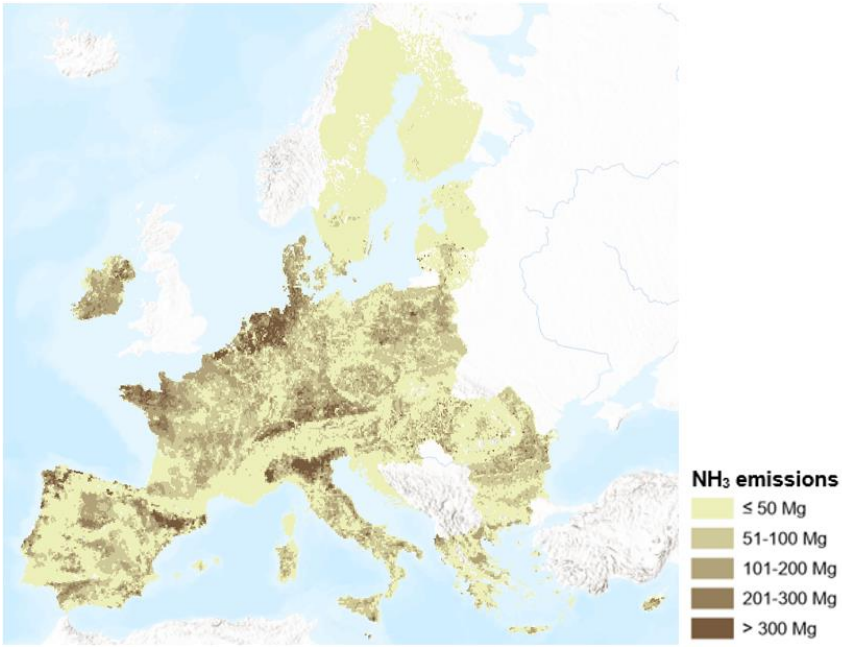


Figure 40 Spatial distribution of agricultural ammonia emission in EU27[114]



There could be benefits from a more integrated approach to the various forms of nitrogen emissions from agriculture. Some stakeholders and national experts suggested

[113] Air pollutant emissions data viewer (Gothenburg Protocol, Air Convention) 1990-2022 | European Environment Agency's home page

[114] Based on EMEP data: https://www.ceip.at/the-emep-grid/gridded-emissions/nh3, year 2023

that the scope of the Nitrates Directive should be extended to include also ammonia emissions from agriculture, which they argue would allow to capture more comprehensively the environmental impacts on air and water due to excess manure both in stables and when applied on the field. Others have called for the directive to retain its current scope and focus. More generally, there have been calls for an action plan to promote integrated nutrient management. Recently, this became an element in the strategic dialogue on the future of European agriculture[115]. The Commission responded in *A Vision for Agriculture and Food* [3] emphasising the need to improve nutrient management at farm level and promoting integrated territorial approaches, as well as in the *European Water Resilience Strategy* [2], which envisages to launch an assistance Toolbox for Member States to support actions to reduce nutrients pollution, including through enhanced modelling, interactive maps and exchanges of best practices.

The IED is relevant in the context of the Nitrates Directive, as it addresses the prevention and control of all pollution resulting from the intensive rearing of poultry or pigs[116]. However, the IED mainly addresses pollution from installations (e.g. housing of pigs and poultry and associated manure storages). The issue of the land application of livestock manure is left primarily to the Nitrates Directive. As intensive pig and poultry rearing results in large amounts of manure, it can contribute significantly to the environmental problems linked with the disposal of the manure in hotspot regions characterised by high livestock density and related pollution issues. This is also the case for the intensive cattle and dairy farms, but these fall out of the scope of the IED. However, in both cases it falls on the Member States to make sure that the amount of manure cumulatively produced by the intensive rearing plants and by other farms in the region remains in line with the amount of manure that can be put on land in this region under the Nitrates Directive. As explained in the previous sections, when there is an important imbalance, the risks of pollution, the costs of manure disposal and the societal costs of pollution increase significantly. This also illustrates the importance of using all the levers provided by these acts in complementarity and coherently. Leaving the Nitrates Directive shouldering the burden alone reduces its effectiveness.

Coherence with nature legislation (Birds and Habitats directives, Nature Restoration Regulation)

Fertilisation and manure management can have a significant impact on protected habitats and species and hence on the Natura 2000 network of protected areas. In particular, the fertilisation by chemical fertilisers or manure can have an important impact on protected habitats and species both on land and in water, when these are sensitive to nitrogen or phosphorus. Therefore, the limits of fertilisation or manure application in nitrate vulnerable zones generally contribute to protect nature and biodiversity against excessive fertilisation. On the other hand, these limits may turn out to be insufficient to prevent the deterioration of protected habitats or species or ensure their conservation objectives when farming within or near Natura 2000 areas. Guidelines of 2018 explain that

[115] Strategic dialogue on the future of EU agriculture - European Commission

[116] The revised IED (Directive 2010/75/EU or 'IED 2.0') as amended by Directive 2024/1785 covers about 38500 farms targeting the largest and most polluting intensive pig and poultry farms, which amounts to 30% of pig and poultry farms in the EU. A review clause requests that the Commission assess the need for Union action to comprehensively address the emissions from the rearing of livestock within the Union, in particular from cattle by 31 December 2026.

when potential adverse effects of a draft nitrates action programmes are identified on one or several Natura 2000 sites, including in the context of the Strategic Environmental Assessment of the Action Programme, an assessment under Article 6(3) of the Habitats Directive would have to be conducted [44]. While it is for the Member States to ensure that appropriate measures are in place, experience shows that it has not always been applied, including when derogations allowing the application of manure above the limit of the Nitrates Directive have been authorised within or close to Natura 2000 areas.

Over time, Member States have therefore been gradually brought to integrating the requirements stemming from the Birds and Habitat's Directives in their national nitrates action programmes on the basis of dedicated environmental assessments, notably by ensuring limits on fertilisation and manure compatible with the objectives for protected sites. This evolution is still ongoing and can be controversial among stakeholders[117], as illustrated by the fact that the changes have often come about as a result of court cases. As explained in Annex IX, CJEU jurisprudence from 2018 has clarified the need for appropriate environmental assessment vis-à-vis the objectives of the Birds and Habitats Directives as regards manure application, including from grazing, which would be particularly relevant in the case of derogations from the manure limit. In 2023, the European Court of Auditors [36] recommended that the Commission, when granting derogations, should include in its assessment a review of potential conflicting objectives arising in other EU policy areas. The Commission has published a guidance note in 2019 to support Member States in coordinating the implementation of the Nature directives and the Nitrates Directive [45]. Experience from the last years have highlighted that despite the guidance from the CJEU and from the Commission, the assessment process in relation to nitrates derogations or manure application around N2000 areas are often cumbersome and controversial. Therefore, a better integration in the design and preparation of nitrates action programmes of the specific requirements for the conservation and restauration of EU's natural heritage on land and seas would increase transparency, simplify the application of the programmes at farm level, and facilitate the early adoption of mitigation measures and financial support for farmers and responsible authorities.

As the nitrate action programmes are relevant for several environmental directives and their measures have impacts beyond the Nitrates Directive, the requirement, confirmed by the CJEU (see Annex IX) that the programmes must be subject to an environmental assessment under the SEA Directive, allows Member States to assess their overall environmental effects, thereby strengthening a coherent approach, as well as publicity and accountability in the decision making process.

Coherence with CAP and the organic farming regulation.

The Common Agricultural Policy (CAP Regulation) and the Nitrates Directive (ND) are closely linked and work together for the sustainability of agriculture in the EU[118]**.** The integration and synergy between these instruments highlight their mutual interdependence in implementing good agricultural practices for sustainable farming and

[117] While there can be financial compensation of farms under the CAP, to mitigate additional costs and income foregone due to the additional constraints on the farming activity, farmers have complained that the constraints can be disproportionate. Nature organisations responsible for managing protected sites highlighted that high nitrate levels in nature reserves hinder the ability to meet habitat quality standards.

[118] Annex XVI describes in detail the interlinks between the CAP and ND. See also Section 3 describing how the CAP has influenced the implementation of the ND since its adoption.

environmental protection throughout the EU. (Annex XVI describes in detail the interlinks between the CAP and ND).

The ND and the CAP support each other in the achievement of their respective objectives. The ND ensures that all farms in nitrate vulnerable areas apply the same type of environmental protection rules as regards nutrient pollution, thus providing a common baseline and facilitating a level playing field. Through the promotion of good agriculture practices for all farms in the EU, with mandatory requirements for farms in NVZ and voluntary requirements for farms outside the NVZ, the ND contributes to the general and specific objectives of the CAP. On the other hand, the CAP Strategic Plans also contribute to the objectives of the Nitrates Directive. The core of the ND (Articles 4 and 5 including the Member States' Nitrates Action Plans), are part of Statutory Mandatory Requirement (SMR) 2, legally integrating the Nitrates Directive as an element of the CAP Regulation. Additionally, ND measures are a baseline for all payments under the CAP. This has strengthened awareness and enforcement of the ND. This also creates synergies between the Nitrates Directive and the CAP when it comes to controls of compliance on farms, as all Member States authorities perform compliance controls as part of the conditionality under the CAP. Almost all Member States also carry out specific desk-based and on-the-spot checks under the Nitrates Directive (in addition to the checks under the CAP)

There is a strong complementarity between the Nitrates Directive measures and the CAP interventions. The CAP GAECs[119] (4, 5, 6 and 7) complement the good agriculture practices under the ND by extending the scope and coverage of mandatory requirements of the latter. Some GAECs and ND measures are partly similar (e.g. requirement to have buffer strips); however, these mostly help to strengthen the implementation overall and are not generally a problem (e.g. buffer strips - farmers outside NVZ and beneficiaries of the CAP also apply mandatory buffer strips). It should be noted though that GAECs only apply to recipients of CAP support, whereas the ND is mandatory for all farms in NVZ or in whole countries with a whole territory approach. Voluntary measures (including eco-schemes and agri-environment-climate commitments) build upon the ND baseline and provide incentives for farms to go further in reducing nutrient losses, thereby strengthening the implementation of the ND and further contributing to its objectives. The CAP farm advisory services (FAS) and exchanges of best practices for the implementation of the CAP complement and reenforce the implementation of measures to reduce nutrient losses of the ND.

Member States and farms can receive CAP support for certain investments under the Nitrates Directive (up to 2 years after the measures are considered mandatory)120. However, some Member State experts highlighted a tension between supporting voluntary measures through CAP funds and implementing them as a mandatory measure under the Nitrates Directive without funding support: while the CAP provides a legal basis for compensating mandatory restrictions under the WFD and the Habitats Directive, this has not been the case for the Nitrates Directive, which could possibly discourage Member States from imposing more demanding measures on farms under the directive.

Overall, there are no major overlaps of the measures or duplication of efforts. The CAP support is to a large extent relying on voluntary additional measures underpinned by

[119] Good Agricultural and Environmental Condition requirements.
[120] The period was prolonged to 3 years in the simplification package [27]

funding, whereas the Nitrates Directive remains focused on the baseline requirements. A majority of respondents to the public consultation and the Member States considered that both policies are coherent, although some stakeholders have pointed to a need for better integration of environmental objectives within the CAP.

The Nitrates Directive is also found to be fully coherent with the Organic Farming (OF) Regulation. Indeed, the approach of organic farming on fertilisation, protection of soils and water, and on livestock makes the compliance with the requirements of the Nitrates Directive more straightforward. The OF Regulation mirrors some of the requirement of the Nitrates Directive, in particular the limit on the use of animal manure (170 kg N/ha). It also limits the use of fertilisers to low solubility mineral fertilisers (mineral nitrogen fertilisers being prohibited), requires that livestock farming be land based and limits the concentration of livestock per hectare. Mandatory practices such as crop rotation and practices that encourage soil cover go further than the Nitrates Directive where these are not mandatory measures. Member State experts mentioned organic farming as a model with overall less fertiliser inputs and better impact on soil health that increases resilience to climate change impacts, although some also pointed to the lower yields in organic farming. Some stakeholders were of the view that the national implementation of the Nitrates Directive may not sufficiently contribute to promoting organic farming, as the rules are modelled on conventional farming practices. Organic farming associations have in turn emphasised that the national implementation of the Nitrates Directive can be difficult to reconcile with organic farming practices, in particular as regards calendar requirements for sowing, harvesting or fertiliser use. In view of supporting organic farming, some have highlighted the option of exempting such farms from certain requirements[121].

4.1.4 Potential for simplification and burden reduction

This evaluation also examined the potential for simplification and burden reduction under the Nitrates Directive. The assessment is based on the analysis of effectiveness, efficiency and coherence and the extensive consultations with stakeholders and public authorities. The analysis highlighted a number of areas with simplification potential, both for farms and for public authorities. In line with the simplification objectives of this Commission[122] and as requested by the Regulatory Scrutiny Board, the evaluation already puts forward simplification options that the Commission could consider as a follow-up to the evaluation, after necessary assessments and consultations. The options are presented here below. As will be clear from the presentation below, most of the options could be implemented without requiring any legislative changes to the directive. This reflects the flexibility that the directive gives Member States in its concrete implementation.

Reduction of administrative costs for farms and public administrations. As the Nitrates Directive leaves wide discretion to the Member States in the design of measures under the directive, the burden posed on farms depends largely on the implementation at national level. The cost estimates presented in section 4.1.2 indicate that activities related to the implementation of the directive, such as fertiliser planning, record keeping,

[121] In the CAP simplification proposal [27], final certified organic farms will automatically be considered as meeting some of the EU's environmental requirements for CAP funding.

[122] The template for the evaluation staff working document explains that: “Where appropriate, evaluation findings should pinpoint areas where there is potential to reduce inefficiencies (particularly unnecessary costs) and simplify the intervention”.

familiarisation with rules and public controls, are associated with administrative costs for farms. A significant share of these costs is likely to be "business as usual" costs that would have been incurred under any circumstances as part of normal farm management practices, but some part would be directly attributable to the implementation of the Nitrates Directive. In the public consultation a large majority of stakeholders linked to the agricultural sector and related industry still considered that implementation costs for farms were disproportionate. On the other hand, environmental NGOs and water supply managers considered that the costs for farms were proportionate, indicating a certain polarisation on the issue[123]. Farmers have raised concerns over administrative burdens[124].The directive leaves it as optional for Member States whether they want to impose specific rules on fertiliser planning and record keeping as part of their binding measures, but most Member States have seen a need to impose such requirements in one form or another[125]. Other potential avenues for simplification mentioned included reducing the need for administrative or on-site controls, for example by exempting small farms or farms in areas with good water quality. Member State experts also mentioned technological solutions (remote sensing), and clear rules with minimal exceptions making enforcement easier.

(1) **Administrative burden reduction for small farms**: National rules could be adapted following the model of the 2025 simplification of the CAP, exempting or reducing some administrative obligations for small farms. In effect, this would also be a simplification for the public administrations.

Actionable simplification: This potential simplification would need to be enacted at national level, but it could benefit from clear guidance from the Commission so that Member States can operate within a clear and common framework. The Commission, together with the Member States in the Nitrates Committee, could adopt recommendations around possibilities to reduce requirements or exempt small farms from certain administrative requirements.

(2) **Simplification for farms and authorities through technological solutions**: The use of digital tools for record keeping and data gathering could be promoted to minimise burden on farms and Member State authorities[126]. This could also include technological solutions for remote monitoring and providing information to farms. The simplification and burden reduction potential would depend on the concrete implementation in the Member States.

Actionable simplification: This potential simplification is based on national implementation choices but would benefit from exchange of best practices and experiences among Member States experts. The Commission together with the Member States in the Nitrates Expert Group will organise exchanges of best-practices,

[123] Public consultation Q 3.8.

[124] Record keeping could be a case in point here. While Member States often require records to be able to check during control visits, the extent and nature of these requirements differ across the EU.

[125] The establishment of fertilizer plans on a farm-by-farm basis and the keeping of records on fertilizer use is listed among the optional measures for inclusion in national codes of good practice and action programmes (part B of Annex II).

[126] Authorities could for instance provide digital tools for fertiliser planning and reporting and other purposes that farms could integrate with their own farm management information systems.

research results and expert information, including on opportunities of financial and technical support[127].

Flexibility in the implementation of the measures set out in Annex II and Annex III of the directive. Annex II and III require that Member States implement certain types of measures in their nitrate action programmes but do not prescribe how it should be implemented. The evaluation finds that Member States are making use of this flexibility to adapt to local circumstances and thus that the national implementation is already extremely varied, with different declinations at national or regional level. The flexibilities in the national implementation should allow Member States to minimise costs and optimise efficiencies in the local context. Nevertheless, farm associations have highlighted the potential for simplification of the national implementation of measures under the directive [46], [47] mentioning for example the need for increased stability of the rules and greater flexibility to avoid a "one-size fits all" approach and unnecessary constraints on farming activities, that are perceived as ineffective and demotivating. This may refer to the need for flexibility in fixed deadlines to take into account climatic conditions, flexibility in the choice of measures at farm level or better taking into account the individual environmental performance of farms. Some of these concerns have also been relayed by Member State experts pointing out that the burden for farms depends on how the measures are applied and that local conditions play an important role in that. Climate change is also increasingly affecting agricultural practices creating new conditions that may not yet have been sufficiently reflected into national measures. Some of the concerns raised by farm organisations also reflected situations where water quality challenges necessitated stricter measures and the "low-hanging fruits" had already been picked, leading to the need for more costly measures such as reducing fertiliser use below the economic optimum or requirements of increasing complexity (See Annex XII). In this area, specific suggestions for simplification of national rules, included:

(1) **Flexibility in closed periods** (prohibition periods for fertiliser application)[128]. Farm organisations and Member State experts have pointed to the impact of climatic unpredictability on the effects of closed periods. Closed periods in winter may need to be adapted to changes in temperature and growing seasons, which may also include less stable weather patterns with larger variations between years. More generally, risk periods for nutrient losses are becoming more unpredictable due to extreme climatic events such as droughts and concentrated rains, consequently requiring a better management of fertilisation throughout the year.

(2) **Limiting other aspects of "calendar farming"[129].** Concerns were raised by farm organisations that rules are not always flexible enough to adapt to climatic uncertainty or specific soil conditions, agricultural practices and crop types, and that farms not

[127] The EU CAP network https://eu-cap-network.ec.europa.eu/index_en could also play a role. The 2025 study on simplification and administrative burden for farms is relevant in the simplification discussion.

[128] The Nitrates Directive requires Member States to impose in nitrate sensitive areas closed periods when fertilisers and manure cannot be spread due to high risks of nitrate losses related to the climate and soil conditions (heavy rains, frozen soils, water-logged fields.). It is up to the Member States to define the closed periods, which can also be differentiated in light of local conditions, crops and types of fertilisers.

[129] In addition for closing periods for the application of fertilisers, national nitrate action programmes may include dates and deadlines in various other contexts, such as for the sowing of catch crops in the early autumn, for the establishment of a new crop after spreading of fertilisers or ploughing of grasslands, or for ensuring the existence of a plant cover on soils at a certain point of the autumn or winter.

respecting set dates might be penalised for following what they otherwise consider as good agricultural practices adapted to prevailing circumstances. Such constraints should be limited to what is needed to mitigate the risk of nutrient losses and should be based on scientific assessments of local environmental conditions, climatic uncertainty and the needs of specific agricultural practices (e.g. organic farming).

(3) **Flexibility in function of environmental performance of individual farms**: Concerns were also raised that the "one-size fits all" approach in the nitrates action programmes is not providing enough flexibility for farms to choose alternative ways to reach results, suggesting that "result-based" approaches could provide more flexibility[130]. Examples could include a better recognition of farms applying advanced technology to target the use of fertilisers (precision farming), farms with a verified high environmental performance (based on measurements) or sustainable farming approaches such as organic farming. Some stakeholders have raised the possibility of exemptions for farms in areas with good water quality. The evaluation has elaborated on the importance and success of the preventive approach of the intervention, especially in all areas with intensive agriculture and high fertiliser use. The fact that nitrate pollution is not currently significant in an area does not make a case for abolishing preventive measures, in the same way as the absence of accidents does not make the aviation safety policies irrelevant. That said the intervention is by design targeted to areas where pollution or the risk of pollution is a problem, and not to farms. Nothing prevents Member States to design a more differentiated treatment between the farms in accordance to (a) local circumstances, (b) the actual level and risk of pollution, (c) the environmental performance of a farm.

Actionable simplification: Similarly to the examples above, this type of simplification is based on national implementation choices, but it could be facilitated at EU level. The Commission could facilitate the uptake of best practices and innovative solution, opportunities of financial and technical support for better design of nitrates action programmes. Together with the Member States in the Nitrates Expert Group, the Commission could organise **structured exchanges** of best practice and scientific knowledge including results from deployed innovative solutions[131]. This could focus on issues such as unnecessary calendar-based constraints on farms and enhancing flexibility in ways that still achieve results. Another focus could be on the adaptation to climate change and how to effectively mitigate related risks[132]. Solutions like advisory services and technological tools such as precision farming and more accurate weather forecasts could also be relevant. Depending on the issues, the outcome of these structured exchanges could also entail **development of recommendations** to help Member States in their implementation of the simplification measures.

[130] Results-based measures refer to systems were farms have relative freedom of implementation (within the limits of the required measures) and are inspected on results, which can be defined generally or at farm level. It was however recognised that result based measures can also lead to a need for monitoring and verification, which may impose additional burdens both on farms and public authorities. The time lag between measures and results explained in section 3 would also make this approach difficult.

[131] The Commission through research programmes, such as Horizon Europe and Life, provides extensive support for research to close knowledge gaps and promote innovative solutions.

[132] For example, while closed periods remain fully relevant as it remains appropriate to have restrictions on spreading fertilisers in high-risk periods with heavy rains and no crop growth, there may be ways of making them more flexible while enhancing risk management more broadly throughout the year.

Developing and sharing knowledge on the effectiveness of measures, as already planned as part of the **nutrient toolbox announced in the Water Resilience Strategy** [2], could help national administrations in designing flexible and effective action programmes, which could also have a positive effect on the stability of measures. The aim is to support Member States in identifying the right level of effort required and the most cost-effective measures adapted to the local circumstances, thereby ensuring transparency and fairness towards farmers and other operators and encourage engagement and result-based approaches.

Increased flexibility will sometimes have to be weighed against the interest in having simple and effective measures that are easily verifiable and controllable. In this context it should be pointed out that burden reduction for farms does not necessarily align with burden reduction for the public administration, and that there could be a trade-off between flexibility on the one hand and simplicity on the other, as flexibility tends to add complexity to measures[133].

Other simplification suggestions from farm organisations have focussed on the application limit for manure and processed manure. Reflecting on these suggestions in light of the findings of the evaluation, it is important to distinguish between concerns about specific aspects of national implementation that impose unnecessary burdens and proposals to change core environmental safeguards of the Directive. Indeed, as described in earlier sections, the livestock manure limit is a core aspect of the directive. In general, application of manure above this limit leads to water pollution, and tackling eutrophication would rather point to applying lower amounts of manure in polluted areas. Setting a common limit for the application of nitrogen from manure and processed manure is essential in curbing different pathways of nutrient pollution from manure and limit negative environmental effects of intensive livestock production. It should also be reiterated that the limit is subject to flexibilities such as the possibility of derogations when Member States can justify a higher amount. However, the likely environmental impacts, the implications for the level playing field in the internal market, as well as the sensitivity of these discussions make a common EU mechanisms to assess and approve such derogations necessary. The Commission also recently put forward an amendment of the Directive to allow a higher limit for certain types of materials derived from the advanced process of livestock manure (RENURE). This amendment was carried out through a comitology procedure [48][134] and will facilitate the use of excess nutrients in high livestock density regions. This topic is further discussed in section 4.3 on relevance below.

Actionable simplification: As part of the simplification exercise, the Commission has amended the Nitrates Directive to allow Member States to authorise certain processed manure products (RENURE) above the limit with appropriate safeguards. Following the adoption of the RENURE amendment in February 2026, the Commission will support Member states in its implementation.

Furthermore, the evaluation has identified a potential for simplification in the monitoring and reporting to the EU by national authorities and better integration

[133] An example of this could be when farms are exempted from a mandatory reduction in fertiliser limits if they comply with some specific practices or can show that they reach certain results. Such exemptions create additional complexity both in the design and control of measures.

[134] Comitology register

with the WFD. The analysis on effectiveness, efficiency and coherence shows that increased coherence and integration of the monitoring of waters under the Nitrates Directive and the WFD could be beneficial and bring simplification**.** It would facilitate the identification of polluted waters and reduce the burden for public administrations[135]. Eventually it would also facilitate and make more robust the designation of NVZ, seen as an important burden for public administrations. These findings are largely shared by Member States experts. As a response to the objective of streamlining processes to foster simplification, cooperation between relevant working groups under the Nitrates Directive and the WFD, which include Member State experts, has already been reinforced in 2025[136]. The aim is to assess the best way forward which would combine simplification in monitoring and reporting and increased coherence in the national implementation. Options for streamlining are being examined both for the monitoring of nitrate concentrations and for the assessment of eutrophication, where the challenges and the level of integration are different. Key potential aspects include the finetuning of monitoring networks, frequency of monitoring, alignment of parameters, indicators, thresholds, criteria to assess nitrate concentrations in groundwater and surface water, and trophic status of surface waters. It is also the case that both the Nitrates Directive and the WFD leave wide margins in the concrete implementation of monitoring and reporting, resulting in wide differences of approaches among Member States, but at the same time this provides significant flexibility to align approaches. The result of this work will inform the Commission and the Member States on how far the streamlining can be brought, and on the technical adaptations that would be needed to achieve the desired simplification and coherence. A revision of the guidelines for monitoring and reporting under the Nitrates Directive could be a first step and provide a baseline to explore avenues to simplify the framework.

Many stakeholders have further suggested to align the reporting deadlines for the Nitrates Directive on the WFD by extending the Nitrates Directive cycle from 4 years to 6 years. As it happens, reporting cycles under the WFD and the Nitrates Directive are set to converge end of 2027, which will also be a key moment to take stock on the achievement of water quality objectives and potentially better align reporting processes. From that moment, there is scope to align reporting processes. A change of the Nitrates Directive cycle to 6 years as from 2027 has the potential to reduce burdens of public administrations. As the cycle is also linked to the requirement for review of NVZ and the national action programmes, it could also provide more stability and certainty for farms. The simplification potential would also depend on the results of above technical analysis and would need to be well prepared[137]. The evaluation has indeed highlighted many constraints due to the large variations in the national implementation in different Member States as well as potential challenges due to different approaches under the directives, which, if not addressed correctly, would risk bringing additional burden for Member State authorities or reducing the effectiveness of monitoring and reporting. It would also be necessary to

[135] Monitoring of water quality constitutes the largest single cost item for public administrations in connection with the implementation of the Nitrates Directive (see section 4.1.2)

[136] This concerns the Nitrates Expert Group under the ND as well as the Groundwater Working Group and the ECOSTAT working group under the WFD.

[137] Some stakeholders have suggested a reporting cycle of 8 years, but there is a high risk that such long period hampers timely reaction compared to the current cycle and in relation to the time lag of the effect of measures on water quality and undermines the effectiveness and enforceability of the directive. An eight-year period would be long compared to most other related EU instruments, such as the Water Framework Directive (6 years) and the CAP (7 years).

ensure consistency with the new monitoring and reporting requirements in the recent amendment of the WFD [57].

Streamlining monitoring and reporting across the directives could further improve the coherence of public messaging on nitrate pollution and eutrophication from agriculture in Member States to policymakers, farmers, other stakeholders, and the public and would be in line with the "source to sea" approach to nutrients promoted in the Water Resilience Strategy. In consultations with Member State experts there was openness to exploring a more extensive reliance on water quality assessments made in the context of the WFD and alignment of reporting deadlines, but it was particularly stressed that the link with agricultural practices and the impact of agriculture on waters should not be lost. It was also stressed that some specific monitoring would still be needed for the Nitrates Directive to follow nitrate concentrations in waters affected by agriculture and to be able to assess the effectiveness of the national action programmes[138]. Finally, Member State experts highlighted there are many technical and practical challenges that will need to be examined with the Member States in view to maximise the potential simplification benefits[139].

Actionable simplification: The Commission is already working at technical level with the Member State experts in the working groups under the Nitrates Directive and the WFD, to identify options to streamline monitoring and reporting of nitrate concentrations and eutrophication, with work initiated in 2025.

These consultations will be taken into account in the work to revise the reporting guidelines under the Nitrates Directive for the next reporting period 2024-2027.

In the longer term, the potential of aligning the reporting deadlines and cycles as from 2028 could be explored, also taking into account upcoming new reporting requirements under the WFD.

Finally, the evaluation has highlighted that it may be beneficial to facilitate processes and diffuse tensions around derogations near protected areas. Experience from the last years have highlighted that despite the guidance from the CJEU and from the Commission, the assessment process under the Habitats Directive in relation to nitrate derogations or manure application projects around N2000 areas, when carried out, are often cumbersome and controversial. This is a national implementation issue where the requirements from the Habitats Directive interact with the implementation of the Nitrates Directive in certain areas. It is not a feature of the Nitrates Directive itself but reflects the fact that these interactions are either overlooked or considered very late in the process of designing action programmes and nitrate derogations. As a result, the additional mitigation measures aimed to protect the habitats and species from degradation and ensure their conservation according to the law, are not sufficiently prepared and the situation is creating a lot of tensions. Therefore, the Commission could support Member States in integrating in the design and preparation of nitrate action programmes the specific requirements for the

[138] Assessing the effectiveness of action programmes requires more specific water monitoring than what is needed to assess the quality status of waters or to identify pollution in the first place.

[139] Questions such as the frequency and times periods of monitoring and data reporting, the parameters for nitrogen and phosphorous in relation to eutrophication in all waters in agriculture areas, the trend setting and continuity of data sets, the adequacy of WFD reporting in identifying the needs and effects of agriculture practices, the necessity of maintaining several networks, including the networks to monitor the effects of NAP measures and the identification of NVZ in the river basins, will need to be looked at.

conservation and restauration of EU's natural heritage on land and seas. The aim would be to increase transparency and facilitate assessments and the early adoption of mitigation measures as well as financial support for farmers and responsible authorities.

Actionable simplification: In this context, based on the upcoming interpretations of the CJEU (Case C-531/24) and the outcome of the stress test for the Birds and Habitats Directives, the Commission could update the guidelines for Member States on manure application and nitrate derogations in Natura 2000 areas, with the aim of facilitating a simple and practical implementation process and access to financial support for Member States and farmers.

4.2 How did the Nitrates Directive make a difference and to whom?

By putting a check on nitrate pollution of surface and groundwaters throughout the EU, the directive has provided benefits to EU citizens, as consumers of water and beneficiaries of a well-functioning environment, and to economic sectors depending on clean water and healthy aquatic ecosystems, including the food, fisheries and tourism sectors. The analysis on coherence shows that the directive has not been made redundant by new legislation but is essential to reaching EU environmental objectives. In the public consultation all stakeholder groups tended to support the view that the directive has contributed to a more harmonised and ambitious approach to addressing nitrates pollution from agriculture. In consultations with Member State experts, it was further stressed that separate efforts by Member States would risk being undermined due to socio-economic pressures and that common action is needed to ensure similar market conditions across the EU and to address transboundary pollution and marine eutrophication.

Besides its positive impact on the environment and public health, the Nitrates Directive also contributes to a level playing field improving the functioning of the Union Market by promoting good agricultural practices to reduce pollution across the EU. The directive supports public goods such as clean freshwater resources and well-functioning aquatic ecosystems by setting harmonised standards and by promoting and where necessary enforcing good agricultural practices for nutrient management across the Member States. While ensuring the adherence to these practices should be in the interest of national populations of every Member State, agricultural market pressures could push agricultural production in the direction of lower standards to maximise short term productivity and competitiveness. Public policy in line with the Nitrates Directive helps reassure farmers that others are also adhering to the same basic practices, carrying each their share of the burden to protect essential public goods.

The common manure application limit and the derogation process through the comitology committee help to maintain a common baseline and avoid distortion. The application limit for livestock manure provides a common threshold as part of the minimum common basis for all farmers in the EU (in NVZ) to mitigate environmental and health risks related to intensive livestock production. It provides a common legally binding value promoting a level playing field among farmers across the EU, which is also an important objective of the common agricultural policy. It has acted as a common minimum standard to comply with at EU level, allowing Member States to decide whether to use lower levels or to apply for derogations when they wanted to apply higher ones. In areas of very high livestock concentration, it could be argued that the manure application limit acts in an analogous way to a cap-and-trade system for the availability of manure space,

establishing a price signal for farms to moderate livestock intensification due to the additional costs, rising in line with the excess production of livestock manure to be disposed of, which helps internalise the externality costs associated with high livestock concentrations. In the absence of any such limitation, pressures for the concentration of EU livestock production within a few regions could only get stronger, possibly resulting in additional distortion and environmental and health-related challenges in those regions[140].The comitology procedure for derogations has the added benefit of improving transparency and peer review among the Member States, which can contribute to greater attention to mitigating environmental effects, better trust in the rules and hence compliance throughout the EU.

If the Directive would have let Member States set their own manure application limits, the pollution risks from manure may have been higher. The Commission would not have had the opportunity to monitor and assess the impacts of higher limits through the derogation procedure. Without a common legally binding limit and the specific derogation procedure, there would have been a risk of distortion of competition between livestock sectors in different Member States, resulting in a pressure on authorities to set more lenient limits than what would be optimal for society as a whole in each region ("race to the bottom"). As shown in Annex XII, experience with the balanced fertilisation where nitrogen limits per crop are set at Member States level has shown that in the large majority of cases the limits set by Member States are much higher than what would be advisable for water protection and the risks due to soil and climate. The risk of excessive flexibility is even higher for the manure limit than for the broader fertilisation limits. The latter have an economic upper limit in the form of the optimal economic rate (for the farmer) of fertiliser application. The corresponding optimal economic rate limit for manure application would far exceed the environmentally sustainable level.

The common manure application limit is essential as a basis for organic farming and allows organic farms, where no chemical fertilisers are allowed above the manure limit, to compete with other farms. Without a common limit for the EU, there is an additional risk of unfair competition with organic farming, while the EU is promoting its expansion as one of the paths to increase sustainability of EU agriculture.

The Nitrates Directive plays a crucial role in addressing transboundary water pollution by promoting efforts across the Member States. Although fertilizer and manure pollution often falls within national boundaries, surface water pollution can cross borders via interconnected rivers, lakes, and coastal waters. A significant portion of agricultural nutrients lost from farmland ends up in coastal waters, impacting shared seas from the Baltic and the North Sea to the Mediterranean and Black Sea. Protecting these waters from excess nutrients presents a collective challenge that requires collaborative efforts to ensure all countries contribute to pollution reduction. Effective coordination of action can ensure that political and economic stakeholders in each Member State understand that other countries are also committed to taking action, thereby encouraging more robust measures within their own country.

[140] It should be noted however that the assessment of the impact of the directive on the competitiveness of agriculture indicates that the economic impact of the directive may have been limited in most cases (Annex XVIII). See also the section on efficiency in section 4.1.3 above.

Despite its strategic importance, expert consultations suggest that the directive has not fully addressed transboundary challenges, as Member States find them complex and demanding[141]. While the directive empowers the European Commission to facilitate cooperation in specific cases (Art. 3(3)), this mechanism remains underused. However, important complementary frameworks, such as the WFD and the MSFD, provide river basin management and marine protection approaches. These directives incorporate common standards and intercalibration efforts to achieve good status across borders. Moreover, transnational initiatives and international conventions, focusing on regions like the Baltic Sea, North Sea, Mediterranean Sea, Rhine, and Danube, reinforce cross-border solutions and concerted strategies focussed on specific aquatic environments. The Nitrates Directive plays a key complementary role as a basic measure and instrument for the attainment of agreed objectives under these other frameworks.

4.3 Is the Nitrates Directive still relevant?

The Nitrates Directive was designed to address the pollution of waters by agricultural nutrients, and sets out a targeted and flexible approach to addressing the challenge. While the water acquis has evolved significantly since the early 1990s, notably with the adoption of the WFD in 2000 and the MSFD in 2008, the Nitrates Directive with its targeted intervention logic remains fully relevant and fills a specific and crucial role within this broader context, contributing to the effectiveness of the general water acquis. Consultations with stakeholders and experts confirmed this[142]. Its simple and flexible design has helped to accommodate without changes the evolution of the broader water acquis. Meanwhile, as described in the effectiveness section above, nitrate pollution of surface and groundwaters and eutrophication freshwaters and seas remain a significant challenge across large parts of the EU.

The fact that most European measurement points for ground and surface waters exhibit nitrate concentrations well below the 50 mg threshold does not detract from the directive's continued relevance. On the contrary, it illustrates the effectiveness and success of the preventive approach of the Directive. The prevention of pollution is achieved through mandatory measures on 70% of agriculture land in areas where pollution is already a problem or that are at risk of being polluted if no action is taken, and section 3 explored the effectiveness of such measures in these areas. Outside such areas, the directive works through voluntary measures, which is a risk-based approach, providing flexibility for Member States and farmers where pollution is not yet an acute issue. The preventive role of the Directive has also been recognised by the national Courts, such as the Las Conchas ruling (Galicia) in 2025 recognised inaction of the authorities in preventing pollution of ground and surface waters by nitrates due to agriculture. The stagnation in progress that appears to have taken place after 2010 only serves to further underline the indispensable role of the Nitrates Directive in stemming the pressure towards intensification of agricultural production and consequent environmental impacts. On the other hand, eutrophication which occurs at much lower nitrate concentrations than 50 mg/l remains

[141] Stakeholder responses in the public consultation in turn highlighted the continued relevance of tackling cross-border pollution (Q 3.9).

[142] In their replies to the public consultation, a majority of all types of stakeholders considered that the objectives of the directive were still either "relevant" or "somewhat relevant". National experts consulted also considered that the scope and objectives of the directive remain relevant. In particular, reference was made to the directive's focus on mandatory measures directly applicable at farm level.

significant throughout the EU, recalling that further effort is needed to reduce nutrient losses and the necessity of measures for the larger parts of the EU. This picture is also confirmed by a recent assessment under the WFD [30].

While the objective of the directive is narrowly defined and focussed on a particular challenge, the directive plays a role in promoting broader policy goals[143]. This is most evident in reaching the objectives by 2027 in line with Article 4 of the WFD, where the reduction of agricultural nutrients is a key challenge in the attainment of good chemical status of groundwaters as well as the good ecological status of surface waters. Thanks to the limit on manure application, the Nitrates Directive also plays a positive role in limiting ammonia emissions, improving air quality and reducing deposition of nitrogen on waters and on sensitive terrestrial ecosystems. Therefore, the Nitrates Directive clearly contributes to the achievement of the international commitment of the Global Biodiversity Framework target to reduce nutrient losses by 50% by 2030, as regards losses from agriculture. Through its focus on balanced fertilisation and better use of livestock manure the directive also contributes to the reduction of greenhouse gas emissions (carbon dioxide and nitrous oxide) linked to the production and use of nitrogen fertilisers and manure. Moreover, the directive also contributes to the adaptation to climate change through the protection of clean freshwater resources. Finally, the Nitrates Directive makes a non-negligeable contribution to a more balanced and sustainable development of the EU agricultural sector across the EU. By protecting water resources and contributing to reducing emissions of livestock production and sustainable fertiliser use in agriculture, without significant negative impact on the competitiveness of the sector, the directive contributes positively to the objectives of the European Water Resilience Strategy, the Vision for Agriculture and Food and the Competitiveness Compass.

The 50 mg/l threshold for nitrate in freshwaters remains relevant to protect potential drinking water resources. The threshold remains in line with standards set by the World Health Organisation [49] and the EU Drinking Water Directive. Protection of drinking water resources is a societal and economic priority, even more acute with climate change, as less rainfall may lead to a reduction of drinking water resources and to an increase of concentrations of nitrates in freshwaters. The limit is also used as a quality standard for the assessment of good chemical quality of groundwaters under the Groundwater Directive, but more stringent threshold values could be established when it is considered that the standard could result in failure to achieve the environmental objectives for surface water specified in the WFD. Indeed, stakeholders and experts underlined that the threshold is not appropriate for the assessment and management of eutrophication risks, where much lower thresholds would be relevant[144]. Moreover, recent research focussing on the carcinogenic effects of high nitrate levels in drinking water indicates that a stricter approach could also be warranted for public health purposes [50]. Hence, while a majority of the national experts considered that the 50 mg/l threshold for nitrates in freshwaters sufficiently takes

[143] Consultation of Member State experts showed that the directive is seen as relevant in addressing EU policy objectives such as protecting water resources and aquatic ecosystems, as well as to a certain extent protecting soils and biodiversity and sustainable and resilient agriculture and food security.

[144] Contributions to the public consultation and other stakeholder consultations (see Annex V).

into account all relevant health aspects, many consider this threshold too high to provide sufficient protection.[145]

The manure application limit of 170 kg N/ha is recognised as generally appropriate for good agricultural practices in NVZ and has become the reference point for sustainable agricultural practices. The manure application limit was set as a precautionary threshold balancing the needs of agriculture and livestock production with environmental and public health concerns**.** It is not an agronomic limit for specific crops, and it applies in addition to the requirement of balanced fertilisation[146]. When the Directive was adopted, the manure application limit was seen as sufficiently high for the large majority of the livestock sector in the EU but sufficiently constraining to avoid major water pollution situations. The Directive also catered for specific circumstances, such as grassland and high precipitation, by allowing higher amounts through derogations to the limit. Depending on local circumstances, Member States can thus set lower application levels or apply for derogations. By promoting the responsible (re)use of manure in NVZ, limiting key pollutants and enhancing ecosystem protection, the 170 kg N/ha has been integrated as the legal norm for fertilisation in the organic farming regulation throughout the EU. The manure application limit not only contributes to the objectives of the Nitrates Directive, but by promoting sustainable agriculture and livestock production, also plays a key role in the achievement of the objectives of other EU legislation and international commitments (See also Annex XVII).

Environmental and human health protection calls for a precautionary approach on the amount of manure to be applied on land. Applying up to 170 kg N/ha on agricultural land in NVZ may not be appropriate in all situations as it may not sufficiently limit the soil, water and air pollution by nitrogen and phosphorus, nor the negative impacts on biodiversity. The necessity to address eutrophication and the experience gained from the cumulative and long-term environmental effects of high levels of manure application (including derogations) would rather point to the necessity to lower the manure application limit in some polluted areas. In the situations where the manure limit of 170 kg N/ha is too high for reaching environmental goals, it will be for the Member States to set lower limits adapting to local circumstances. (see Annex XVII)

The common limit on the application of livestock manure in NVZ promotes circularity and has been adapted to accommodate new processing techniques. Some stakeholders[147] have seized on this limit and the definition of livestock manure that includes processed as well as unprocessed manure, arguing that the directive does not sufficiently reflect technical progress in manure processing. According to this argument, the Nitrates Directive hinders new "circular" approaches to the recycling of nutrients from manure.

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[145] An international group of experts, convened by the Danish government, has recommended that the limit value of nitrate in drinking water is to be lowered substantially from 50 mg/l to 6 mg/l. The international expert group's report published in December 2025 "Evaluation of the parametric value for Nitrate in drinking Water" concludes that "based on the totality of evidence, a parametric value of 6 mg/L for nitrate in drinking water should provide protection against potential effects on colorectal cancer and developmental effects associated with chronic exposure to nitrate from drinking water".
mim.dk/publikationer/2025/december/evaluation-of-the-parametric-value-for-nitrate-in-drinking-water

[146] The one size fits all manure limit was criticised by some stakeholders for not being scientifically justified as an agro-environmental limit in line with crop needs.

[147] Generally representing intensive livestock farming and related industry as well as the biogas sector among others.

However**,** it is not evident that the livestock manure limit in NVZ represents a constraint on the promotion of recycled organic fertilisers in agriculture. The directive is based on the very notion of better utilising the nutrient content of livestock manure while maintaining the organic link between the livestock and the soil (land-based farming). The limit on livestock manure therefore promotes natural circularity. By putting a constraint on manure application at farm level in NVZ, the limit does not prevent farms to produce more manure, rather, the limit promotes the sharing of livestock manure between farms at the regional level, and further promotes the redistribution of excess nutrients from high livestock density regions where nutrients are a pollutant to regions where nutrients are needed, through processing and transport. It therefore promotes the processing of livestock manure in biogas plants, as this can facilitate the redistribution of nutrients in the form of digestates within the region. Indeed, manure which in excess causes pollution in one area, can be useful in another area. As long as the excess manure or processed manure is reused on another farm, the nutrients from the manure can be used replacing the potential use of chemical fertilisers (with the related CO2 emissions). The directive also provides flexibility in the form of derogations, allowing for balanced outcomes taking into account technical developments as well as the environmental challenges. Apart from derogations in justified cases, the directive also provides for a procedure to update its annexes to technical and scientific progress through a comitology procedure. The latter was recently used by the Commission to initiate a targeted amendment to increase flexibility of the limit in the case of certain highly processed forms of livestock manure (RENURE) [48].

The Directive has contributed to strategic autonomy and food security by promoting the efficient use of fertilisers and manure on farms. A key objective of the directive is to reduce losses of nutrients to the environment on farms. Good agricultural practices such as balanced fertilisation and better manure management contribute to a more efficient use of the existing fertiliser supply, thereby reducing unnecessary use and costs for farmers. Over the years, the directive has significantly reduced chemical fertiliser use, without generally affecting yields. Since the outbreak of the war of aggression in Ukraine in 2022, fertiliser prices have increased dramatically in the EU prompting a debate over the impact on the agricultural sector and calls for action at EU level to promote strategic autonomy in this sector[148]. The RENURE amendment mentioned above will also facilitate the better use of nitrogen from manure in regions with high livestock concentrations replacing chemical fertiliser.

In regions with very high concentration of livestock production, above a certain level of manure production, the manure application limit helps but is not sufficient *on its own* to reduce or maintain levels of nutrient emissions from manure below harmful levels. Thirty-five years after the adoption of the Directive, some Member States continue to struggle with very high levels of manure production concentrated in a few regions, which makes it difficult to comply with the environmental limits and the requirements of EU law in specific areas [149]. In those situations, the farm level manure application limit is

[148] In the RESourceEU Action Plan [51], the Commission announced an action plan to ensure the availability and affordability of domestic fertilisers, including actions to enable recycled nutrients and other alternatives to fertilisers by Q2 2026.

[149] Member States that have regions with particularly high livestock density include Belgium, Denmark, Germany, Spain, France, Italy and the Netherlands.

not always sufficient[150], due to the cumulative impacts on nitrogen pollution of the spatial concentration. Therefore, Member States should further take into consideration the cumulative effects of the manure production by all farms in a region so as to ensure that there is an adequacy between the overall livestock density per region and the manure (and processed manure) that can be applied in the area without exacerbating the negative impacts on the environment. For this reason, in order to avoid the lock-in effect of manure recycling, the RENURE amendment limits increase of livestock density and manure production as a result of RENURE in Member States and regions with *average* manure production above 127,5 kg N/ha. Recent studies based on modelling [8] conclude that reducing livestock density at 1,4 LSU/ha *on average* in an area, could significantly reduce nitrates leaching and runoff, especially in hotspot regions with the highest livestock densities, where reductions in the nitrogen surpluses and nitrogen leaching and run-off could reach 50%[151]. However, any structural changes in farming has also broader socio-economic impacts and need to be carefully assessed[152]. Indeed, in its Vision for agriculture and food, the Commission highlighted that priority should be given to addressing nutrient pollution hotspots and promoting integrated territorial approaches.

Phosphorus is not explicitly covered in the legal text of the directive, but the directive's implementation, alongside the WFD, significantly contributes to address the risk of pollution with phosphorus from agriculture. Water pollution by phosphorus from agriculture is covered in part under the Nitrates Directive implementation and complemented by the Water Framework Directive. Firstly, the Nitrates Directive does not mention measures to limit phosphorus losses explicitly but the agricultural measures in Annex II and III of the directive to limit nitrogen losses contribute to address phosphorus pollution, in particular the manure application limit. Second, a 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. Further, 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 emissions from agriculture, they should add further measures.

All in all, at least half of the Member States have added measures to limit phosphorus fertiliser application in their national legislation (either under the Nitrates Directive action

[150] Other requirements from the other EU environmental laws will also play a role (e.g. IED, NECD, HD).

[151] As the analysis did not take into account manure trade (exports) from these regions, the leaching and runoff reduction effect could however be somewhat overestimated. As we have seen, processing and exports of excess manure can be significant in these regions.

[152] From the EU agriculture outlook 2022, chapter 7. The study also analyses the impacts of several scenarios of reduction of livestock density in hotspots regions. The Impacts on prices, net trade, food consumption and farm income show that in all scenarios agriculture income of livestock farmers would increase despite reduction in production, but there would be important increase of production costs in certain sectors and a less important increase in consumer prices. There would also be reductions in exports and in feed production, with impacts on arable farms.

programme or other legislation). The obligation to address phosphorus pollution from agriculture is further reinforced through conditionality, GAEC requirements and voluntary measures under the CAP. Annex XII describes how measures to address phosphorus emissions have been tackled.

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. Furthermore, the WFD provides an encompassing approach to all forms of phosphorus pollution, and Member States should address the different sources of the pollutant. The UWWTD also plays a key role in addressing eutrophication and phosphorus pollution. 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.

The directive is compatible with an expanding production of biogas in the EU, which represents an opportunity for improved circularity in the use of nutrients through the use of biogas digestates as organic fertilisers in agriculture [26]**.** The biogas sector has expanded significantly in Europe over the past years. Biogas production is based on a variety of inputs, including agricultural and other waste streams, including livestock manure. Through anaerobic digestion, biogas plants transform such inputs into energy in the form of biogas on one hand and on the other hand a byproduct - digestates - that can be used as an organic fertiliser. Indeed, the utilisation and valorisation of the digestates potentially represents an important income stream for the developing biogas sector. As a fertiliser, digestate poses some of the same challenges as those associated with untreated manure, such as variability in nutrient concentrations, higher bulk and water content, and inconsistency in nutrient release dynamics due to the slow mineralisation of organic nitrogen. While nutrients contained in digestate are generally more readily available for plant uptake than those in untreated manure, improving nutrient use efficiency, they remain organic fertilisers, which means that the risk of losses, including ammonia, remains higher than for chemical fertilisers. The RENURE amendment mentioned above would allow Member States to authorise the application of manure-based biogas digestates above the limit provided that they are further processed in line with the provisions of the directive, ensuring that they attain qualities close to chemical fertilisers. Overall, the analysis

indicates that the directive is fully compatible with the use of biogas digestates in agriculture, which is confirmed by the already significant development of the biogas sector in several Member States, including Member States where the manure limit applies throughout the whole territory (See Annex XIX). Nevertheless, improving the circularity of nutrients continues to be high on the agenda of the Commission and an important focus of attention from stakeholders in the livestock and biogas sectors [52]. In November 2025, the Bioeconomy strategy [53] highlighted that closing the nutrient cycle is essential for environmental and economic resilience, that circular manure use, including through RENURE, can reduce dependence on synthetic fertilisers, and announced that the Commission will promote nitrogen efficiency in bioeconomy systems. The Fertilisers Action Plan[54] announced work towards possible extension of the RENURE Act for certain types of liquid digestates based on manure, to enable their use above the manure limit in NVZs with appropriate environmental safeguards. Innovation on products and processing techniques from processed manure is essential to develop fertilising products of consistent quality that can replace chemical fertilisers without affecting the progress towards water quality objectives. The existing legislative flexibility to modify the annexes of the Nitrates Directive to scientific and technical progress offers the possibility to adapt to such future innovation.

The Directive is sufficiently flexible to adapt to climate change through the adaptation of national implementation. A key question in the evaluation was whether the directive is sufficiently able to respond to challenges related to climate change, which is impacting agricultural practices in profound ways. For example, a more unpredictable climate presents a challenge for rules that are based on the presumption of seasonal regularities. As already mentioned above, critics have coined the term “calendar farming” to denote rigid restrictions on the timing of certain activities that are not taking account of the natural variability of the climate from years to year. This can refer to such things as periods where livestock manure cannot be spread on the fields or deadlines for sowing and harvesting. Climatic extremes such as droughts and heavy rains also can affect yields and the risk of leaching and run-off from fields, which would need to be taken into account in the definition of good practices for the application of fertilisers. The detailed design of the measures is within the purview of the national authorities responsible for the implementation of the directive in each Member State, not of the directive or the Commission. From the consultations, it appears that the challenges of nutrient management vis-à-vis climate change challenge are increasingly being taken into account in national action programmes and advisory services following extreme events in recent years. However, there may be a need to step up national response as Member States are reporting that climate change is aggravating water pollution with nutrients, but also that measures may require more flexibility so as to be able to adapt from one year to another or through the season. Section 4.1.4 above investigates potentials for simplification for a discussion of calendar farming and possible actions that could be taken to facilitate the exchange of best practice between Member States.

The directive’s technological neutrality and flexibility allows Member States to support innovation and introduce new technological developments supporting the implementation of measures. Introducing new technologies to implement the measures of the Nitrates Directive is fully compatible with its technology neutral legal framework, relying on the flexibility provided to Member States to design and adapt measures

accordingly. One such example is precision fertilisation which helps farmers to implement the requirements of the directive to fertilise soils at the right time and in the right amounts to avoid losses. Member states also have the possibility to support and test innovative implementations (sand-boxes).

5. WHAT ARE THE CONCLUSIONS AND LESSONS LEARNED?

The Nitrates Directive adopted in 1991, aims to protect human health and aquatic ecosystems across Europe by reducing and preventing diffuse water pollution by nitrates from agriculture. Pollution is caused the losses of nutrients[153] when chemical fertilisers and livestock manure are used for crop production. It is defined in terms of either nitrate concentrations in fresh groundwaters and surface waters exceeding the drinking water standard of 50 mg of nitrates per litre or the eutrophication of rivers, lakes and coastal waters. Too high nitrate concentrations make freshwaters unsuitable for drinking water abstraction or involve additional treatment costs. In surface waters, high nutrient concentrations lead to eutrophication, due to excessive growth of algae and other plants, resulting in oxygen depletion and liberation of toxic substances, thereby affecting aquatic and marine ecosystems.

The Directive acts at farm level by promoting and enforcing agricultural practices to reduce nitrate losses to water in a context where agricultural activity was and remains the dominant source of nitrates pollution in waters. Specifically, Member States are required to promote good agricultural practices by setting out basic principles for all farms on managing and using manure and other fertilisers (right amount, type, place and time). In areas that are identified as polluted or at risk of pollution, Member States should enforce those practices by implementing action programmes with specific mandatory requirements for all farms in those areas.

The Directive was adopted in 1991, and at that time, after a period of steady growth in fertiliser use since the 1960s, the nitrate content in waters in some Member States was found to be increasing and was already high compared with drinking water standards. There was also a need for protecting the North Sea and other waters in the EU. The eutrophication of marine waters caused by nitrogen run-off from agriculture land was found to be a major problem in many European coastal areas.

This is the first comprehensive evaluation of the Nitrates Directive. It therefore covers the entire period from the early 1990s to the present day to the extent that data was available.

Effectiveness, Efficiency and Coherence

1. Looking back over 30 years of implementation, the intervention is found to be effective and the Directive's measures scientifically sound. Significant progress has been achieved in more efficient fertiliser use and in reducing fertiliser losses to water which have so far been partially translated to reductions in water pollution. A temporary stagnation or even increase of agricultural pressures in the 2010s, was reflected in some stagnation or deterioration in overall water quality in recent years. But renewed progress in reduction of agricultural pressures in the last years should bring positive impacts on water quality

[153] Nutrients designate nitrogen and phosphorus. Nitrates is a form of nitrogen soluble in water. Manure contains nitrogen and phosphorus.

in the coming years. This overall picture includes a large variety of developments across regions and Member States.

As illustrated in Section 3 and Annexes XI and XII, an extensive body of scientific literature and more than 30 years' worth of data (on fertiliser use, nitrogen surplus, nitrate and phosphorus concentrations in water) and experience in the Member States, have demonstrated the causal links between the management of chemical fertilisers and manure at farm level and losses of nitrates and phosphorus to water. Experience has also shown the relevance and effectiveness of the measures under the Directive in reducing these losses. Moreover, recent EU legislation [56] has further harmonised the collection of key indicators such as the nutrient surplus, which will fill data gaps and provide important data for evaluating future progress[154].

Data and analysis in sections 3.1,3.2, 3.3 and 4.1.1 show that the Directive is generally an effective instrument and has had a significant impact in reducing and preventing water pollution with nitrates of agricultural origin. In terms of results, the Directive has contributed to increasing fertiliser use efficiency and limiting nitrogen fertiliser application (including manure), which has in turn contributed to reducing nitrogen surpluses across the EU, a key indicator of the risk of nitrate pollution.

In terms of impacts on water quality, national and EU data shows that the Directive has only been only partially successful so far in lowering nitrate concentrations in surface waters and groundwaters below the threshold value of 50 mg/l and in eliminating eutrophication of surface waters. However, the Directive has been fairly successful in stabilising nitrate concentrations in groundwaters and reducing concentrations in surface waters since the 1990s, after decades of increasing pollution. The Directive has thereby significantly contributed to protecting drinking water resources. One important factor explaining the partial success in lowering nitrate concentrations is the response time lag, which can span several decades for groundwaters due to complex underlying physical and biological processes.

Nevertheless, the results of the Nitrates Directive seem to have stagnated and even partly reversed in the 2010s, which was reflected in a temporary increase in fertiliser use and deteriorating nitrogen surplus in some Member States. During this period, generous derogations from the manure limit allowed high or increasing livestock concentration to continue in some regions, driven by external regulatory and market factors. However, this aggregated EU level view hides examples in Member States where reduction of nitrate concentrations continues in the most polluted monitoring points between 2008 and 2023. In recent years, policy has been tightened, with stricter conditions for granting derogations and successful enforcement actions taken by the Commission against Member States. Recent reductions in fertiliser use, manure application and nitrogen surpluses, shown by data in the last reporting cycle (2020-2023), reflect strengthened implementation in Member States, and over time are expected to lead to water quality improvements.

2. The Directive helped reduce and prevent eutrophication thanks to general reduction of fertiliser and manure use and of nitrate and phosphorus concentrations in surface

[154] Gross nitrogen and phosphorus surplus are key indicators for nutrient pressures, but since 2015, reporting by Member States has been incomplete, resulting in significant data gaps. With the new rules, Member States shall provide data to Eurostat on a mandatory basis as of 2026, with the first reporting to take place in 2029. In the meantime, Eurostat continues to rely on the voluntary reporting.

waters but measuring progress and success has been less straightforward. The Water Framework Directive (WFD) provides a comprehensive and scientific basis for assessing eutrophication in relation to the ecological status of surface water, for attributing loads to different sources and for defining nitrogen and phosphorus concentration thresholds compatible with good ecological status and absence of eutrophication. Thus, the WFD provides a framework to develop progress indicators and assess success. However, gaps remain in ensuring full coherence of the monitoring and reporting of eutrophication between the Nitrates Directive and the WFD.

Data and analysis in Sections 3, 4.1.1 and Annexes XI to XIV allow to conclude that the Directive has been less successful so far in addressing eutrophication and protecting aquatic ecosystems, although as explained in Section 2, the Nitrates Directive is not the only intervention acting on eutrophication. The excess of nitrates and phosphorus responsible for eutrophication can be caused by other sources besides agriculture, such as urban and industrial wastewater discharge. The UWWTD has played and continues to play an important role in reducing such pollution. In addition, eutrophication is a complex and multifaceted phenomenon. Excess nitrogen and phosphorus act as triggers in unbalancing the aquatic ecosystems and eventually causing eutrophication. However, nitrate and phosphorus concentrations below a safe level is a necessary but not necessarily a sufficient condition for the recovery of the aquatic ecosystems in the short term. Therefore, assessing the success of the Nitrates Directive in addressing eutrophication is less straightforward than for nitrate concentrations. However, by acting on the main factors responsible for triggering eutrophication, it has certainly contributed to preventing and reducing the phenomenon, which was widespread in fresh and coastal waters when the Directive was adopted. Section 3 describes the temporal evolution of key result indicators such as nitrogen surplus, which can be directly linked with the reduction of nitrogen loads and reduction of nitrate concentrations in water, as well as the temporal evolution of water quality indicators. It further describes the challenges in addressing and measuring progress on eutrophication and the measures taken to remedy it. In particular, the report explains how the Nitrates Directive initially lacked the parameters and framework for monitoring and reporting eutrophication and the criteria for success. The nitrate concentration thresholds for eutrophication are much lower than the drinking water threshold and therefore the reduction to be achieved much greater. Whereas the measures of the Nitrates Directive are also effective in reducing phosphorus losses to water, the absence in the Nitrates Directive of explicit measures and limits for phosphorus, and the absence of reporting obligation are also part of the difficulty to assess success. Section 4.1.1 on effectiveness refers to both positive developments and remaining challenges regarding eutrophication and reiterates the point made in Section 2 regarding the need for a long-term perspective on eutrophication.

Finally, Section 4.1.3 on coherence clarifies that the WFD provides the framework, criteria and parameters for measuring overall progress on eutrophication in relation to good ecological status, for identifying the necessary nutrient load reduction and the respective attribution to different sectors, and for defining nitrogen and phosphorus concentrations thresholds compatible with good ecological status and absence of eutrophication. The analysis of coherence finds that while significant progress has been done, gaps remain in ensuring coherence of the monitoring and reporting of eutrophication between the Nitrates Directive and the WFD. Finally, Section 4.2 analyses how phosphorus pollution as a key

factor for eutrophication and the absence of explicit phosphorus limits in the Nitrates Directive have been dealt with, and eventually been sufficiently addressed in combination with the WFD, noting that end of 2025 more than half of the Member States reported to have set explicit rules to limit phosphorus inputs in their national laws.

3. Climate change is increasingly affecting outcomes in terms of impacts on water quality and it will significantly alter the physical and societal context within which the Nitrates Directive is implemented in the future. The Directive is capable of responding to climate change, with its generic and adaptable measures, through evolution in its practical implementation, not necessitating legal amendments. The inherent flexibility of the Directive should allow for innovative and resilient approaches to address the challenges coming along with climate change and help farms to adapt, notably through the exchange of knowledge and best practice, allowing Member States to design more flexible and effective measures.

As discussed in Sections 3.3.6 and 4.1.1, an additional factor affecting the ultimate impact of the Directive on water quality is climate change, which has made fertiliser management more challenging in recent years, resulting in higher losses (lower nitrogen use efficiency) and hence in higher nitrate concentrations in surface and groundwaters. Climate change has also exacerbated the effects of eutrophication due to warmer waters, which further accelerates the growth of biomass and the subsequent depletion of oxygen when the biomass decomposes.

4. Nitrogen pollution from agriculture imposes significant costs on society, estimated to be in the general order of magnitude of EUR 68-182 billion annually. The benefits of the Directive in lowering cost of pollution are estimated to be in the general order of magnitude of EUR 10-22 billion per year, and are found to be three to seven times the total implementation costs for farms and public authorities, which have been estimated to EUR 2.8 - 3.1 billion per year. The costs for farms represent less than 1% of agricultural output in the EU. In general, there would seem to be a good correlation between the implementations costs and level of pollution, as the Directive generally imposes higher implementation costs in situations when pollution is more severe. The highest costs linked to the implementation of the Directive are concentrated in nutrient pollution hotspot regions and mostly borne by intensive livestock production, which is a key driver of nutrient pollution due to the high manure production. However, the evaluation shows that even in Member States with high livestock density the competitiveness of livestock farming remains generally unaffected by the Directive. In areas where there is no pollution risk, the implementation costs can be close to zero (outside NVZ), so the geographic distribution of costs and benefits of the Directive would tend to be coherent in this sense. The general distribution of costs would seem consistent with the polluter pays principle.

As regards the efficiency of the intervention, data and analysis in section 4.1 conclude that nitrogen pollution from agriculture imposes significant costs on society, estimated to be in the general order of magnitude of EUR 68-182 billion annually, and are found to be in the same range as the reference scientific work of the European Nitrogen Assessment in 2013. Not all forms of nitrogen pollution are directly addressed by the Nitrates Directive, as it mainly aims to address nitrate pollution, but the Directive has significantly reduced the societal cost of nitrogen pollution. The benefits of the Directive in lowering cost of pollution are estimated to be in the general order of magnitude of EUR 10-22 billion per

year. In general, it should be noted that due to methodological challenges, these estimates are associated with significant uncertainty. However, they allow to indicate a general order of magnitude, which is sufficient to draw general conclusions and to compare with the implementation costs. The estimated societal benefits of the Directive are three to seven times the total implementation costs for farms and public authorities, which have been estimated to EUR 2.8 - 3.1 billion per year. The implementation costs include net adjustment costs of approximately EUR 1.5 billion and administrative costs of approximately of EUR 1.2-1.5 billion annually for farms. These costs represent less than 1% of agricultural output in the EU.

The overall adjustment costs are mostly concentrated in the livestock sector (EUR 2 billion in total) whereas the arable sector as a whole has a net negative cost (EUR 0.5 billion), as arable farms in and around intensive livestock regions benefit by receiving a payment for allowing the use of their land for spreading excess manure and by reducing their chemical fertiliser need. The high costs at EU level for livestock farms mainly reflect the specific situation in two Member states, and outside these, the overall cost is both much lower and more evenly balanced between arable and livestock farms. In addition, the costs linked to the implementation of the Directive tend to be concentrated in regions with high nutrient pollution, which appears consistent with the polluter pays principle.

Further analysis in Annex XVIII and section 4.1.2 concludes that the Nitrates Directive has in general not been a hindrance for the maintenance of a highly competitive agricultural sector in the EU, even in Member States with high livestock density. Economic analysis performed for the evaluation indicates that the impact of the Nitrates Directive on agricultural competitiveness has likely been rather insignificant in most cases. Although implementation costs can be significant for livestock producers in certain regions with very high livestock density, the analysis suggests that other forces are substantially more influential in shaping the industry's development. This conclusion is supported by international competitiveness indicators as well as an econometric analysis of indicators linked to costs, margins, incomes and agricultural activity at regional level.

The administrative costs for farms in implementing the Directive are driven by time spent on fertiliser planning, record keeping and familiarisation with the rules and are estimated between 1.5-10.8 working days per farm, with the range varying depending on the size of the farm. A significant part of these costs are “business as usual” costs, as farmers would for example have an interest in some level of planning and record keeping in any case. The costs of implementation depend to a large extent on the design of the measures determined by Member States. Also, it is the Member States that set the requirements on fertiliser planning and record keeping on farms, as such measures are optional under the Directive, and rules can vary widely. The evaluation has identified potential simplification in this respect. Finally, the yearly costs borne by national administrations for the implementation of the Directive have been estimated to EUR 120 million in total. These costs vary widely across the Member State and in around half of the Member States public administrative costs are below EUR 1 million per year.

5. The agricultural practices promoted under the Nitrates Directive are generally effective in addressing pollution if properly implemented. Over time Member States have strengthened the preventive approach of the Directive. Currently, problems in implementation are usually linked to the insufficiency rather than the absence of

mandatory measures, as illustrated in the recent enforcement actions by the Commission or national courts.

As regards the effectiveness of the measures, as discussed in section 3.1, 4.1.1 and detailed in the relevant annexes, the agricultural practices promoted under the Nitrates Directive, based on basic principles of responsible fertiliser and manure use (right amount, right type, right place and right moment) and focusing efforts on polluted areas are generally found to be effective in addressing pollution *if properly implemented*. In the early days of the Directive, the implementation has been slow and incomplete. Enforcement through infringement procedures and cross-compliance with the CAP have been key factors to ensure that NVZ and monitoring networks were in place and nitrates action programmes included the necessary mandatory measures. It is also the case that over time Member States have strengthened the preventive approach of the Directive, either by enforcing mandatory measures throughout the whole country (whole territory approach) or by imposing some mandatory measures outside NVZ. In the last decade, problems in implementation are usually linked to the insufficiency rather than the absence of mandatory measures. It is also the case that some of the agricultural practices that are generally recognised as effective are not implemented in all Member States, as it is not mandatory for the Member States to include these in the action programmes.

6. Balanced fertilisation is an effective and efficient measure to promote nitrogen use efficiency and balance between the private economic interests of the farm and the societal interests to prevent and reduce nitrogen pollution and its associated costs. It has ensured considerable reductions in fertiliser use while agricultural production has continued to increase, thereby contributing to strategic autonomy and food security.

Balanced fertilisation requires Member States to set limits on nitrogen fertilisation in function of the needs of the crop and the nitrogen available in the soil and allows to adapt fertilisation limits in function of agricultural, environmental and economic conditions. As explained in section 2, 4.1 and Annex XI, an effective implementation of balanced fertilisation is a key measure to reduce the farm's nutrient balance and minimise the loss of nutrients to the environment. Section 4.1.2 explains that the cost of balanced fertilization is found to be insignificant, indicating that the fertilisation standards are usually close to the economic and agronomic optimum for the farmer. However, there can be a mismatch between the private economic optimum of the farmer and the social economic optimum for society due to the externality costs associated with fertiliser use, which fall on society as a whole. While the price of chemical fertilisers can act as an incentive for farmers to adjust better fertiliser use to the plant uptake, due to its constant short-term fluctuations and the private economic interests of the farm which may not equate the societal economic interests, relying on the fertiliser price factor alone to limit fertiliser use would not be sufficient to ensure a continued and long-term pollution prevention and reduction to achieve water quality objectives.

7. The wide flexibility that the Directive leaves in its concrete implementation allows Member States to adapt implementation to local conditions, which should be more efficient. The flexibility has further allowed to adapt to new and emerging challenges, while regular meetings in the Nitrates Expert Group has allowed sharing of best practices. As a result, national implementation varies considerably between Member States, or even between different regions in the same Member State. However, flexibility also implies an

important responsibility for Member States to impose and enforce necessary measures. Market pressures are pushing the sector in the direction of intensification with high fertiliser inputs to optimise yields and towards the geographic concentration of livestock production in a few regions, which has likely had a negative impact on the Directive's implementation. The evaluation also identifies both positive and negative examples where the flexibility of the Directive and the Member States' choices have favoured cost-effective implementation of measures. However, in some Member States, authorities and farmers' associations have highlighted that in order to accommodate increased flexibility and maintain overall effectiveness, national rules have become more complex and more difficult to implement or control. The evaluation has identified this as a potential area for simplification through exchange of good practice.

The evaluation assessed the overall effectiveness and efficiency of the intervention based on a relevant selection of measures and national contexts. This has allowed to draw some general conclusions on whether the flexibility of the Directive and the Member States choices have favoured cost-efficient implementation of measures. Section 4.1.1 and 4.1.2 on effectiveness and efficiency (and the relevant annexes) analyse the different approaches taken by Member States on key aspects, such as closing periods, fertilisation limits, manure application limit and derogations, and the consequences of those approaches on effectiveness, identifying both positive and negative effects. The cost analysis provides the cost of these key measures in the Member States and across sectors, for buffer strips, manure storage, manure disposal, transport and processing. A measure like cover crops, although not mandatory in NVZ, but effective and with low implementation costs, appears rather cost-efficient. For buffer strips, Member States have in some cases, especially where land prices are high, reacted to the costs by reducing effectiveness.

8. Setting a common limit for the application of nitrogen from manure (and processed manure) in NVZ has served as a pivotal benchmark in curbing different pathways of nutrient pollution from manure, contributing positively to limiting negative environmental effects of intensive livestock production. In general, manure application above the limit leads to a risk of excessive water pollution. The evaluation finds the manure application limit is effective, scientifically sound and cost-efficient, but, in polluted areas, not be sufficient to achieve the objectives of the Directive and additional measures adapted to the local conditions may need to be taken. Furthermore, the analysis highlights how the choice of a few Member States or regions to allow the production of manure far above the limit of what can be applied on land as being both ineffective to tackle pollution and very costly for livestock farms. On the other hand, an excess of manure production on a more limited number of farms in the same region can be seen as beneficial for nearby arable farms while keeping costs for livestock farms on a reasonable level.

As discussed in sections 4.1.1, and 4.2, as well as Annex XX and XII the limitation of manure application (170 kg N/ha) is an effective and necessary instrument to tackle the emissions from manure and leaves sufficient room for farms to operate in most regions, while also allowing for derogations under certain circumstances. While the limit is harmonised at EU level, there are flexibilities at Member State and farm level in its implementation. It is found that the manure application limit of 170 kg N/ha remains justified and appropriate for balancing the needs of agriculture with environment and public health concerns, and has been integrated as the legal norm for fertilisation in the EU organic farming regulation. It remains fully relevant as a means to balance the private

economic interests of the livestock farmer and the societal interest to limit the external costs of nutrient pollution from manure. The Nitrates Directive can achieve this balance by redistributing the manure between regions and between livestock and arable farms, thereby reducing the latter's costs. However, in regions with very high livestock concentration, Member States may need to take additional measures to reduce levels of nutrient pollution from manure below harmful levels.

9. Derogations remain a tool for flexibility regarding the manure limit, but the evaluation shows that they may affect the effectiveness of the Directive and therefore have to be used carefully to avoid long-term negative impacts.

As explained in section 4.1.1 and relevant annexes, over time, derogations to the manure application limit have come with additional conditions, as well as higher engagement of farmers and authorities. These factors may have had some positive environmental effect, but they have also created expectations and entrenched the derogated farms in high nutrient-output farming that may have been damaging over time. Derogations have come under increased societal and legal scrutiny as there is increasing concern that the higher livestock concentration and manure production allowed by derogations have contributed to negative effects on water, soil, air quality and protected habitats in the Member States concerned.

10. The evolution of EU case-law and national court cases, and the numerous consultations with all stakeholders have highlighted the importance of cross-sectoral and societal dialogue in the national or regional implementation of the Nitrates Directive to design robust and proportionate solutions which can reconcile the needs of agricultural production with environmental, public health and other economic interests.

Additional dialogue and exchanges among sectors and with stakeholders would also facilitate the implementation of required measures and improve their efficiency. More extensive national level studies on the costs of nutrient pollution and the benefits of the measures modulated on the specific national context and reflecting the diversity of situations could be crucial tools for Member States to draw conclusions supporting policy choices and in discussions with stakeholders.

11. Environmental laws on water and air quality have not made the Nitrates Directive redundant, on the contrary, they rely on the implementation of the Nitrates Directive because of its targeted focus on reducing nutrient pressures from agriculture. In particular, the Nitrates Directive critically contributes to the WFD objectives as it has been fully integrated in the broader water framework of the WFD as the comprehensive instrument to reduce these pressures. The Nitrates Directive plays an essential role in promoting and enforcing sustainable agriculture and livestock production throughout the EU. It is fully coherent with the CAP and both instruments work together for the sustainability of agriculture in the EU. The balanced fertilisation requirement remains at the centre of the Nitrates Directive, complemented by other good agricultural practices for the management of fertilisers and livestock manure.

As regards coherence, Section 3.1, 3.4 and 4.1.3 (and the relevant annexes) highlight that many EU laws on water, nutrients and agriculture have been adopted since 1991, which has had a major impact on the policy context of the Nitrates Directive and on its implementation. In general, the analysis concludes that the objectives, scope and measures of the Nitrates Directive are largely coherent and complementary with the EU

environmental acquis. In 2000, the Water Framework Directive (WFD) introduced an overarching and comprehensive legal framework for water policy in the EU, setting water quality objectives and deadlines to reach them. By embedding the national measures under the Nitrates Directive as basic measures to be included in WFD Programmes of Measures, the WFD has significantly changed the context for the Nitrates Directive's implementation. The WFD has played a key positive role in the implementation of the Nitrates Directive and has been instrumental in developing attention to eutrophication in the Member States implementations. However, the integration of the implementation of the two directives remains incomplete and could be further improved. In particular, there is scope for a stronger integration and coherence in terms of preparation of the national measures as well as in the monitoring and reporting.

The Nitrates Directive is found to be coherent and complementary to the CAP. The objectives, agriculture measures, financing and enforcement of the Directive and the CAP are very much intertwined, supporting each other in the achievement of their respective objectives highlighting their mutual dependability in implementing good agriculture practices for sustainable farming and environmental protection throughout the EU. There are synergies and complementarity in the national implementation, notably on the conditionality and controls, and through the voluntary measures under EcoSchemes and Agri-Environmental and Climate Commitments. Through major reforms since the adoption of the Nitrates Directive, the CAP has supported the implementation of the Nitrates Directive and shaped how Member States and farmers address nutrient management, although the abolition of the milk quota in 2013 has rather increased nutrient pressures.

A key finding of the coherence analysis in section 4.1.3 is that through its specific sectoral focus on nutrient pollution from agriculture, the Directive critically contributes to achieving objectives of other EU environmental legislation, in particular the WFD and the CAP so that these rely on the effective implementation of the Directive. This is also case for the Marine Strategy Framework Directive (MSFD), aimed at reducing water pollution, but also for other legislation such as the National Emission reduction Commitments Directive (NECD) and the Habitats Directive (HD), notably due to the indirect impact of the Nitrates Directive on reducing ammonia emissions. The limits of fertilisation or manure application under the Nitrates Directive generally contribute to protect nature and biodiversity against excessive fertilisation, but the process for Member States to fully integrate the specific requirements of protected habitats and species when farming within or near Natura 2000 areas is still work in progress. It may therefore be appropriate to facilitate a practical implementation process, including for derogations, for Member States and farmers reflecting the case-law and experience.

EU added value and relevance

12. The Directive has provided benefits to EU citizens, as consumers of water and beneficiaries of a well-functioning environment, and to economic sectors depending on clean water and healthy aquatic ecosystems, including the food, fisheries and tourism sectors. The Directive plays a complementary role alongside other frameworks dedicated to transnational cooperation and the development of coordinated strategies. Addressing nutrient pollution remains necessary and urgent for achieving key EU policy objectives, in particular water resilience and a sustainable and competitive agriculture including the

livestock sector. In spite of the progress under the Nitrates Directive, nitrates pollution in groundwater and eutrophication of surface waters remain important challenges throughout the EU.

The findings in sections 4.1, 4.2, 4.3 and relevant annexes support the conclusion that the Nitrates Directive has clear benefits and EU added value contributing to results that go beyond what could have been achieved through Member States acting on their own. The Directive remains relevant for the protection of surface and groundwaters in the EU as well as for other environmental objectives. Indeed, nitrate pollution of surface and groundwaters and eutrophication of freshwaters and seas remain a significant challenge across large parts of the EU. Effectively reducing pollution and solving these problems require a steady and continuous effort over several decades. Even when the pollution level is low the Directive remains relevant and necessary to prevent pollution for the protection of human health and aquatic ecosystems in all areas where fertiliser use and manure application risk polluting waters.

13. The Nitrates Directive provides a cost-efficient and sustainable approach in protecting drinking water resources. The Directive's objectives to prevent and reduce pollution remain therefore fully relevant for the resilience of drinking water resources, even more so when considering increasing scientific evidence that nitrate levels in drinking water should be lower than 50 mg/l to protect against carcinomic effects.

As illustrated in section 4.1.1 and 4.1.2, significant progress towards the objectives of the Directive has been achieved in the protection of fresh drinking water resources as nitrate pollution has stabilised and further reduced in many places, while experience in Member States shows that the preventive measures promoted by the Directive are also more sustainable and cost-efficient compared to treatment equipment or finding alternative drinking water resources. It is also the case that significant problems with excess nitrates or eutrophication in drinking water reservoirs have recently emerged in several Member States. Therefore, the fact that a very large majority of European measurement points for ground and surface waters exhibit nitrate concentrations well below the 50 mg/l drinking water threshold including in areas with intensive agriculture does not mean that efforts can be relaxed, but rather that the preventive approach is effective and should be pursued to ensure resilience of drinking water resources. The 50 mg/l threshold itself remains relevant and in line with existing EU and international standards for drinking water, based on the possible toxic effects of nitrates in high concentrations. Recent studies indicate that even lower concentrations could also lead to a risk of carcinogenic effects, so this issue needs to be followed. Any future developments around the EU nitrate drinking water standard would have consequences for the implementation of the Nitrates Directive.

14. The Directive contributes to a level playing field among farms across the EU, by setting out the basic standards for nutrient pollution control and a common menu of the types of practices that should be implemented. The common manure application limit in NVZ and the derogation process through the comitology committee help to maintain a common minimum baseline and avoid distortion, including with organic farming.

As further detailed in Annex XVII, the common manure limit and the derogation process through comitology are key elements in this regard. The manure limit provides a common threshold as part of the minimum common basis for all farmers in the EU (in NVZ) to mitigate environmental and health risks related to intensive livestock production. The

comitology procedure for derogations, subject to approval by the Commission and the Member States, reflects the sensitivity linked to the risk of market distortion and has the added benefit of improving transparency and peer review among the Member States. The common manure limit is also essential as a basis for organic farming and allows organic farms, where no chemical fertilisers are allowed, to compete with other farms. Without a common legally binding limit and the specific derogation process, distortion and competition between livestock sectors in different Member States would lead to excessive flexibilities in regions with high livestock concentration and to a risk of a "race to the bottom". This would likely result in significantly more serious negative trends than those, connected with a wide application of derogations witnessed in the 2010s.

15. Overall, the Nitrates Directive remains necessary, relevant and effective, although the evaluation identifies potential areas for improvement. Its intervention logic and key measures are effective to address the problem that it was designed to address. It tackles water pollution by nutrients from agriculture in a generally effective, efficient and coherent way, and is fully complementary to other legislation tackling other sources of nutrient pollution, such as urban wastewater. The Directive contributes to achieving outcomes that could not have been attained by the Member States acting alone, and its provisions generally remain relevant to the current context and emerging policy challenges. In particular, it is by design a very flexible legal instrument, targeting its intervention to areas where pollution or the risk of pollution is a problem and allowing wide discretion for Member States in the national implementation and adaptation to scientific and technological progress, which facilitates the adaptation of measures to new circumstances (e.g. technological innovation, climate change).

Potential for simplification and policy change

16. The evaluation has identified potential areas for improvement on which the Commission and Member States could follow-up as part of a coherent effort. These potential areas for improvement detailed below are linked to simplification potential, better implementation, increased coherence with the WFD, climate change adaptation and better management of excess manure and high livestock concentration, some of which are broader policy issues beyond the Nitrates Directive itself.

Section 4.1.4 examine the potential for simplification and burden reduction. The analysis, including extensive consultations with stakeholders and public authorities, highlighted a number of areas with simplification potential, both for farms and for public authorities. In line with the simplification objectives of this Commission, the evaluation already puts forward general simplification options that the Commission could consider as a follow-up to the evaluation, after necessary assessments and consultations.

17. There are indications that national implementation of the Nitrates Directive modulated by the broad flexibility left to national or regional authorities has not always been sufficiently effective or efficient. At the same time the evaluation identified potential for simplification and burden reduction for farms through the adaptation of national implementation in the Member States, which depends to a large extent on the choices made at national level. The Directive's flexibility should allow Member States to continue to manage the evolving realities faced by farms in the light of changing market conditions, technological pressures and climate change, while both minimising unnecessary burdens

and ensuring that measures are proportionate and effective in reaching EU water quality standards.

The evaluation has identified potential simplification in the national implementation, reflecting the flexibility that the Directive gives Member States concerning:

(a) Reduction of administrative costs for farms and public administrations. The cost estimates presented in section 4.1.2 indicate that activities related to the implementation of the Directive, such as fertiliser planning, record keeping, familiarisation with rules and public controls, are associated with administrative costs for farms. Potential simplifications at national level include looking at options for administrative burden reduction for small farms and simplification for farms and authorities through technological solutions.

(b) Flexibility in the implementation of the measures set out in Annex II and Annex III of the Directive. The evaluation finds that implementation by the Member States is already extremely varied, with different declinations at national or regional level, as the measures under the Directive are already targeted to the areas which are polluted and at risk of being polluted. Potential flexibilities in the national implementation concern in particular calendar-based requirements such a closed periods or modulating rules in function of the environmental performance of the farm. These should allow Member States and farms to minimise costs and optimise efficiencies in the local context while ensuring more effective measures and adapting better to climate change, although there can be trade-offs between flexibility and the interest in having simple and effective measures that are easily implementable and controllable.

The evaluation has identified potential for more flexible and proportionate implementation approaches that are adapted to national specificities, while ensuring that objectives can be effectively achieved, as a potential area for simplification through exchange of best practices, knowledge and research results, as well as dialogue with stakeholders, which can support Member States in designing robust approaches, avoiding the risk of backsliding or postponing difficult decisions. Stronger links could be made between technical, research and innovation progress, and more research could address knowledge gaps and provide innovative solutions for nitrates related challenges.

18. The integration of the Nitrates Directive with the WFD is incomplete. There is scope for a more consistent approach in preparing the national plans, in assessing of eutrophication and in the monitoring and reporting under both directives. In line with the priorities set out in the European water resilience strategy, a more coordinated "source to sea" approach to address both nitrogen and phosphorus pollution, and in particular eutrophication, could help Member States step up national implementation to reach its full potential in complementarity with structural measures under the WFD, improving the tackling of transboundary aspects of nutrient pollution and achieving water quality objectives.

The evaluation has identified potential for simplification in the monitoring and reporting to the EU by national authorities and better integration with the WFD. Increased coherence in monitoring and reporting could provide policy simplification and reduction of burdens for national authorities, although stakeholders have highlighted the importance of the focus on agricultural pollution under the Nitrates Directive. The monitoring cycles are set to converge in 2027 and would be a moment to take stock on the achievement of water quality objectives and potentially align better reporting processes.

19. The manure application limit at farm level acts as a minimum common basis but is not sufficient on its own to reduce or maintain levels of nutrient emissions from manure below harmful levels in areas with very high concentration of livestock production.

The evaluation finds that it has not prevented continued or increased concentrations of livestock in certain regions and Member States, creating a large nutrient imbalance, despite significantly increasing cost of compliance with the Directive for livestock farms and the socio-economic impacts resulting from high levels of nutrient pollution from manure, ultimately undermining the objectives not only of the Nitrates Directive but also of other EU legislation. In its Vision for agriculture and food, the Commission highlighted that "priority should be given to addressing nutrient pollution hotspots and promoting integrated territorial approaches. A key aspect of this would be the management and control of nutrients from livestock farming to limit negative externalities, support extensification in regions with high livestock concentrations". In 2026, the Commission presented a livestock strategy.

20. To reduce nutrient pressure on the environment it remains necessary to improve nutrient management at farm level by reducing losses, increasing circularity and better accounting the nutrients in soil and in manure. Through balanced fertilisation and the manure application limit, the Nitrates Directive promotes responsible use of fertilisers and inherently enforces circularity of nutrients by reusing manure as fertilisers on farms and redistributing excess and processed manure between regions and between livestock and arable farms, which contributes to strategic autonomy. Innovation on products and processing techniques from processed manure can help develop fertilising products of consistent quality that could replace chemical fertilisers without affecting the progress towards water quality objectives. The existing legislative flexibility to modify the annexes of the Nitrates Directive to scientific and technical progress offers the possibility to adapt to future innovation. Recent crises on fertiliser prices highlight the urgency to support Member States and farmers in developing sustainable solutions in this direction.

The Nitrates Directive is technology neutral and flexible to adaptations to technical progress in manure processing practices in the national implementations and through legislative adaptation of the annexes of the Directive to scientific and technological progress. The Commission recently took action in 2026 to adapt the Directive to developments in the advanced processing of livestock manure, by allowing Member States to authorise certain types of materials recovered from livestock manure (RENURE) above the manure limit, while still respecting balanced fertilisation, and with appropriate safeguards to ensure that it does not lead to an increase of concentration of livestock and associated nitrogen pollution. The Commission confirmed its continued commitment to improve availability and circulation of recycled nutrients[155]. Responding to repeated crises around fertiliser prices, the Fertilisers Action Plan of May 2026 further calls to improve nitrogen use efficiency, circularity of nutrients from manure and their distribution in the internal market [54].

[155] In the RESourceEU Action Plan [51], the Commission announced an action plan to ensure the availability and affordability of domestic fertilisers, including actions to enable recycled nutrients and other alternatives to fertilisers by Q2 2026

LIST OF FIGURES

LIST OF TABLES

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