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COMMISSION STAFF WORKING DOCUMENT

Accompanying the document

REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2016–2019

{COM(2021) 1000 final}

Pressure from Agriculture

Germany's utilized agricultural area amounts to 16.7 Mha, representing 47.7% of the total land area and has remained stable since 2007. The major outputs of the agricultural industry excluding services and secondary activities include in a decreasing order milk (19.8%), pigs (13.3%) and cereals (10.6%).

Eurostat

Major land use statistics for Germany

Table 1.Utilized agricultural area (abbreviated as UAA)

Germany	2005	2007	2010	2013	2016
Utilised agricultural area UAA (1000 ha)	NA	16954	16704	16700	16659
arable land (1000 ha)	NA	11877	11847	11876	11763
permanent grass (1000 ha)	NA	4875	4655	4621	4694
permanent crops (1000 ha)	NA	198	199	200	200
kitchen gardens (1000 ha)	NA	5	4	3	2

Note:

Eurostat (FSS)

Germany's arable land has remained stable since 2007. Permanent grass and crops also remained stable while kitchen gardens decreased.

Animal distribution in Germany

Germany's livestock remained more or less stable. The livestock density index (livestock unit per hectare of Utilized Agricultural Area) has also remained stable and is higher than the EU average of 0.8.

Table 2. Livestock statistics

Germany	2005	2007	2010	2013	2016
Livestock index	1.07	1.06	1.07	1.10	1.09
dairy cows (10^6 heads)	4.16	4.09	4.18	4.27	4.22
live bovines (10^6 heads)	12.92	12.71	12.71	12.69	12.47
live pigs (10^6 heads)	26.99	27.11	26.90	28.13	27.38
live poultry (10^6 heads)	NA	NA	128.90	177.33	169.72

Note:

Eurostat (FSS)

Nitrogen and phosphorus fertilizers and surplus (kg/ha UAA)

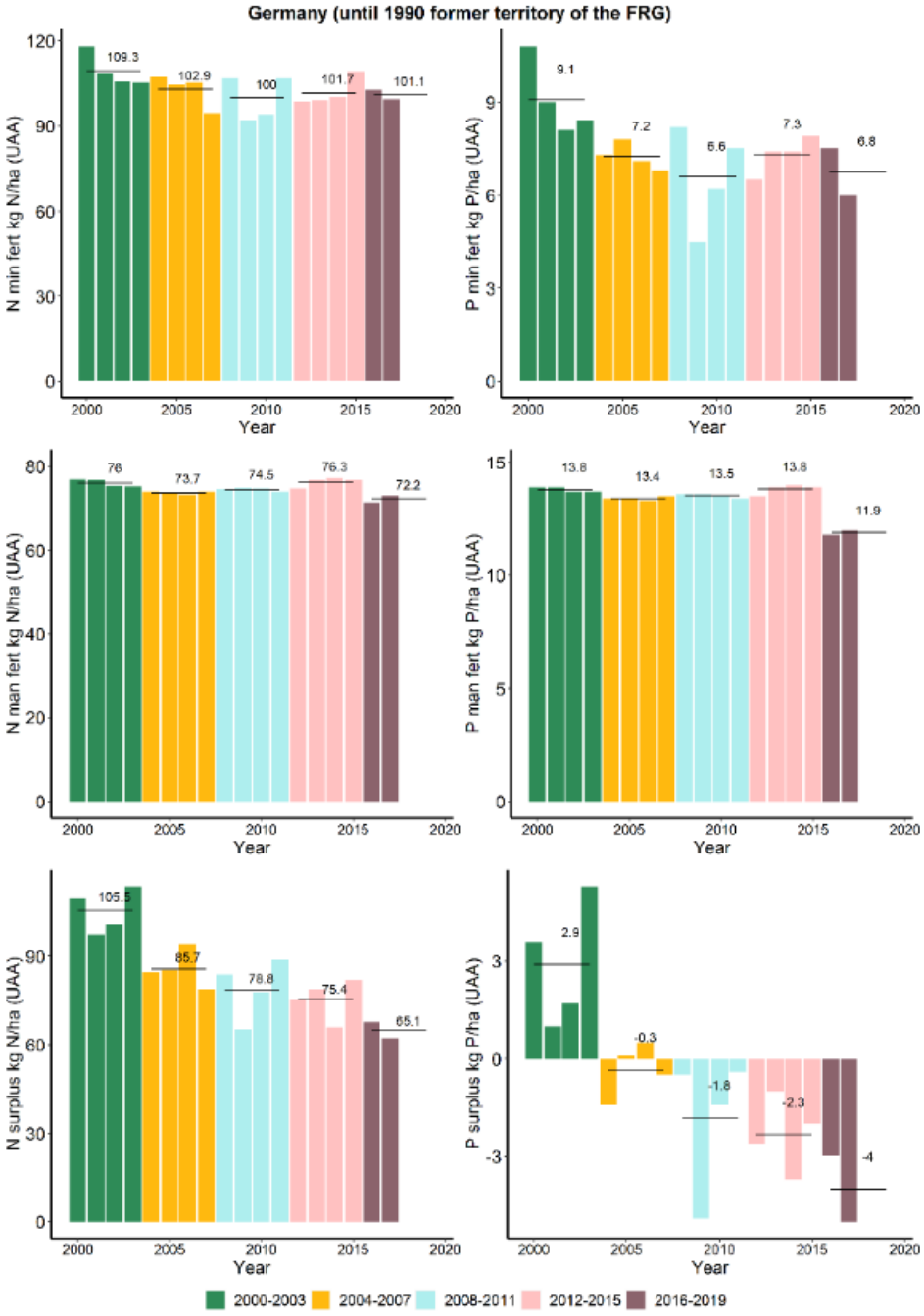


Figure 1. N and P fertilizers and gross surplus (kg/ha)

The gross nitrogen and phosphorus surpluses originate from EUROSTAT data for the years 2000-2017. N mineral fertilizers and manure are stable with respect to the previous reporting period, while P mineral fertilizers and manure decreased. The nitrogen and phosphorus surplus decreased significantly from the last reporting period by 13% and 74% respectively. This clearly indicates that the nutrient use efficiency has increased. In the plots: N/P min and N/P man are respectively the N/P mineral fertilizers and N/P manure. It is noteworthy that Germany reported different values of N and P fertilizers and surplus in the report due to different methods of calculation.

Livestock unit - LSU /ha

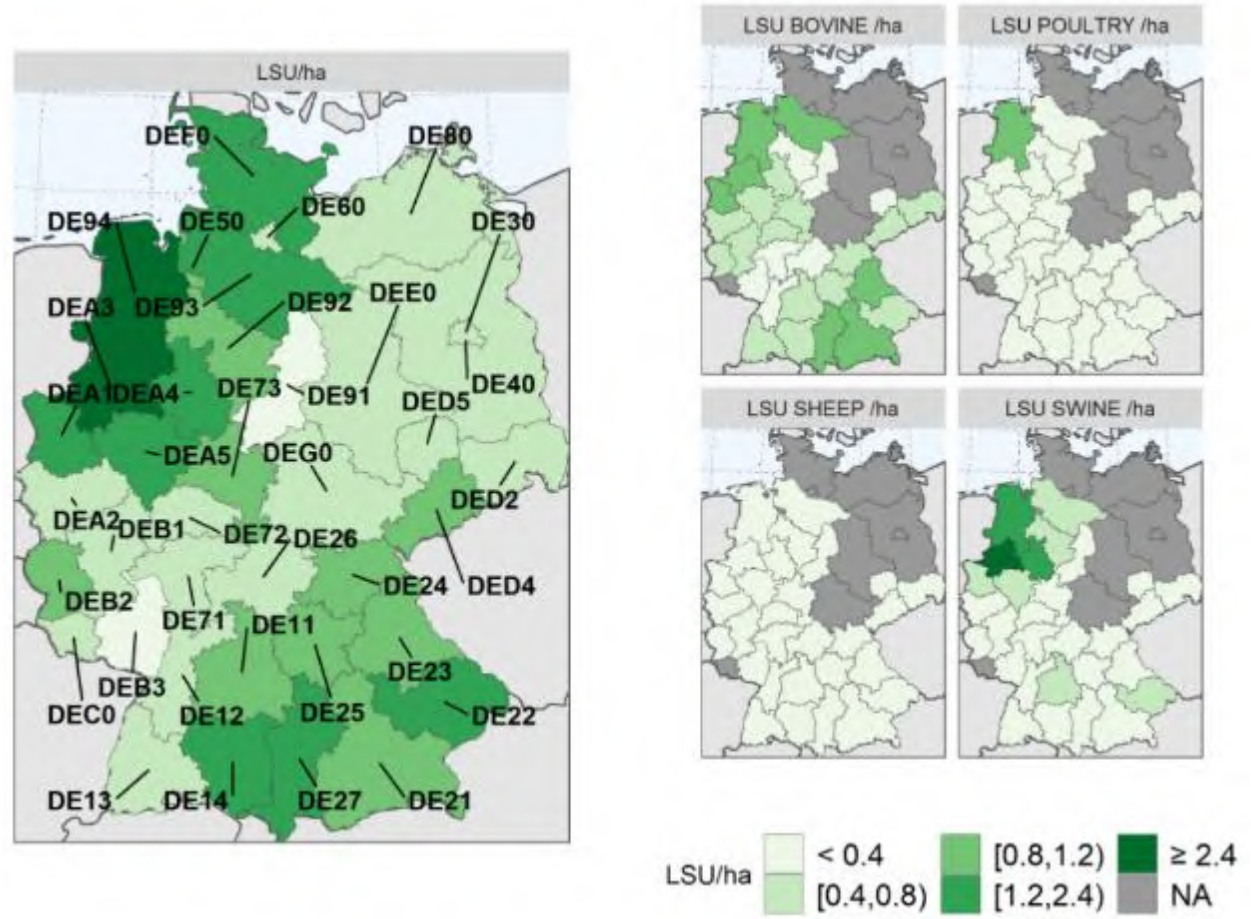


Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production is concentrated in the North West part of the country (total LSU and LSU by animal type were retrieved individually from EUROSTAT).
In this document, the NUTS-2013 version is used.
(https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/nuts)

Water Quality Monitoring

The current assessment period covers only the years 2016-2018, because the 2019 measurement results were not available at the time the Report was compiled. When performing the comparison between this reporting period and the previous reporting year 2015 was considered while it was not in the official data delivery and report in 2016. So the data mentioned in the current report for the previous report will be different than that mentioned in the previous report.

For surface measurements, two stations have same coordinates due to different measured waterbodies. In these cases, the average values covers different measurements in time, but also location. In maps providing the spatial distribution of monitoring points, it is not possible to distinguish stations with the same coordinated: for NO3 concentration, the average value is shown; for trends and trophic status the worst case was considered.

It is noteworthy that in some cases in the bar charts the total value can differ from 100% due to rounding errors.

Groundwater quality monitoring network

Table 3. Number of GW stations with measurements and trends per type

		Number of stations with measurements			Number of stations with Trends		
Station Type	Description	2008-2011	2012-2015	2016-2019	2008-2011	2012-2015	2016-2019
0	Phreatic groundwater (shallow): 0-5 m	66	247	236	66	247	236
1a	Phreatic groundwater (deep) 5-15 m	66	246	232	66	244	230
1b	Phreatic groundwater (deep) 15-30 m	21	137	135	21	136	135
1c	Phreatic groundwater (deep) >30 m	7	67	89	7	65	88
2	Captive groundwater	2	0	0	2	0	0
3	Karstic groundwater	0	0	0	0	0	0
9	Not specified	0	0	0	0	0	0
	Total	**162**	**697**	**692**	**162**	**692**	**689**

Surface water quality monitoring network

Table 4. Number of SW stations with measurements, trends and trophic status per type

		Number of stations with measurements			Number of stations with Trends			Number of stations with Trophic status		
Station Type	Description	2008-2011	2012-2015	2016-2019	2008-2011	2012-2015	2016-2019	2008-2011	2012-2015	2016-2019
4	River water	251	239	249	0	0	249	0	0	249
5	Lake/reservoir water	52	2	60	0	0	44	17	0	62
6	Transitional water	5	5	5	0	0	5	0	0	5
7	Coastal water	0	0	39	0	0	0	0	0	33
8	Marine water	0	0	7	0	0	0	0	0	2
9	Not specified	0	0	0	0	0	0	0	0	0
	Total	**308**	**246**	**360**	**0**	**0**	**298**	**17**	**0**	**351**

Groundwater Quality

Groundwater average annual nitrate concentration

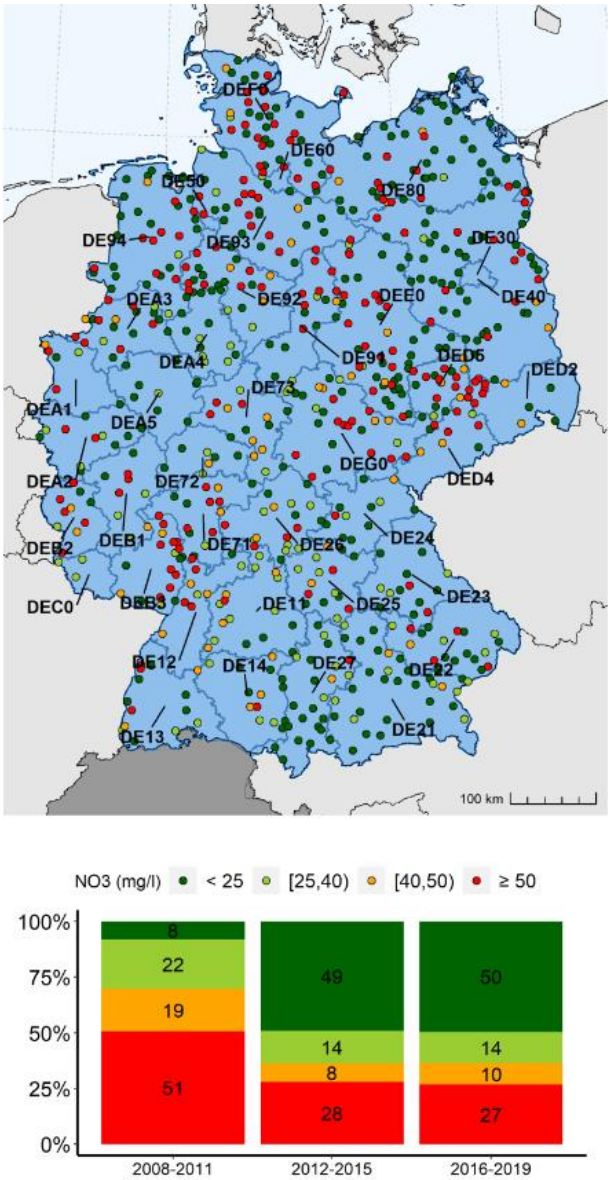


Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis)

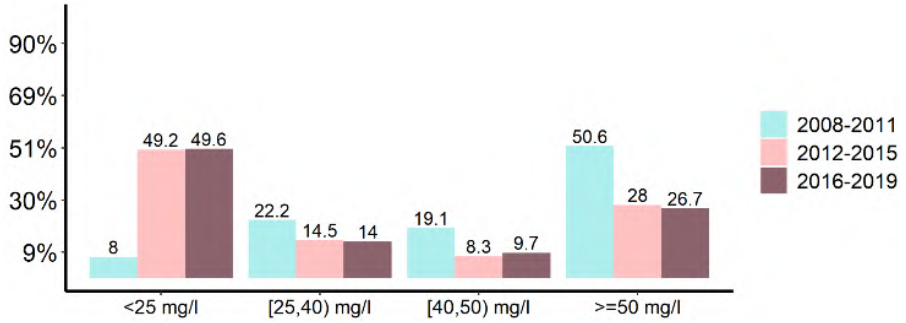
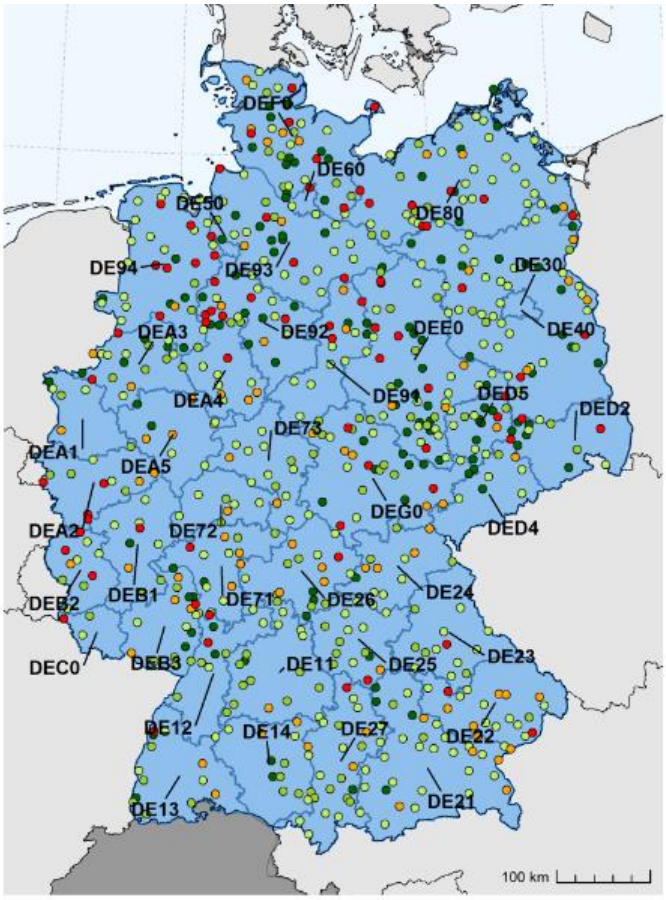


Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Groundwater average annual nitrate concentration trend



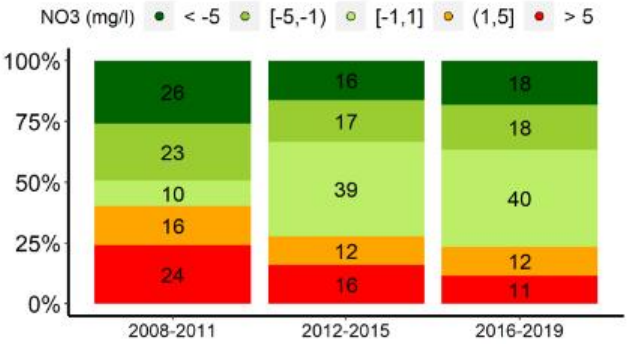


Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis).

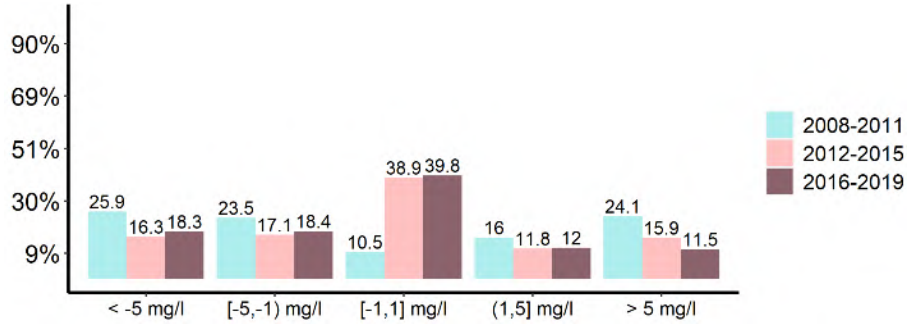
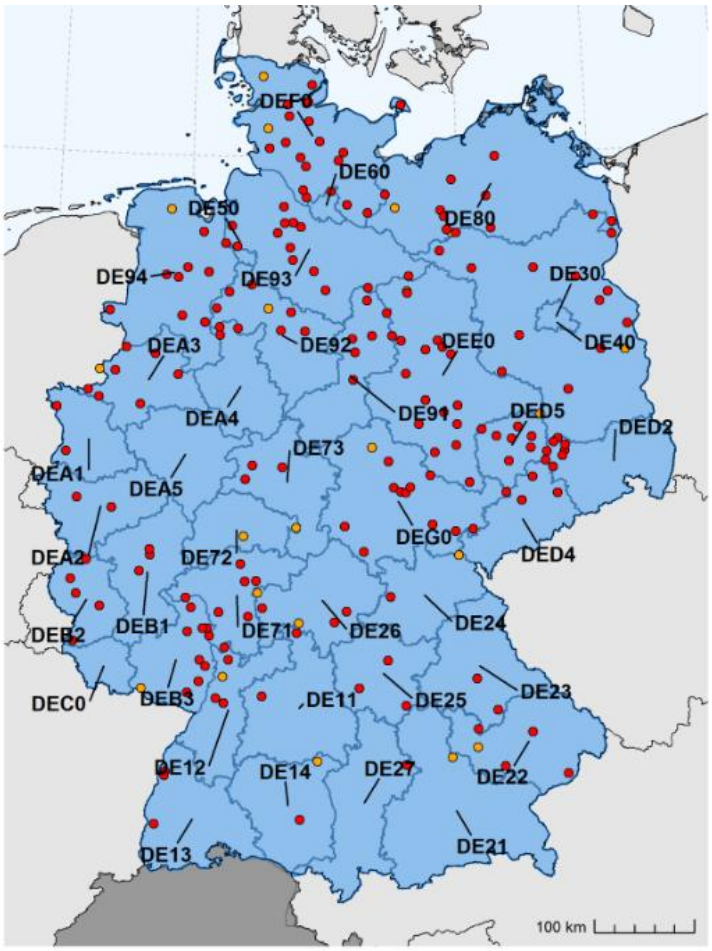


Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Groundwater hotspot

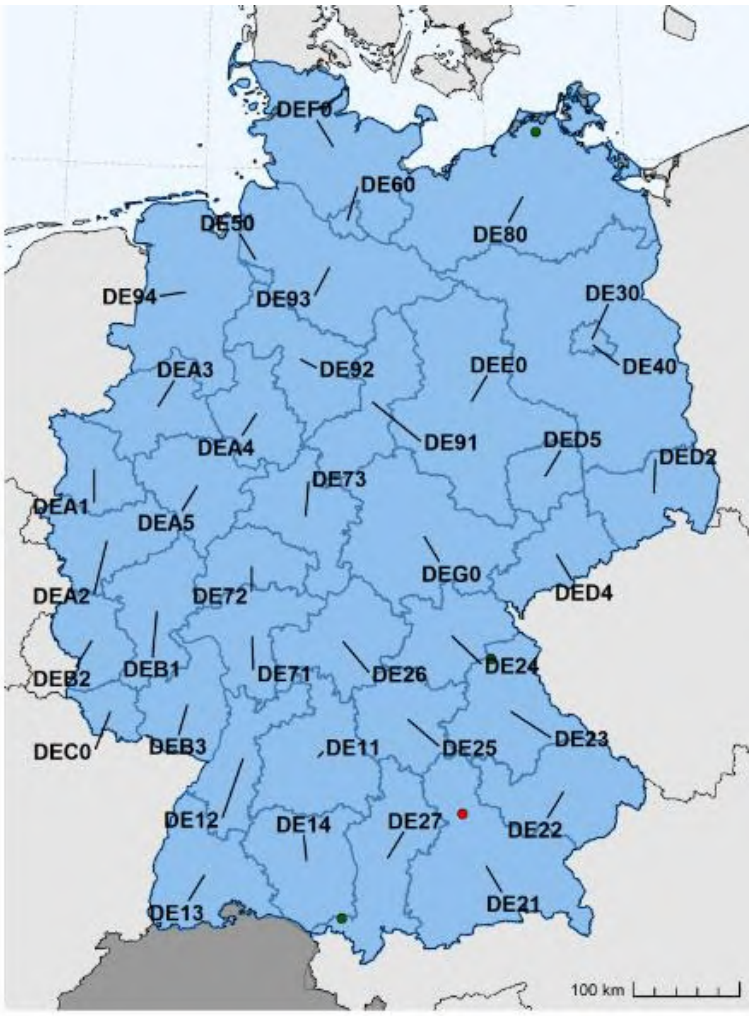


NUTS ID	NUTS NAME	>=40 and < 50 mg/l incr.trend	>=50 mg/l
DE11	Stuttgart	0	2
DE12	Karlsruhe	1	3
DE13	Freiburg	0	3
DE14	Tübingen	1	1
DE21	Oberbayern	1	0
DE22	Niederbayern	1	4
DE23	Oberpfalz	0	2
DE24	Oberfranken	1	1
DE25	Mittelfranken	0	3
DE26	Unterfranken	2	3
DE27	Schwaben	0	1
DE40	Brandenburg	2	13
DE50	Bremen	0	1
DE60	Hamburg	0	1
DE71	Darmstadt	0	8
DE72	Gießen	2	0
DE73	Kassel	0	3
DE80	Mecklenburg-Vorpommern	2	9
DE91	Braunschweig	0	7
DE92	Hannover	1	8
DE93	Lüneburg	0	13
DE94	Weser-Ems	1	9
DEA1	Düsseldorf	0	2
DEA2	Köln	0	2
DEA3	Münster	1	6
DEA4	Detmold	0	1
DEB1	Koblenz	0	3
DEB2	Trier	0	5
DEB3	Rheinhessen-Pfalz	1	8
DED2	Dresden	0	6
DED4	Chemnitz	0	4
DED5	Leipzig	0	8
DEE0	Sachsen-Anhalt	1	16
DEF0	Schleswig-Holstein	2	18
DEG0	Thüringen	1	11
	Total	**21**	**185**

Figure 7. GW hotspot analysis map (top graph) and distribution by NUTS2 (right graph) of average NO3 annual concentration greater than 40 mg/l.

The hotspot analysis identifies all the GW monitoring stations that have NO3 concentration in the range of 40-50 mg/l with increasing trends or are above 50 mg/l. The map shows the spatial distribution of these points, and the table reports the number of stations by NUTS inside and outside NVZ. Only the NUTS of interest are reported.

Groundwater stations removed



Station Type	Description	Number of removed stations		
		total removed	with measurements	with trends
0	Phreatic groundwater (shallow): 0-5 m	1	1	1
1a	Phreatic groundwater (deep) 5-15 m	0	0	0
1b	Phreatic groundwater (deep) 15-30 m	2	2	2
1c	Phreatic groundwater (deep) >30 m	1	1	1
2	Captive groundwater	0	0	0
3	Karstic groundwater	0	0	0
9	Not specified	0	0	0
	Total	**4**	**4**	**4**

Figure 8. GW removed stations map (top graph) and distribution by groundwater type (lower graph).

The removed stations analysis identifies all the GW monitoring stations that were removed in the current reporting period. The map shows the spatial distribution of these points with the concentrations of the previous reporting period, and the table reports the number of stations with measurements and trends per type.

Surface Water Quality

Surface water average annual nitrate concentration

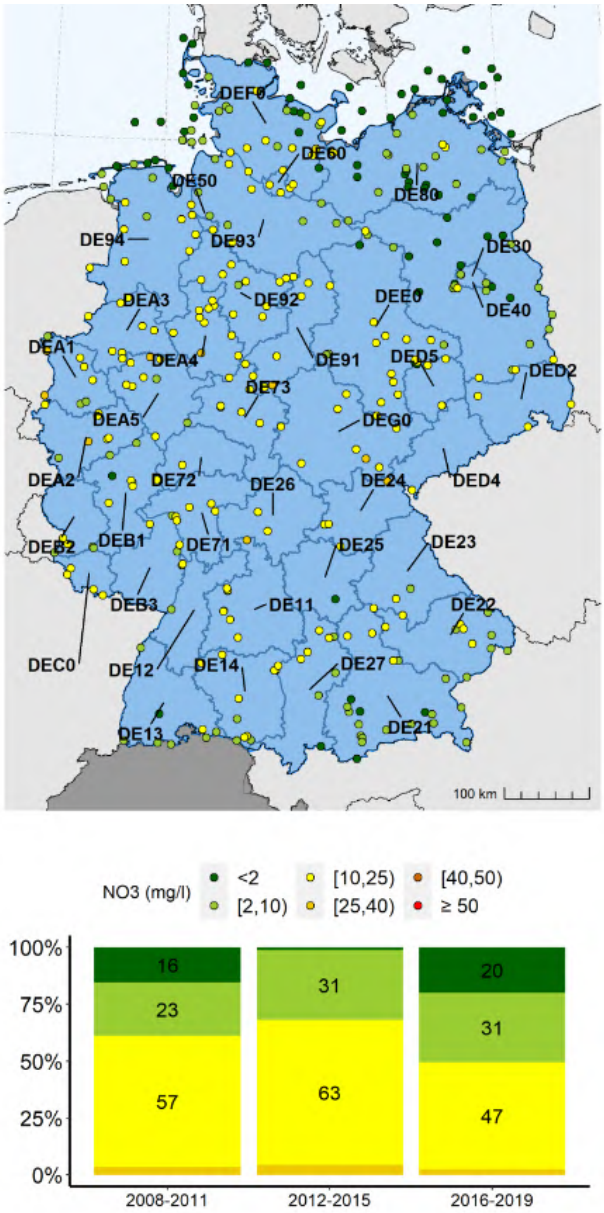


Figure 9. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis).). The percentages below 5% are not labelled, see the next plot for more information.

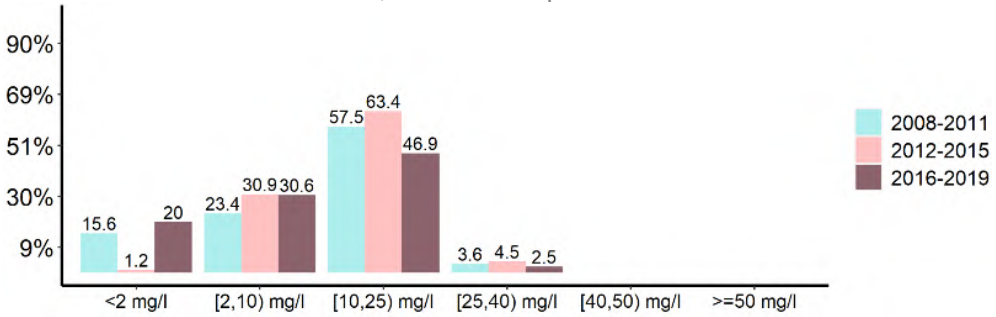


Figure 10. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis). In the map NVZ in blue.

Surface water average annual nitrate concentration trend

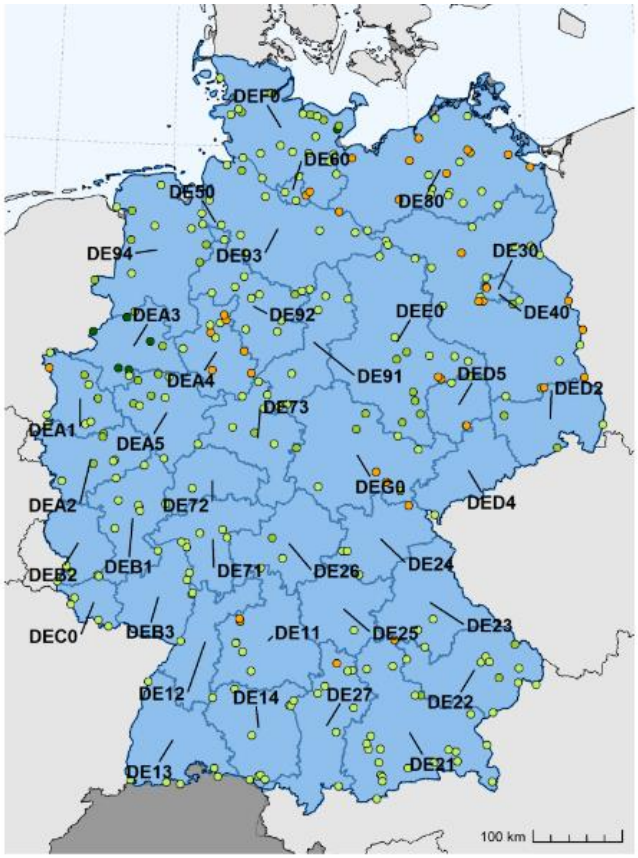


Figure 11. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis).). The percentages below 5% are not labelled, see the next plot for more information.

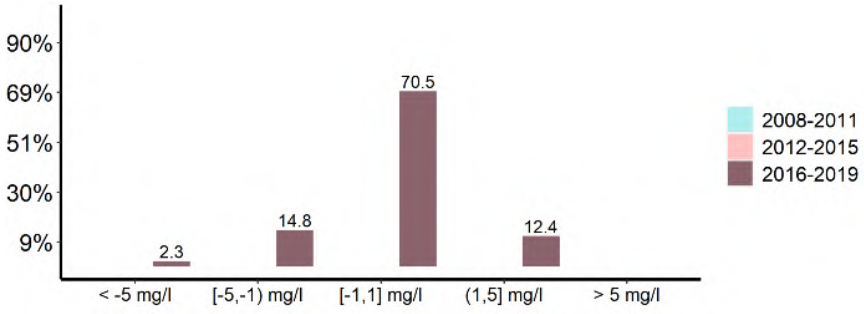


Figure 12. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis).

Surface Water Eutrophication

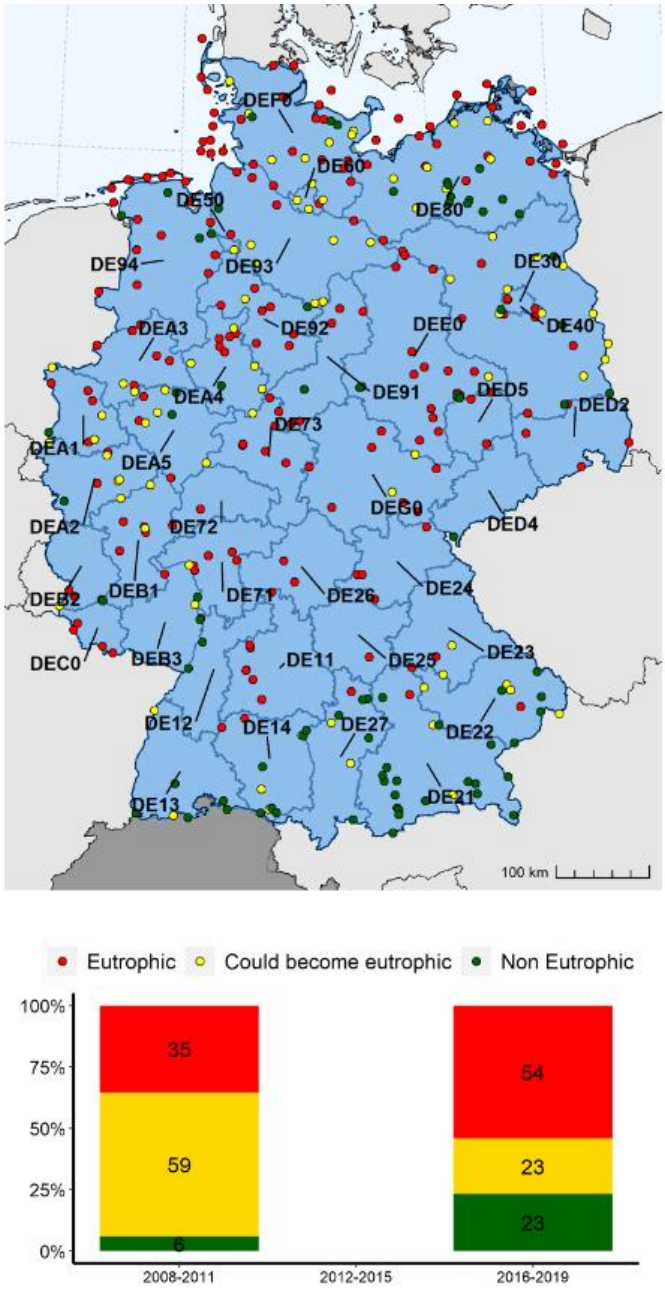


Figure 13. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis).

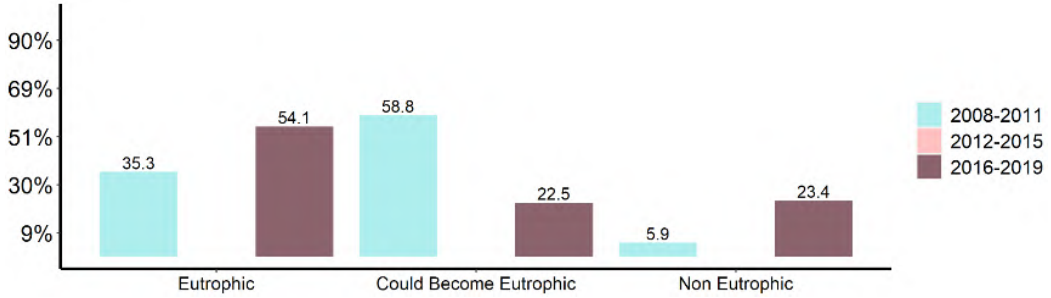
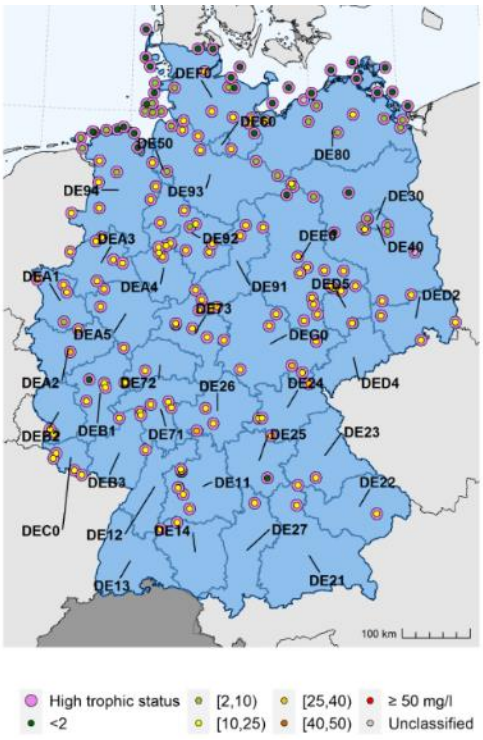


Figure 14. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis)

The Eutrophic status vs average NO3 annual concentration



NUTS ID	NUTS NAME	High trophic status	Number of stations by classes of concentration						
			<2 mg/l	[2,10) mg/l	[10,25) mg/l	[25,40) mg/l	[40,50) mg/l	>=50 mg/l	Unclassified
DE11	Stuttgart	8	0	0	7	1	0	0	0
DE12	Karlsruhe	1	0	0	1	0	0	0	0
DE14	Tübingen	2	0	0	2	0	0	0	0
DE21	Oberbayern	1	0	0	1	0	0	0	0
DE22	Niederbayern	1	0	0	1	0	0	0	0
DE23	Oberpfalz	2	0	0	2	0	0	0	0
DE24	Oberfranken	4	0	0	3	1	0	0	0
DE25	Mittelfranken	1	1	0	0	0	0	0	0
DE26	Unterfranken	3	0	0	3	0	0	0	0
DE27	Schwaben	1	0	0	1	0	0	0	0
DE30	Berlin	6	0	5	1	0	0	0	0
DE40	Brandenburg	5	2	0	2	0	0	0	1
DE71	Darmstadt	4	0	0	4	0	0	0	0
DE72	Gießen	1	0	0	1	0	0	0	0
DE73	Kassel	7	0	1	6	0	0	0	0
DE80	Mecklenburg-Vorpommern	10	0	7	2	0	0	0	1
DE91	Braunschweig	5	0	0	4	1	0	0	0
DE92	Hannover	7	0	1	6	0	0	0	0
DE93	Lüneburg	5	0	2	3	0	0	0	0
DE94	Weser-Ems	6	0	1	5	0	0	0	0
DEA1	Düsseldorf	4	0	1	2	1	0	0	0
DEA2	Köln	2	0	0	1	1	0	0	0
DEA3	Münster	7	0	0	7	0	0	0	0
DEA4	Detmold	5	0	0	5	0	0	0	0
DEA5	Arnsberg	3	0	0	3	0	0	0	0
DEB1	Koblenz	5	1	0	4	0	0	0	0
DEB2	Trier	2	0	0	2	0	0	0	0
DEB3	Rheinhessen-Pfalz	1	0	0	1	0	0	0	0
DEC0	Saarland	4	0	0	4	0	0	0	0
DED2	Dresden	3	0	0	3	0	0	0	0
DED5	Leipzig	4	0	0	4	0	0	0	0
DEE0	Sachsen-Anhalt	14	1	2	11	0	0	0	0
DEF0	Schleswig-Holstein	9	2	1	6	0	0	0	0
DEG0	Thüringen	7	0	0	6	1	0	0	0
NO_NUTS	SALINE	40	25	11	4	0	0	0	0
	Total	**190**	**32**	**32**	**118**	**6**	**0**	**0**	**2**

Figure 15. The SW monitoring stations with eutrophic status versus the average NO3 annual concentration.

The analysis shows all the SW monitoring stations with the higher trophic status and the corresponding value of NO3 concentration. The map shows the spatial distribution of these points, and the table reports the number of stations with measurements with higher trophic status and the corresponding stations by classes of NO3 concentration. Only the NUTS of interest are reported.

In Germany eutrophication of watercourses and lakes is predominantly due to excessively high phosphorus inputs. If the values for good ecological status in accordance with Annex 7 of the German Surface Water Ordinance (OGewV) are exceeded, waters will be at risk of becoming eutrophic or will have already become eutrophic. Germany uses a water type-specific upper phosphorus value, varying from 0.045 to 0.3 mg totP/L for rivers and 0.009 to 0.06 mg totP/L for lakes. The majority of sampling stations for watercourses show a decrease in pollution in terms of total phosphorus concentrations. About 52% of water courses are eutrophic, while the majority of lakes are non-eutrophic (54%).

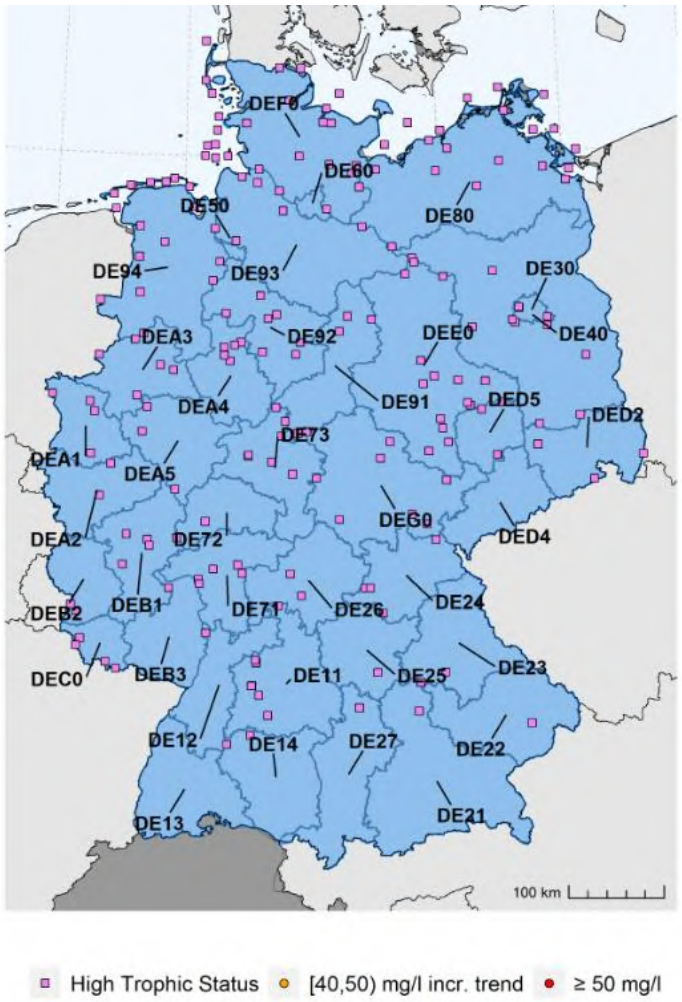
Concerning transitional and coastal waters of the North Sea, national thresholds have been calculated for the eutrophication assessment, in accordance with the OSPAR Common Procedure, for coastal and marine water. According to the assessment of the eutrophication based on the MSFD, only 6% of Germany's North Sea waters achieve good status with regard to eutrophication, 55% continue to be eutrophic and there is no conclusive assessment for 39%. The nutrient inputs via rivers, the atmosphere and other marine areas continue to be too high.

100% of Germany's Baltic Sea waters continue to be eutrophic. Nutrient inputs via rivers, the atmosphere and other marine areas are too high.
Nutrient concentrations in the estuaries of most rivers exceed the management targets for total nitrogen and total phosphorus, and eutrophication is one the biggest ecologic problems for the marine environment of Germany's Baltic and North Sea waters, and the nutrient reduction targets set out in the Action Plans have not yet been met. According to the reported data (excluding data with no reported status) all transitional coastal and marine stations are eutrophic.

Table 5. Summary of SW stations by classes of trophic status and type.

		Number of stations with Trophic status		
Station Type	Description	Eutrophic	Could become eutrophic	Non Eutrophic
4	River water	129	71	49
5	Lake/reservoir water	21	8	33
6	Transitional water	5	0	0
7	Coastal water	33	0	0
8	Marine water	2	0	0
9	Not specified	0	0	0
	Total	**190**	**79**	**82**

Surface Water quality hotspot



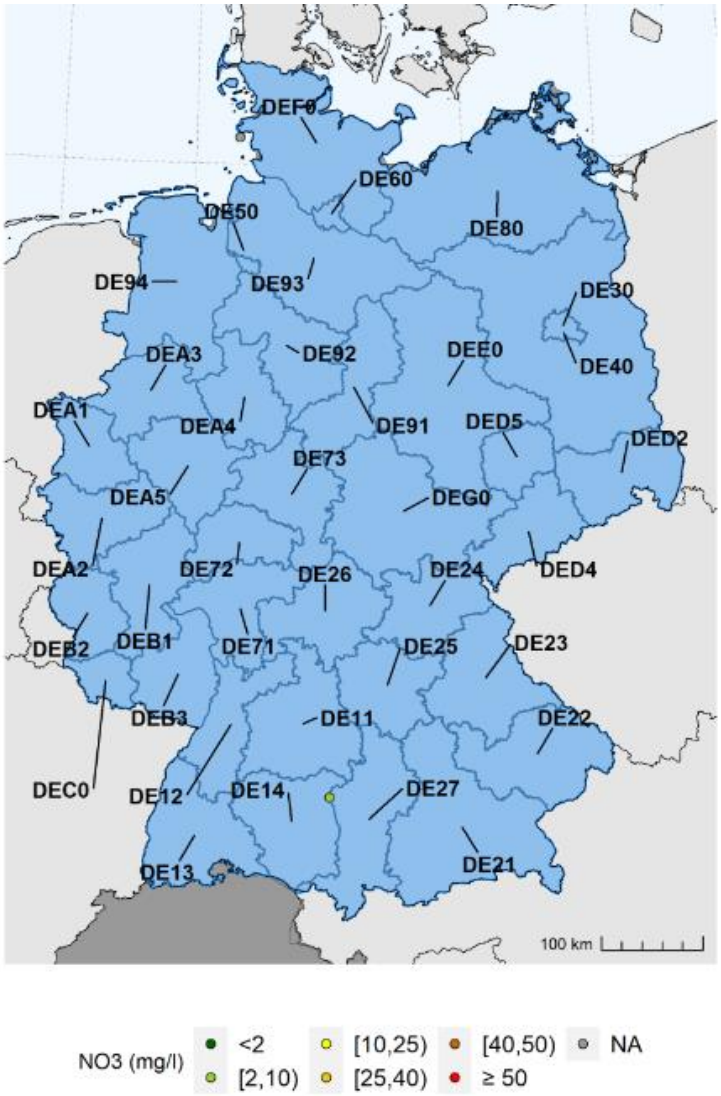
NUTS ID	NUTS NAME	High trophic status	>=40 and < 50 mg/l incr.trend	>=50 mg/l
DE11	Stuttgart	8	0	0
DE12	Karlsruhe	1	0	0
DE14	Tübingen	2	0	0
DE21	Oberbayern	1	0	0
DE22	Niederbayern	1	0	0
DE23	Oberpfalz	2	0	0
DE24	Oberfranken	4	0	0
DE25	Mittelfranken	1	0	0
DE26	Unterfranken	3	0	0
DE27	Schwaben	1	0	0
DE30	Berlin	6	0	0
DE40	Brandenburg	5	0	0
DE71	Darmstadt	4	0	0
DE72	Gießen	1	0	0
DE73	Kassel	7	0	0
DE80	Mecklenburg-Vorpommern	10	0	0
DE91	Braunschweig	5	0	0
DE92	Hannover	7	0	0
DE93	Lüneburg	5	0	0
DE94	Weser-Ems	6	0	0
DEA1	Düsseldorf	4	0	0
DEA2	Köln	2	0	0
DEA3	Münster	7	0	0
DEA4	Detmold	5	0	0
DEA5	Arnsberg	3	0	0
DEB1	Koblenz	5	0	0
DEB2	Trier	2	0	0
DEB3	Rheinhessen-Pfalz	1	0	0
DEC0	Saarland	4	0	0
DED2	Dresden	3	0	0
DED5	Leipzig	4	0	0
DEE0	Sachsen-Anhalt	14	0	0
DEF0	Schleswig-Holstein	9	0	0
DEG0	Thüringen	7	0	0
NO_NUTS	SALINE	40	0	0
	Total	**190**	**0**	**0**

High Trophic Status [40,50) mg/l incr. trend ≥ 50 mg/l

Figure 16. SW hotspot analysis map (top graph) and distribution by NUTS2 (right graph) of average NO3 annual concentration greater than 40 mg/l and trophic status.

The hotspot analysis identifies all the SW monitoring stations that have high trophic status, NO3 concentration in the range of 40-50 mg/l with increasing trends or are above 50 mg/l. The map shows the spatial distribution of these points, and the table reports the number of stations by NUTS inside and outside NVZ.
Only the NUTS of interest are reported.

Surface Water Stations Removed



Station Type	Description	Number of removed stations			
		total removed	with measurements	with trends	with trophic status
4	River water	1	1	0	0
5	Lake/reservoir water	0	0	0	0
6	Transitional water	0	0	0	0
7	Coastal water	1	0	0	0
8	Marine water	0	0	0	0
9	Not specified	0	0	0	0
	Total	**2**	**1**	**0**	**0**

Figure 17. SW removed stations map (top graph) and distribution by surface water type (lower graph)

The removed stations analysis identifies all the SW monitoring stations that were removed in the current reporting period. The map shows the spatial distribution of these points with the concentrations of the previous reporting period, and the table reports the number of stations with measurements and trends per type.

Measures in the Action Programme

In Germany the rules of good agricultural practice for fertiliser use and the measures under the Action Programme are regulated at national level in the federal ordinance on the use of fertilizers (DüV) and the ordinance on facilities handling substances hazardous to water (AwSV). The AwSV came into force on 1 August 2017, and replaces the federal state ordinances on the storage of liquid manure, slurry, farmyard manure, and silage effluent. The DüV was amended in 2017. After that, the European Court of Justice found that the Federal Republic of Germany had failed to meet its obligations arising under the Directive, the DüV was further amended in May 2020. In areas that are highly polluted with nitrates, the federal states are required, as from 2021, to implement seven compulsory measures to improve water status including: reducing the N fertilizer requirement by a farm average of 20%; upper limit of 170 kg N per hectare from organic fertilizers; extension of the restricted period on grassland by four weeks; extension of the restricted period for solid dung and compost by six weeks; prohibition of nitrogenous fertilizer use in the autumn for winter rape, winter barley and catch crops not used as a feed crop; limit to 60 kg/ha of liquid organic fertilizers applied to grassland in the autumn; mandatory intercropping prior to summering. See some details in the table below.

Table 6. Details of the Action Programme

Measure	General details in Action Programme (*)
Period of prohibition of fertiliser application	• Different dates considering fertilizers with substantial nitrogen or phospahte content, and differentiating cropland and grassland (sections 6.8 - of the Ordinance)
Restrictions for application on sloped soils	• Several rules as combination of degree of slope, distance to watercourses and for cultivated and uncultivated areas (section 5.3 of the ordinance)
Restrictions for application on soaked, frozen, or snow-covered soils	• Not allowed in these situations (section 5.1 of the Ordinance)
Restrictions for application near watercourses (buffer strips)	• Minimum distance of 4 metres, or 1 metre if a precision fertiliser spreader is used (other details in sections 5.2 and 5.3 of the Ordinance)
Effluent storage works	• Not available
Capacity of manure storage	• The capacity of tanks must be sufficient for at least six months and other rules based on LSU (section 12 of the Ordinance)
	• Specific rules by federal states
Rational fertilisation (e.g., splitting fertilisation, limitations)	• Specific permitted fertilizers quantities (section 13a of the Ordinance)
Crop rotation, permanent crop enhancement	• Additional regulations by federal states for crop rotation
Vegetation cover in rainy periods, winter	• The amount of available nitrogen applied in the autumn must be fully taken into for the determination of the fertiliser requirement in the spring (other details in section 6.9 of the Ordinance)
Fertilisation plans, spreading records	• Fertiliser-spreading methods and equipment (sections 6.2 and 6.3 of the Ordinance) and specific soil analysis by federal states
Other measures	• Regulation in polluted areas: from 2021, stipulation of 7 compulsory measures and 2 freely selectable measures (section 13.2 of the Ordinance)
	• The federal states have also introduced additional regulations which farmers apply on a voluntary basis or with which compliance is mandatory
Date for application limit of 170 kg N/ha/year:	• 2020 (allow "derogation" is specific cases)

(*) Fertiliser ordinance, amendment 2020 (Düngeverordnung - DüV)

Verordnung über die Anwendung von Düngemitteln, Bodenhilfsstoffen, Kultursubstraten und Pflanzenhilfsmitteln nach den Grundsätzen der guten fachlichen Praxis beim Düngen (Düngeverordnung - DüV)

The federal states have also introduced additional regulations which farmers apply on a voluntary basis (for example, in the context of supporting agri-environmental and climate measures) or with which compliance is mandatory (for example, owing to regulations applying to water protection areas). They specified different measures and control actions by federal states as reported in detailed tables in the report (section “C) Application of the action programmes”)

Since the new Fertiliser Ordinance was amended in 2017 and 2020, no validated data are yet available for the current reporting period 2015 to 2018 (that is different from the official requested: 2016-2019) on the cost-benefit analysis but they reported the following studies: Osterburg et al. (2007), Bach et al. (2016), and Oelmann et al. (2017).

Controls

Administrative controls on the implementation of the Action Programme (AP) measures are carried out in the frame of the cross-compliance check. About 10749 control checks were performed between 2016 and 2018. Around 2089 cases of non-compliance with GAEC1 (nitrates) were detected, 1825 cases resulting in penalties. About 67 cases were subject to penalties concerning the non-compliance with the nitrogen balance.

Designation of NVZ

Germany has adopted a whole territory approach.

Forecast of Water Quality

There was no information given in the German report concerning the forecast of water quality. For the future forecast of both nitrogen and phosphorus will be done through the combined used of several models.

Summary

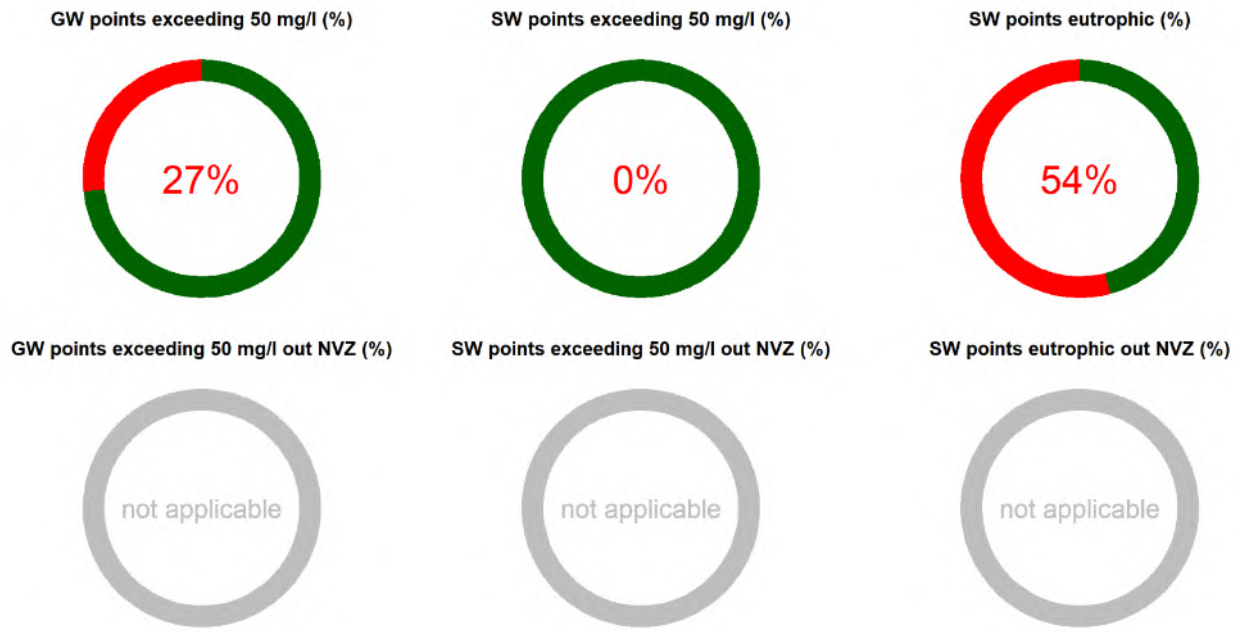


Figure 18. The summary plot for the period 2016-2019

This plot provides in the first row the percentage of stations exceeding 50 mg/l with respect to the total stations with measures and the percentage of eutrophic SW stations with respect to the total for which the trophic status is reported. In the second row, the percentage of stations exceeding 50 mg/l that are outside NVZ with respect to the total of stations exceeding 50 mg/, and the percentage of SW eutrophic stations that are outside NVZ with respect to the total that are eutrophic.

Long term analysis

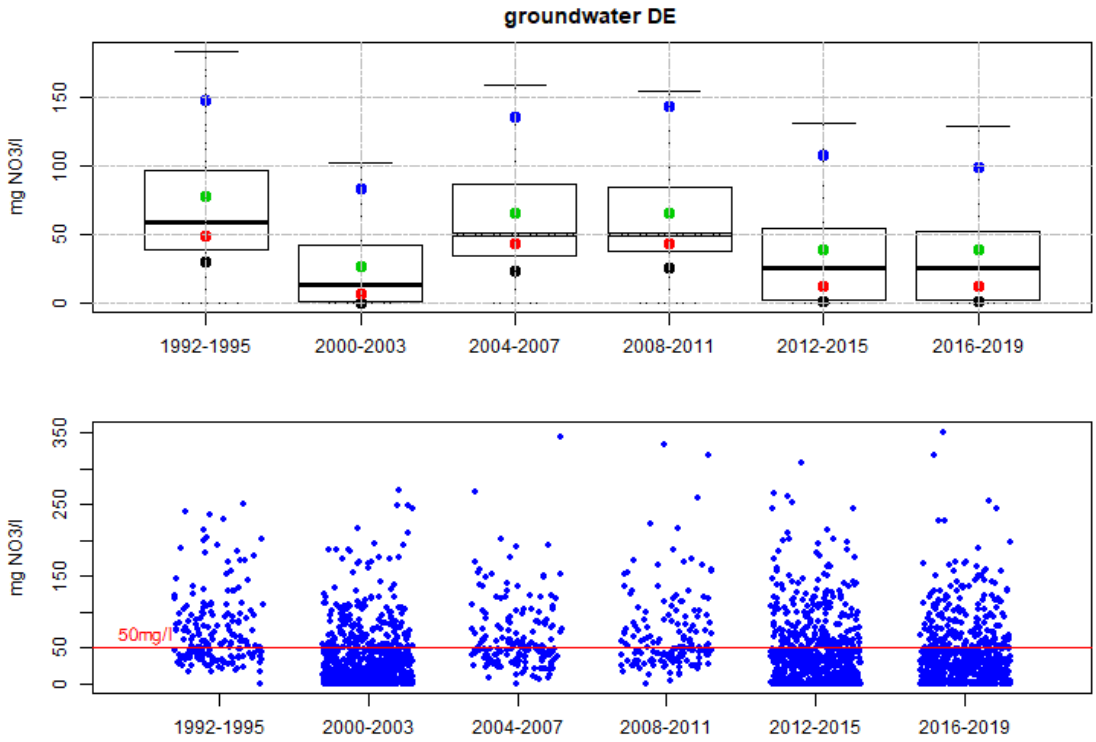


Figure 19. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period, for groundwater stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

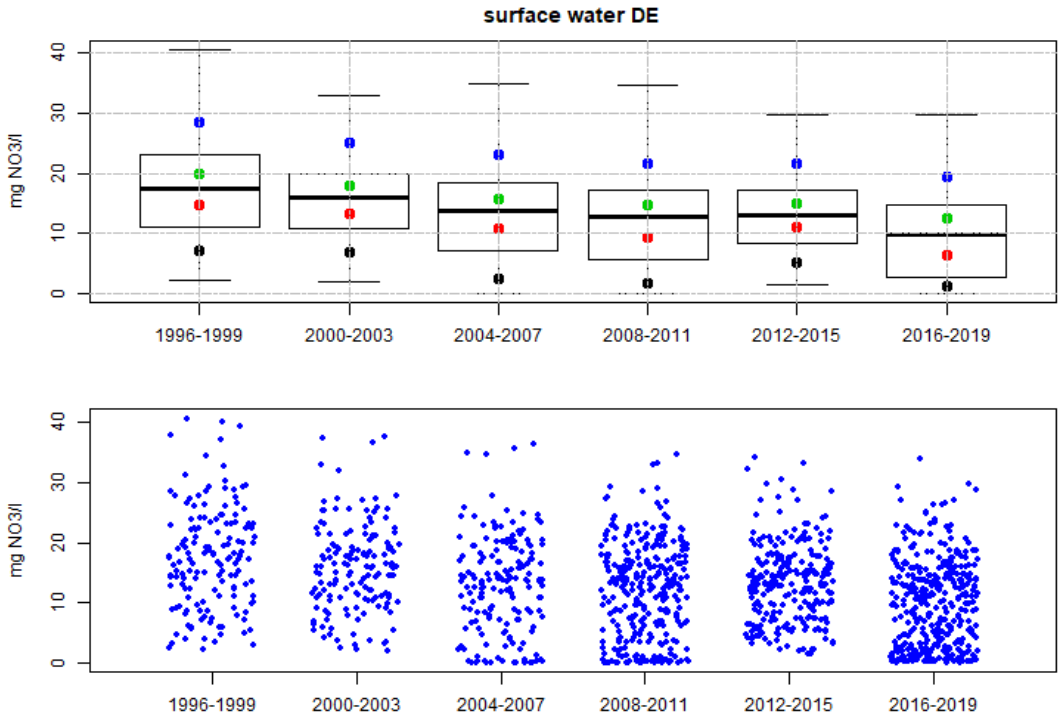


Figure 20. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period, for surface water stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

Conclusions and recommendations

Germany has an average livestock density, the surplus of nitrogen is around the EU average, while there is a deficit for phosphorus.

The number of monitoring stations used for the nitrate report is low and the dataset does not include year 2019. Germany has a high number of groundwater monitoring stations with nitrate concentrations above 50 mg/l and a high number of monitoring stations have a strong increasing trend. A very high number of the surface waters are found to be eutrophic.

Germany revised it action programme in 2018.

The Commission recommends Germany to take reinforced measures to reduce the pollution of groundwater and in areas that drain into waters that are eutrophic. Germany must identify the polluted areas in accordance with the criteria that are set in the Nitrates Directive. It also recommends extending the monitoring data to include the four years of the reporting period.