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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

Czech Republic's utilised agricultural area amounts to 3.5 Mha, representing 45% of the total land area and has decreased by 3% since 2007. The major outputs of the agricultural industry include in a decreasing order: cereals (22.3%), milk (19.7%), and industrial crops (14.8%).

Eurostat

Major land use statistics for Czech Republic

Table 1.Utilized agricultural area (abbreviated as UAA)

Czech Republic	2005	2007	2010	2013	2016
Utilised agricultural area UAA (1000 ha)	NA	3597	3524	3521	3489
arable land (1000 ha)	NA	2624	2547	2505	2497
permanent grass (1000 ha)	NA	932	936	974	949
permanent crops (1000 ha)	NA	38	40	41	42
kitchen gardens (1000 ha)	NA	2	1	1	1

Note:

Eurostat (FSS)

Arable land decreased by 5% from 2007. The area dedicated to permanent crops, permanent grass, and kitchen gardens remain stable since 2010.

Animal distribution in Czech Republic

The number of live pigs has decreased while the number of other animals is stable since 2010. The livestock density index is around 0.5. It is lower than the EU average of 0.8.

Table 2. Livestock statistics

Czech Republic	2005	2007	2010	2013	2016
Livestock index	0.58	0.58	0.49	0.50	0.51
dairy cows (10^6 heads)	0.44	0.41	0.38	0.38	0.37
live bovines (10^6 heads)	1.35	1.37	1.32	1.33	1.34
live pigs (10^6 heads)	2.72	2.66	1.85	1.55	1.48
live poultry (10^6 heads)	NA	NA	25.32	25.34	25.10

Note:

Eurostat (FSS)

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

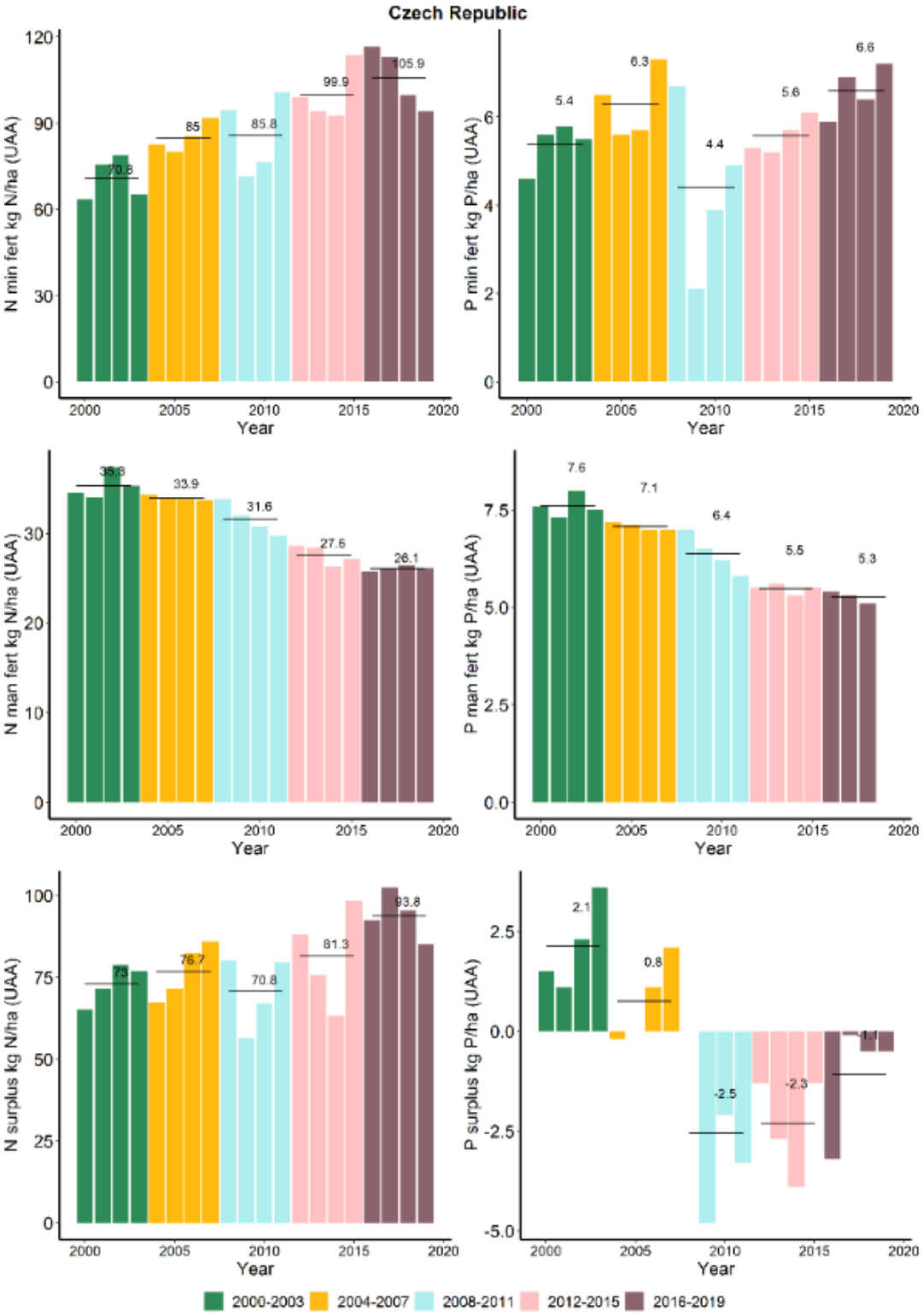


Figure 1. N and P fertilizers and gross surplus (kg/ha)

The gross nitrogen and phosphorus surpluses originate from EUROSTAT data for the years 2000-2017. Data for years 2018-2019 are supplementary data provided by the Czech Republic, which have been included in the figure because of correspondence,

for the previous years, with Eurostat statistics. The use of N and P inorganic nitrogen and phosphorus fertilizers have increased for the last three reporting periods covering the years 2000-2015. The usage of manure has decreased since the first reporting period. The nitrogen surplus increased for the 2012-2015 reporting period by 15% in average. The phosphorus deficit decreased to around -1 kg/ha in 2016-2019. In the plots: N/P min and N/P man are respectively the N/P mineral fertilizers and N/P manure.

Livestock unit - LSU /ha

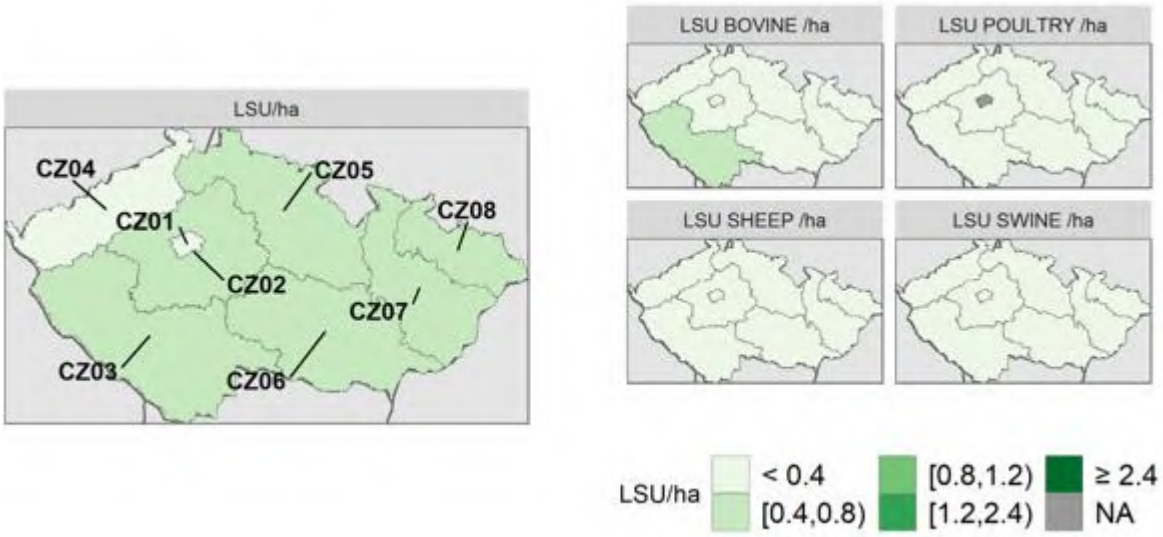


Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production is mostly dominated by bovine in particular in the southern part (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

Surface water is monitored through the network of the Povodí state-owned enterprises (formerly the Agricultural Water Management Administration – ZVHS). The network has been in operation since 1993. In addition, groundwater and surface water are also monitored through the framework monitoring programme operated by the Czech Hydrometeorological Institute (ČHMÚ). The monitoring network for groundwater quality was gradually rebuilt between 2005 and 2009 and has been in full operation since 2010. It is the same network used for reporting under the WFD, and measurements are usually performed twice a year: in the spring and in the autumn. Surface water monitoring is based on a network of main and auxiliary profiles. The main profiles monitor major water courses and sampling is performed regularly once a month. These points are representative for the monitoring of water bodies according to the EU Water Framework Directive with emphasis on water bodies with a greater proportion of agricultural land. Auxiliary profiles include major side streams of water bodies, parts of river basins in vulnerable zones, and small isolated vulnerable zones. They are monitored regularly once every four years; emphasis is placed on areas with predominant agricultural activities.

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	201	201	224	138	200	224
1a	Phreatic groundwater (deep) 5-15 m	214	201	206	109	195	206
1b	Phreatic groundwater (deep) 15-30 m	68	35	36	37	30	36
1c	Phreatic groundwater (deep) >30 m	100	32	33	31	31	33
2	Captive groundwater	28	152	149	8	151	149
3	Karstic groundwater	0	0	9	0	0	9
9	Not specified	0	0	0	0	0	0
	Total	**611**	**621**	**657**	**323**	**607**	**657**

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	571	1917	2086	554	502	1796	571	748	683
5	Lake/reservoir water	0	0	0	0	0	0	0	0	0
6	Transitional water	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Coastal water	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Marine water	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Not specified	0	0	0	0	0	0	0	0	0
	Total	**571**	**1917**	**2086**	**554**	**502**	**1796**	**571**	**748**	**683**

Groundwater Quality

Groundwater average annual nitrate concentration

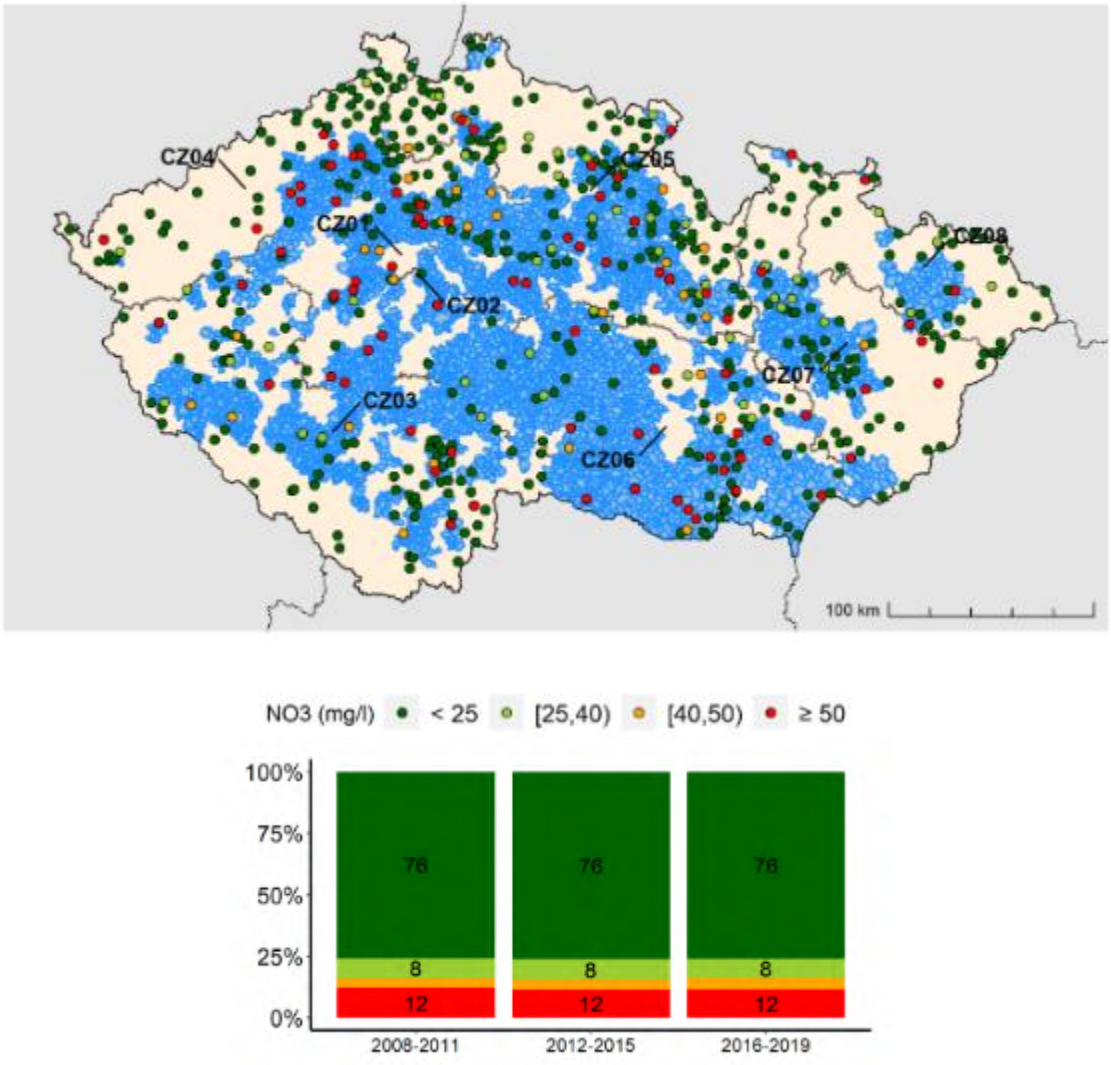


Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

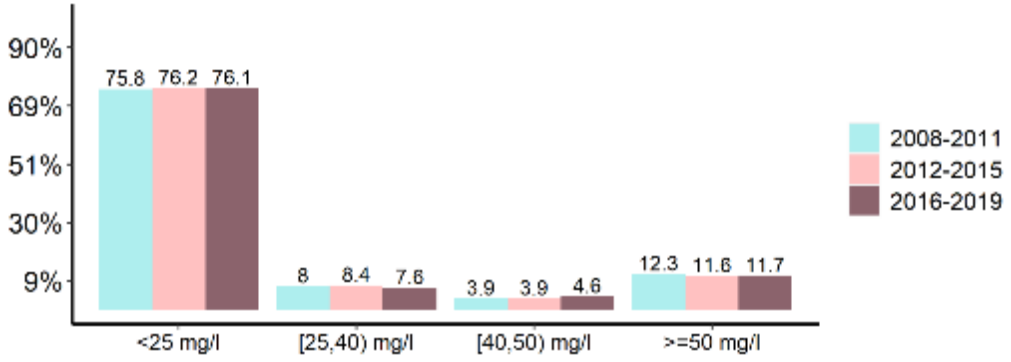
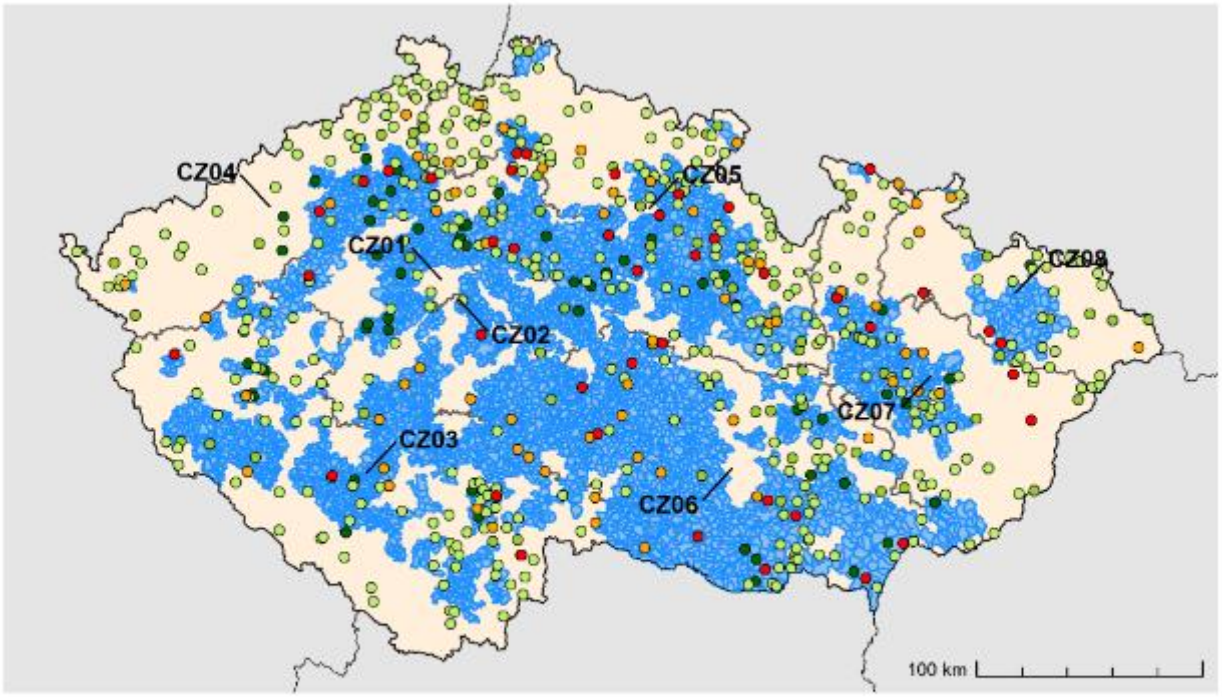


Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Groundwater average annual nitrate concentration trend



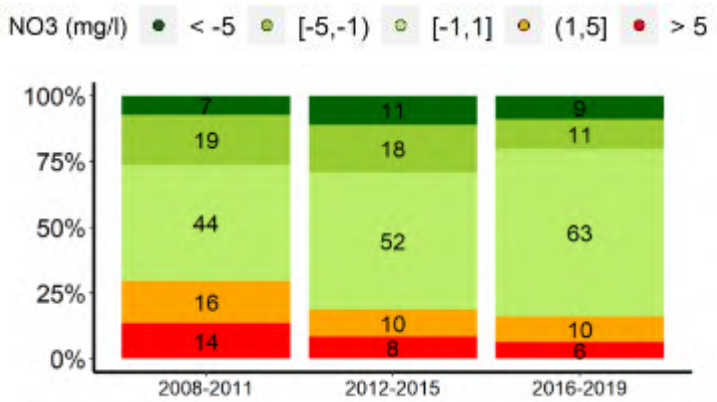


Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). In the map in blue the NVZ.

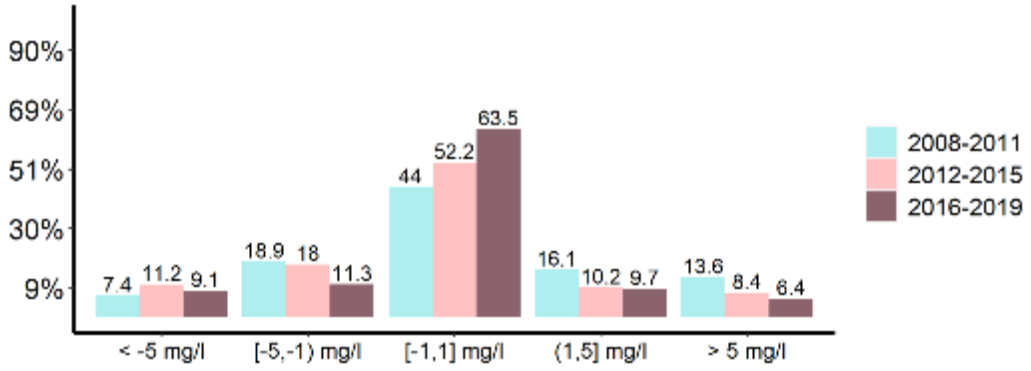
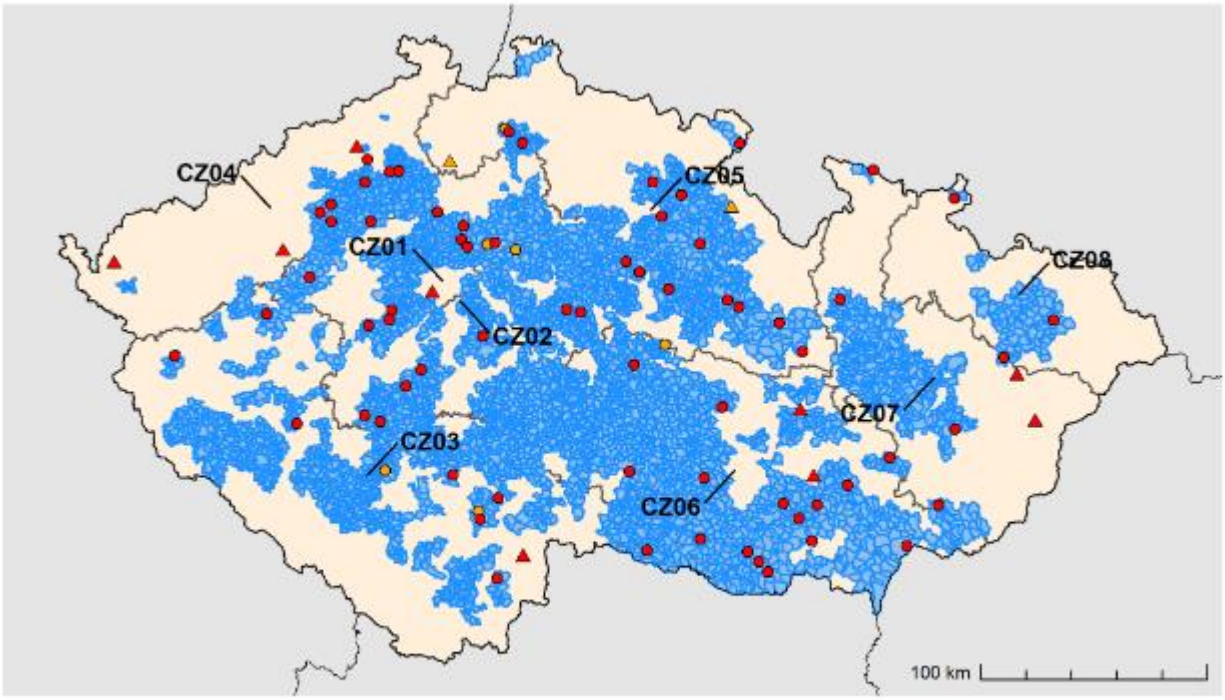


Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Groundwater hotspot

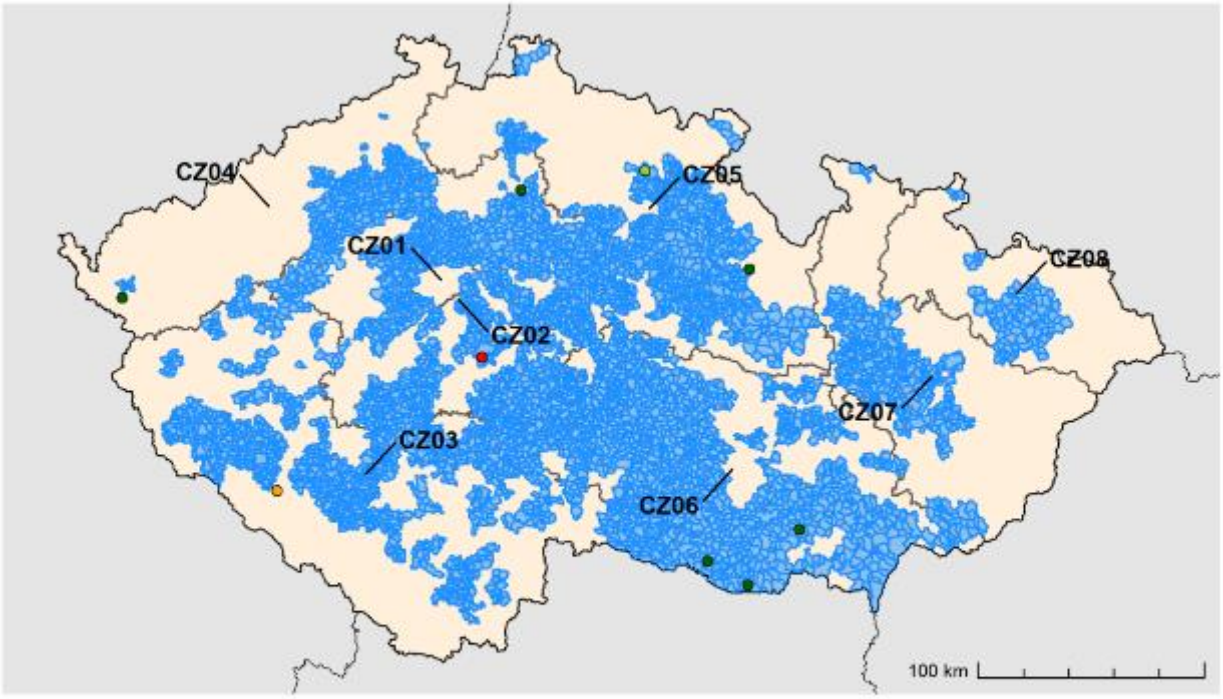


		>=40 and < 50 mg/l incr.trend		>=50 mg/l	
NUTS ID	NUTS NAME	InNVZ	OutNVZ	InNVZ	OutNVZ
CZ01	Praha	0	0	0	1
CZ02	Stredni Cechy	2	0	16	0
CZ03	Jihozápad	2	0	8	1
CZ04	Severozápad	0	0	7	3
CZ05	Severovýchod	1	2	14	0
CZ06	Jihovýchod	1	0	16	2
CZ07	Stredni Morava	0	0	4	2
CZ08	Moravskoslezsko	0	0	3	0
	Total	**6**	**2**	**68**	**9**

Figure 7. GW hotspot analysis map (top graph) and distribution by NUTS2 (lower graph) of average NO3 annual concentration greater than 40 mg/l. In the map in blue the NVZ.

The hotspot analysis identifies all the GW monitoring stations that have NO3 concentration in the range of 40-50 mg/l with increasing trends and 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	3	3	3
1a	Phreatic groundwater (deep) 5-15 m	2	2	2
1b	Phreatic groundwater (deep) 15-30 m	0	0	0
1c	Phreatic groundwater (deep) >30 m	1	1	1
2	Captive groundwater	3	3	3
3	Karstic groundwater	0	0	0
9	Not specified	0	0	0
	Total	**9**	**9**	**9**

Figure 8. GW removed stations map (top graph) and distribution by groundwater type (lower graph). In the map in blue the NVZ.

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

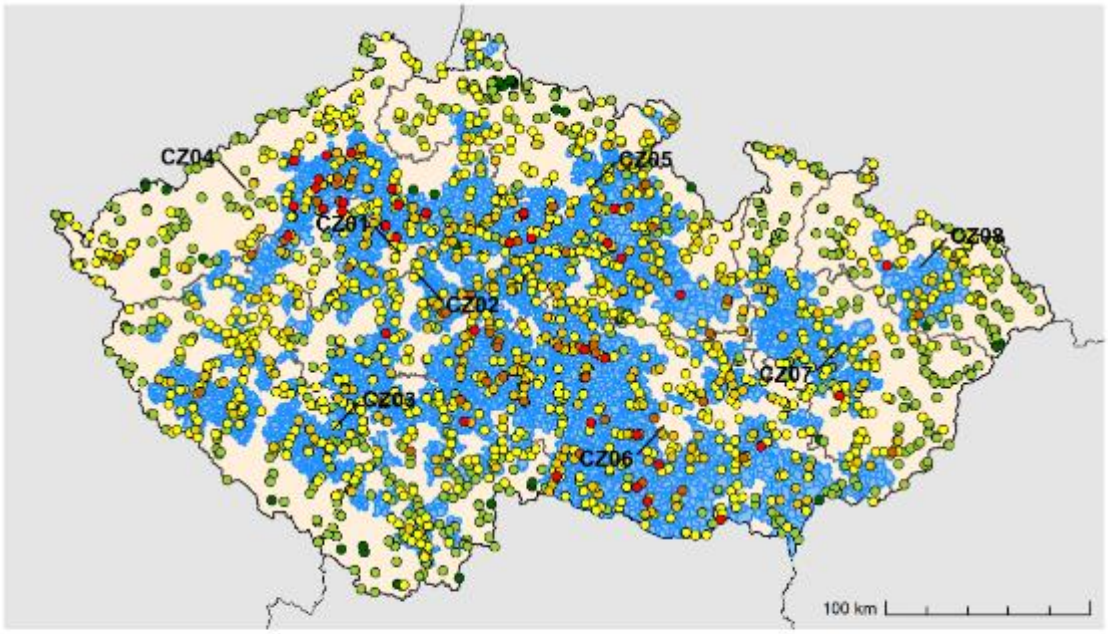


Figure 9. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

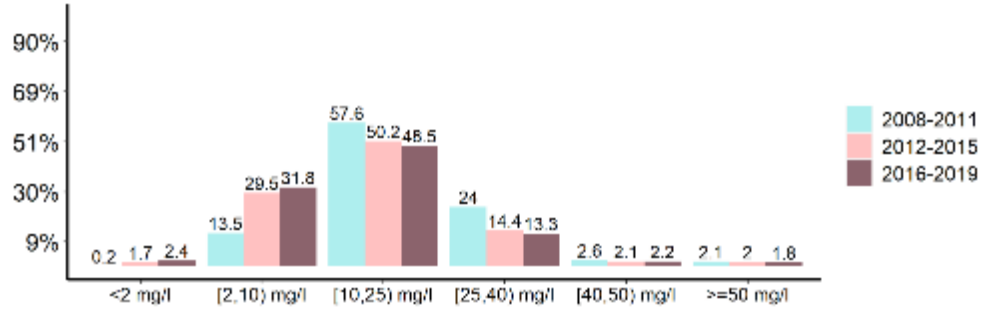
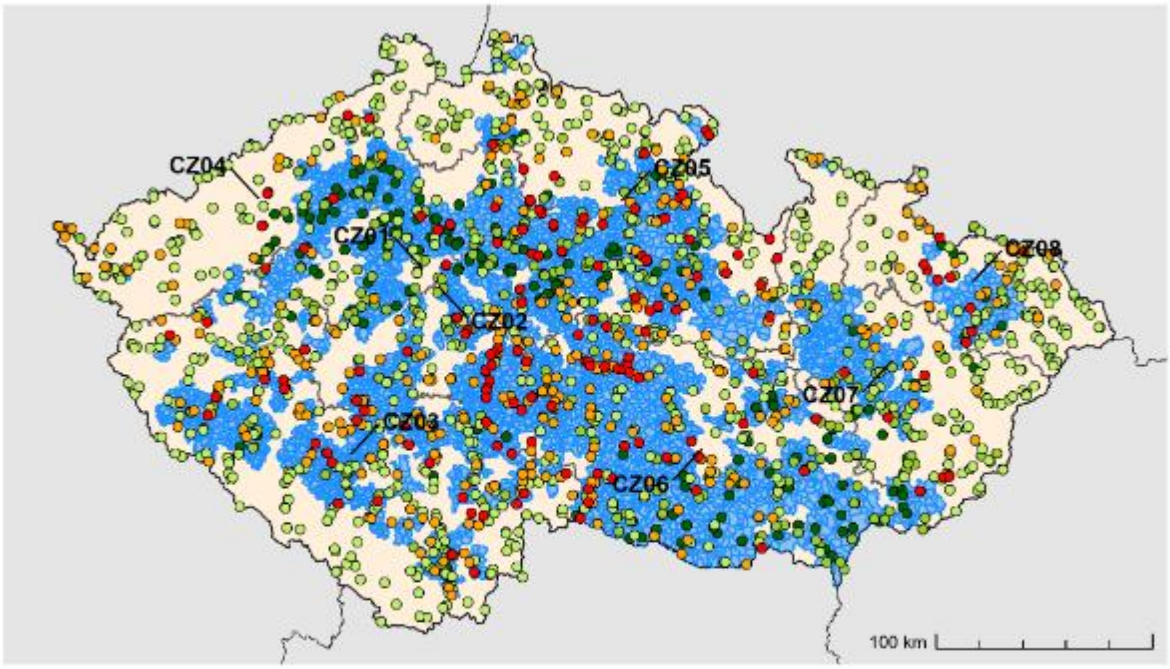


Figure 10. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Surface water average annual nitrate concentration trend



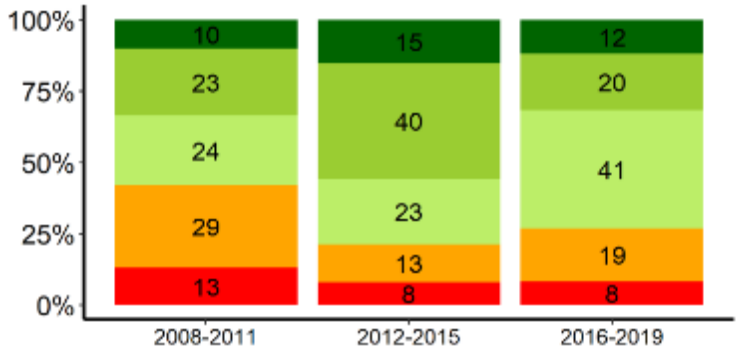


Figure 11. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). In the map in blue the NVZ.

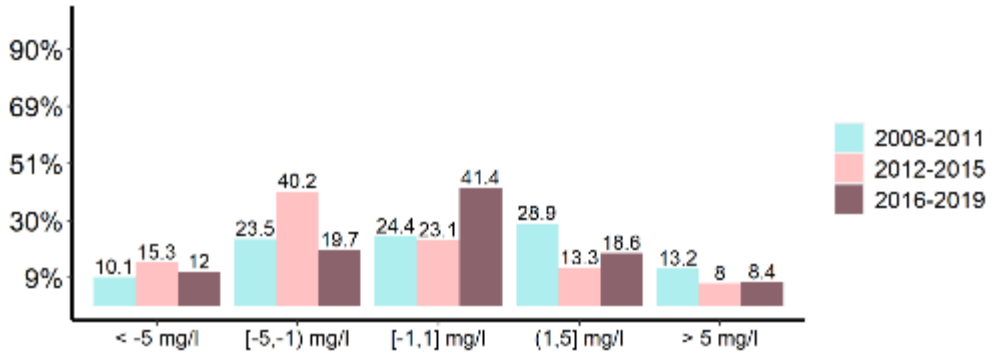


Figure 12. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Surface Water Eutrophication

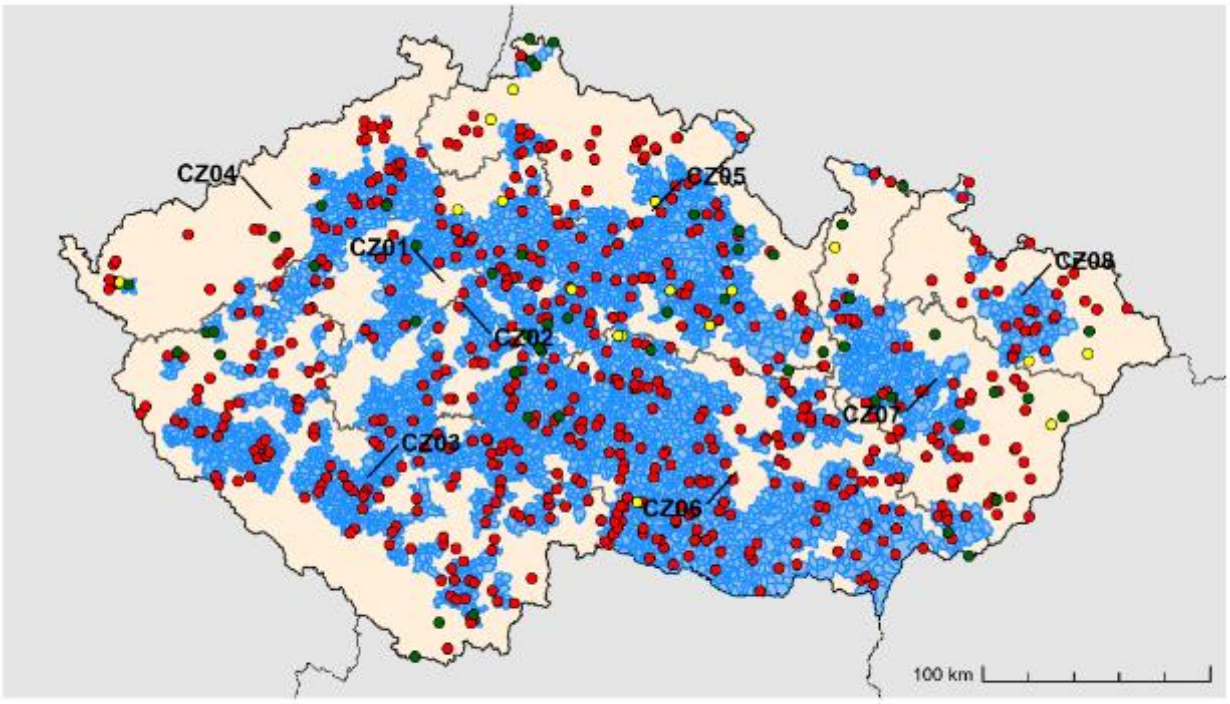


Figure 13. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

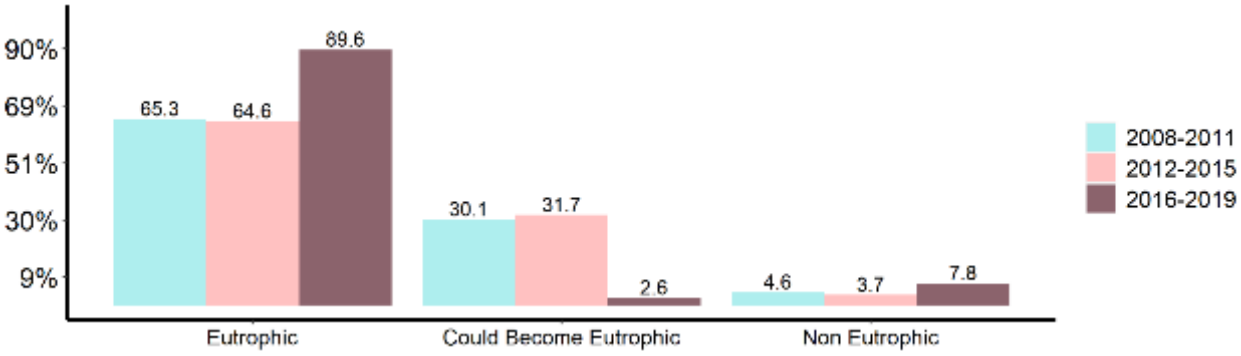
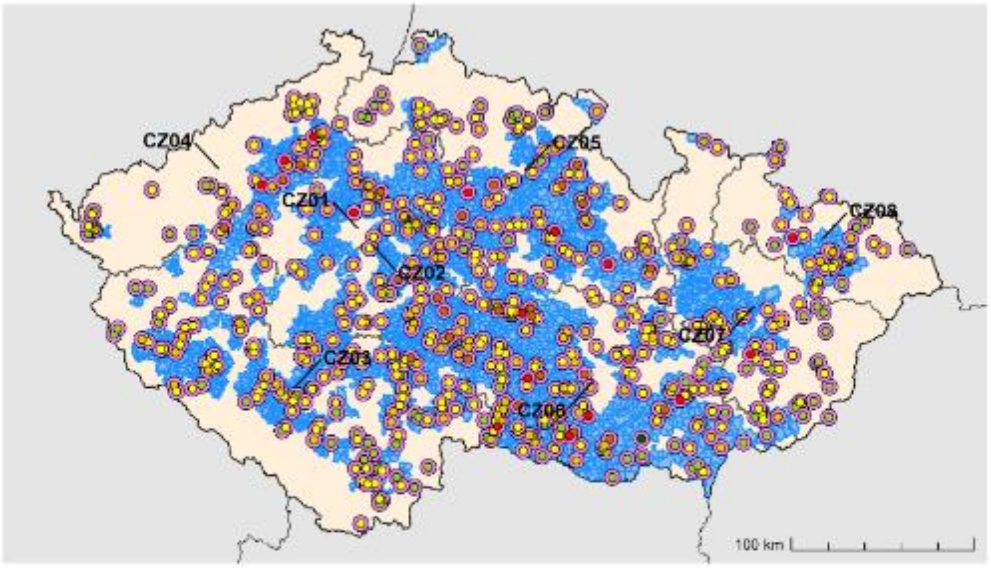


Figure 14. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis)

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
CZ01	Praha	2	0	0	1	0	0	1	0
CZ02	Stredni Cechy	95	1	5	58	24	6	1	0
CZ03	Jihozápad	141	0	30	84	25	1	1	0
CZ04	Severozápad	44	0	6	23	10	2	3	0
CZ05	Severovýchod	80	0	15	43	15	5	2	0
CZ06	Jihovýchod	158	1	25	80	35	12	5	0
CZ07	Stredni Morava	62	0	20	33	8	0	1	0
CZ08	Moravskoslezsko	30	0	7	18	4	0	1	0
	Total	**612**	**2**	**108**	**340**	**121**	**26**	**15**	**0**

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

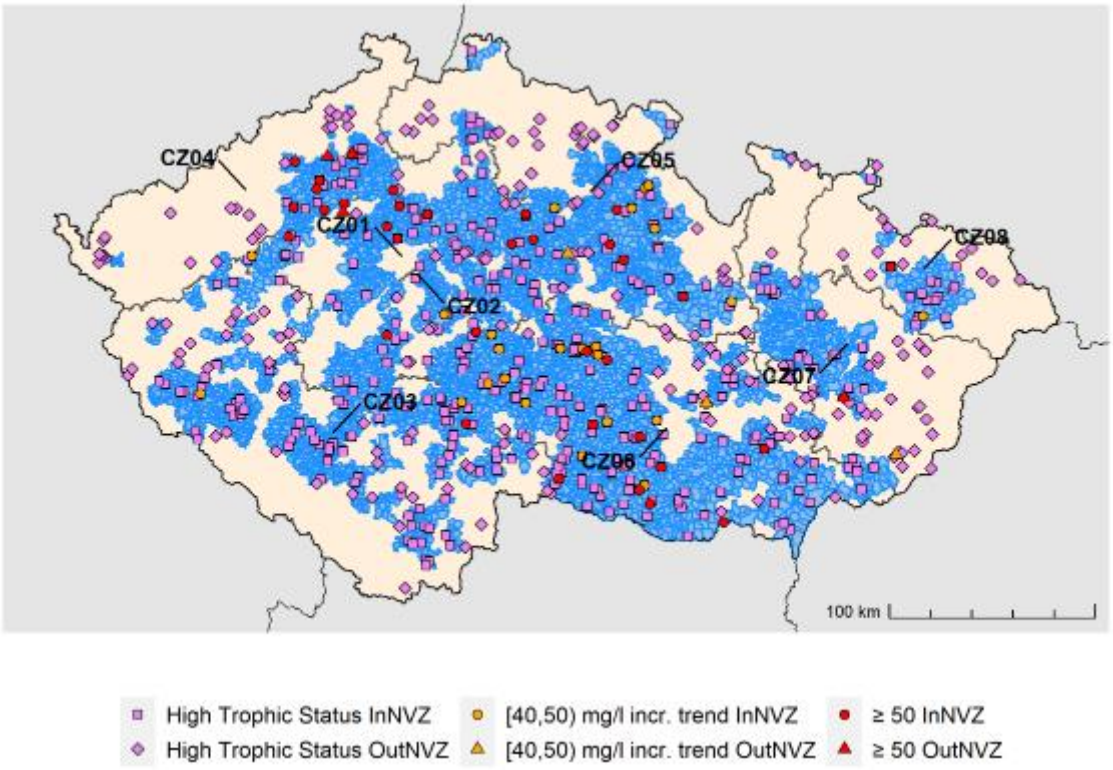
The analysis shows all the SW monitoring stations with the higher trophic status and the corresponding value of NO3 concentration. The map shows the spatial distribution of these points, and the table reports the number of stations with measurements with higher trophic status and the corresponding stations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

The same profiles were used for eutrophication assessment as those used to assess nitrate concentrations in minor and medium water courses in agricultural areas. For the purposes of designating vulnerable zones, the trophic state of water was assessed according to the concentrations of total phosphorus in terms of the type-specific conditions of each water course in which the assessment profile was located. The boundary between good and moderate ecological status constituted the eutrophication level threshold for designating vulnerable zones due to eutrophication in 2019. Water bodies with total phosphorus concentration above 0.1 mg/l are eutrophic or hypertrophic (total P concentration above 0.2 mg/l).

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	612	18	53
5	Lake/reservoir water	0	0	0
6	Transitional water	NA	NA	NA
7	Coastal water	NA	NA	NA
8	Marine water	NA	NA	NA
9	Not specified	0	0	0
	Total	**612**	**18**	**53**

Surface Water quality hotspot

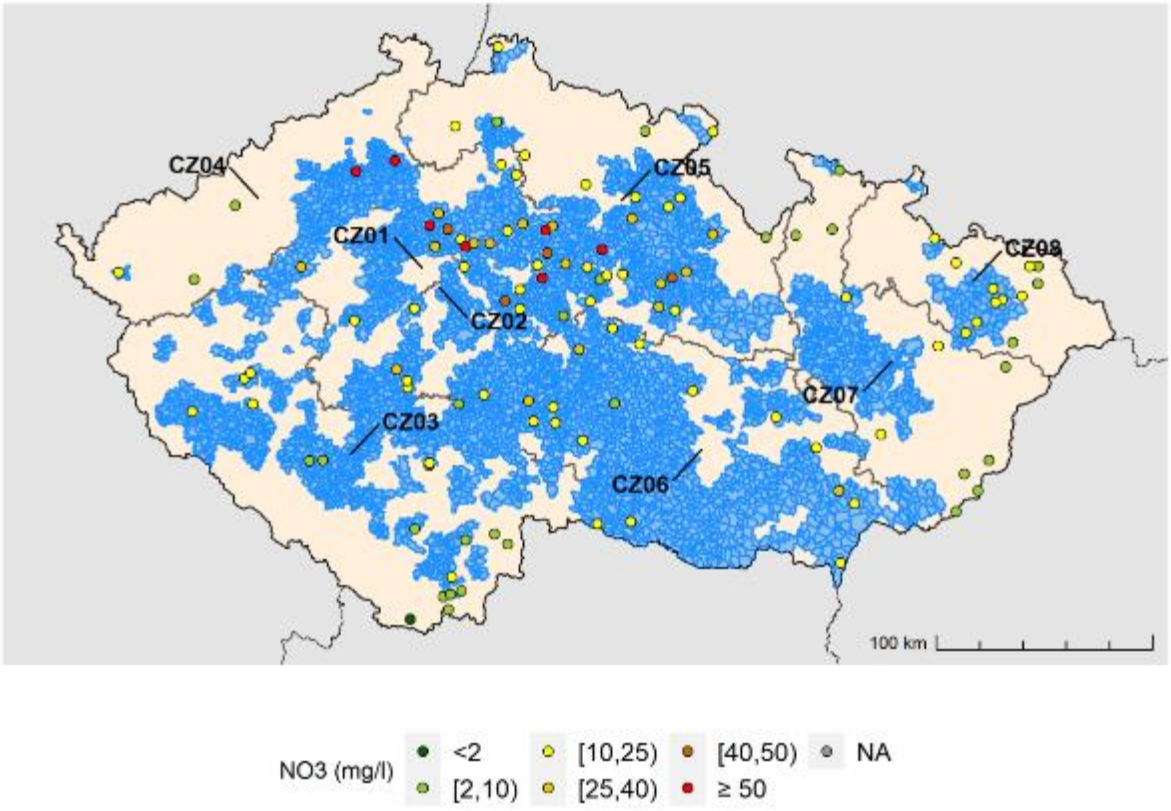


		High trophic status		>=40 and < 50 mg/l incr.trend		>=50 mg/l	
NUTS ID	NUTS NAME	InNVZ	OutNVZ	InNVZ	OutNVZ	InNVZ	OutNVZ
CZ01	Praha	2	0	0	0	1	0
CZ02	Stredni Cechy	74	21	4	0	12	1
CZ03	Jihozápad	95	46	2	0	2	0
CZ04	Severozápad	17	27	0	0	5	2
CZ05	Severovýchod	43	37	6	1	4	0
CZ06	Jihovýchod	131	27	11	1	9	0
CZ07	Stredni Morava	28	34	0	1	0	1
CZ08	Moravskoslezsko	16	14	1	0	1	0
	Total	**406**	**206**	**24**	**3**	**34**	**4**

Figure 16. SW hotspot analysis map (top graph) and distribution by NUTS2 (lower graph) of average NO3 annual concentration greater than 40 mg/l. In the map in blue the NVZ.

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 and 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	121	121	38	56
5	Lake/reservoir water	0	0	0	0
6	Transitional water	0	0	0	0
7	Coastal water	0	0	0	0
8	Marine water	0	0	0	0
9	Not specified	0	0	0	0
	Total	**121**	**121**	**38**	**56**

Figure 17. SW removed stations map (top graph) and distribution by surface water type (lower graph). In the map in blue the NVZ.

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

The first Code of Good Agricultural Practice (CAGP) was drawn up in 2003 and was revised five times, the last in 2016. The new elements of the last revision concern: period of prohibition of application, proximity of watercourses, effluent storage works, and fertilization plans and spreading records. It was also estimated that 60% of farmers voluntarily comply with the code outside vulnerable zones.

The Action Programme (AP) was published for the first time on 30/01/2014 and was revised on 01/08/2016 (fourth Action Programme). However, the technical revision was published with the Government Regulation No 27/2018 on 1 March 2018.

Only one action programme has been published in the Czech Republic and applies to all the designated vulnerable zones, albeit several variants of measures are applied taking into account the soil and climatic conditions of each agricultural parcel. The new measures introduced concern: periods of prohibition of fertilizer application that is different depending on climate region, type of crops, slope, and if a fertilizer has a rapid or slow release of nitrogen; capacity of manure storage, and requirement regarding construction and tightness; rational fertilization, including input/output balance, suitable crop rotation of crops and soil analysis; soil analysis; limitation of total fertilization by type of crops taking into account weather, state of the soils and slope; update of rules on fertilization on slopes; provisions on application of fertilizers near watercourses. All the other measures were not changed with respect to the previous reporting period. The main measures are summarized in the following table.

No cost-effectiveness studies were carried out in this reporting period

Table 6. Details of the Action Programme

Measure	General details in Action Programme (*)
Period of prohibition of fertiliser application	• Periods of prohibition depending of climate region, slope, type of crops, fertilizers rapid or slow release (table 1 in Annex 2 of the Regulation)
	• Start and end dates did not change from previous AP and details are reported in table 1 in Annex 2 of the Regulation
Restrictions for application on sloped soils	• Deletion of requirements for anti-erosion measures on soils moderately and highly endangered by erosion
	• Prohibition of fertilisation of permanent grassland shifted from 10° to 12° (section 11(2) of the Regulation)
Restrictions for application on soaked, frozen, or snow-covered soils	• No change respect to the previous AP
Restrictions for application near watercourses (buffer strips)	• Additional requirement for preventing spontaneous access of animals to bodies of surface water, damage to stream beds and floodplains, destruction of bank vegetation, or water pollution (section 12(2) of the Regulation)
Effluent storage works	• Specification of criteria for the location of a storage place are listed in section 9 of the Regulation
Capacity of manure storage	• The duration of storage of livestock manure on agricultural parcel during intermediate storage thereof was changed from 12 to 9 months (section 9 of the Regulation)
	• Specific criteria for location of a storage (section 9 of the regulation)
Rational fertilisation (e.g., splitting fertilisation, limitations)	Limitations of total fertilization by type of crops (tables 4 to 6 in Annex 3 of the Regulation): • Setting the limits according to three yield levels
	• If vegetation is ploughed in because it is damaged, the input of nitrogen from previous fertilisation of the ploughed-in crops shall not be included in the limit for the replacement crops (section 7(1) of the Regulation)
	• Laying down requirements for fertilisation of vegetables
	• Adjusted set-off of nitrogen from the digestate from 70% to 60% of total nitrogen (section 7(5) of the Regulation)
	• Restricted fertilisation newly also applies to vegetables; elevated doses were permitted in application zone III for winter onion and garlic
	• Use of mineral nitrogenous fertilisers was also permitted for catch crop and to support decomposition of straw in application zone III.b
	• Prohibited application of mineral nitrogenous fertilisers in the summer and autumn (if the soil is left bare in winter).
	• Increased limit of nitrogen input for soya (to 80 kg N/ha) (table 5 in annex 3 of the Regulation)
Crop rotation, permanent crop enhancement	• No change respect to the previous AP
Vegetation cover in rainy periods, winter	• No change respect to the previous AP
Fertilisation plans, spreading records	• Soil sampling and analysis shall be performed by a professionally qualified person with a certificate of accreditation pursuant to Section 16 of Act No 22/1997 on technical requirements on products (section 7(6) of the regulation)
Other measures	• No change respect to the previous AP
Date for application limit of 170 kg N/ha/year:	• 1 November 2004

(*) Government Regulation No 262/2012 of 4 July 2012 on designation of vulnerable zones and on action programme (Technical amendment: Government Regulation No 27/2018)

Controls

The percentage of farmers visited each year in the NVZ areas is 1%. All of them resulted compliant with all the measures excluding those related to winter vegetation cover and irrigation control for which the inspections were not performed by the Central Institute for Supervising and Testing in Agriculture (ÚKZÚZ). However, the inspections revealed inappropriate manure storage both spatially and temporally. In terms of the use of fertilisers, the inspections revealed violations of the prohibition of application during specified periods, as well as non-compliance with the permitted applied quantity of N/ha.

Designation of NVZ

The first NVZs was designated in 2003. Amendments took place in 2007 and 2011. A third revision of vulnerable zones took place in the Czech Republic in March 2015. This was followed by their approval process, which was confirmed in August 2016. The proportion of agricultural land in vulnerable zones with respect to the total area of agricultural land in the Czech Republic went up from 42.5% in 2003 to 50.2 in 2015. A fourth revision of the area of vulnerable zones took place in 2019 and the legislative procedure has not been completed yet.

The NVZ area for Czech Republic extends over 33153.6 km^2, 7.0 % less than in 2012-2015.

Forecast of Water Quality

The assessment of future water quality was performed using trends of long-term time series of nitrate concentrations. The time required for water quality recovery (maximum concentration below 50 mg/l) was performed according to the extrapolated values based on the calculated linear long-term trends. The large majority (79%) of the stations are below the threshold of 50 mg/l with stable or decreasing trends. About 14% of the station have a recovery time below two years while 5% of the monitoring stations will take 15 years and more to recover.

Summary

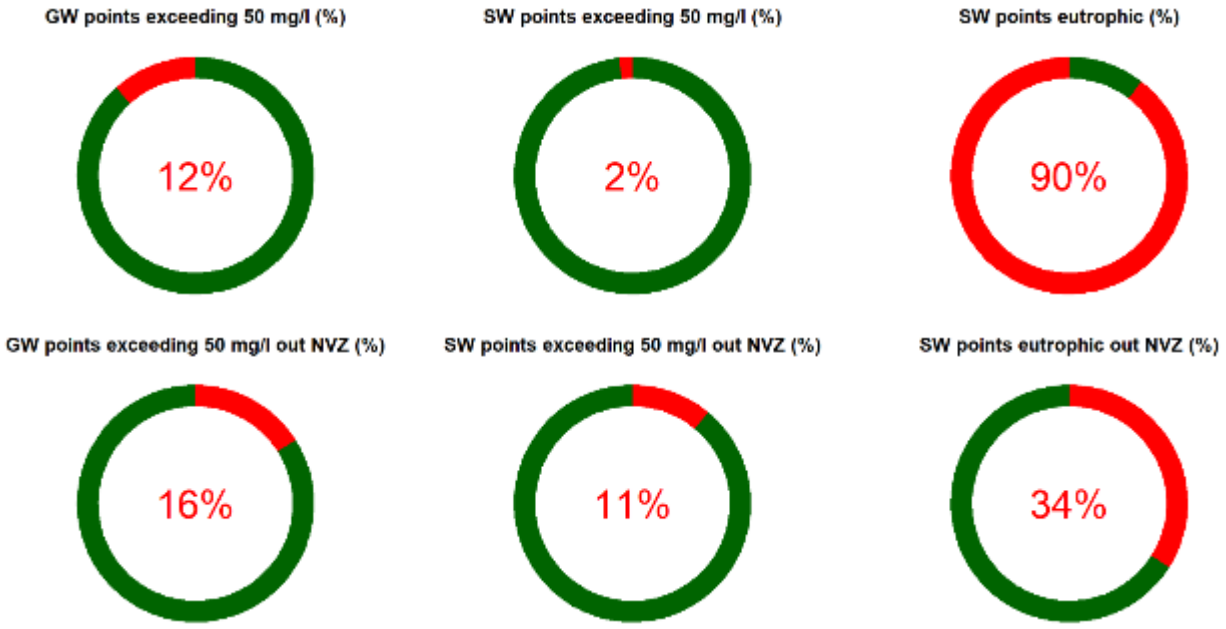


Figure 18. The summary plot for the period 2016-2019

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

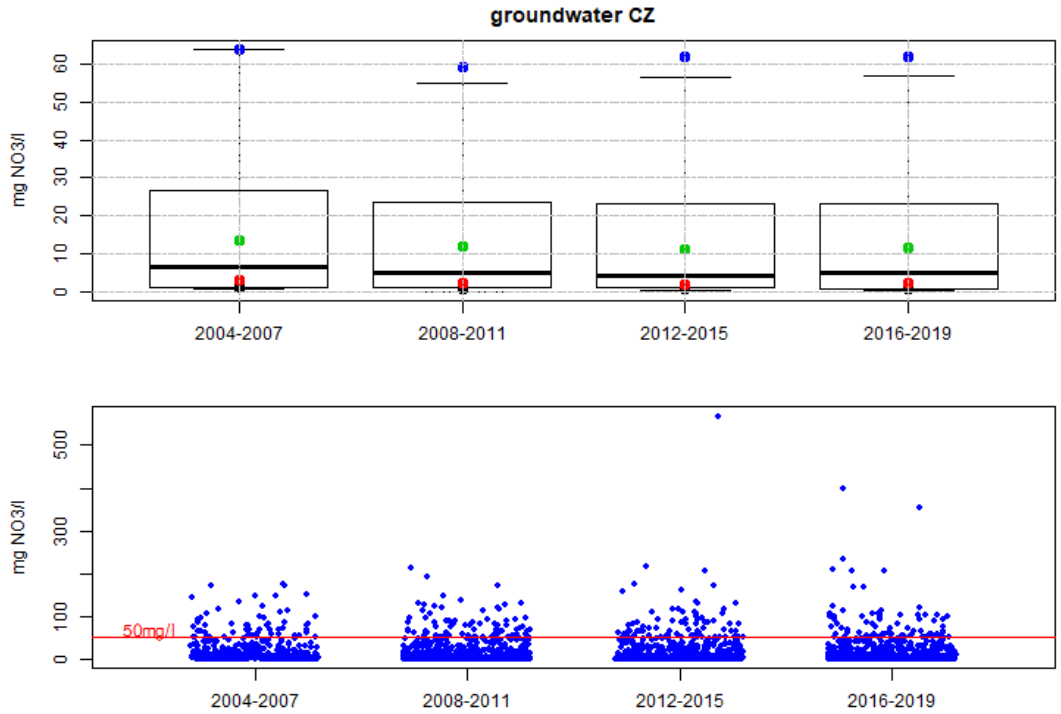


Figure 19. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for groundwater stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

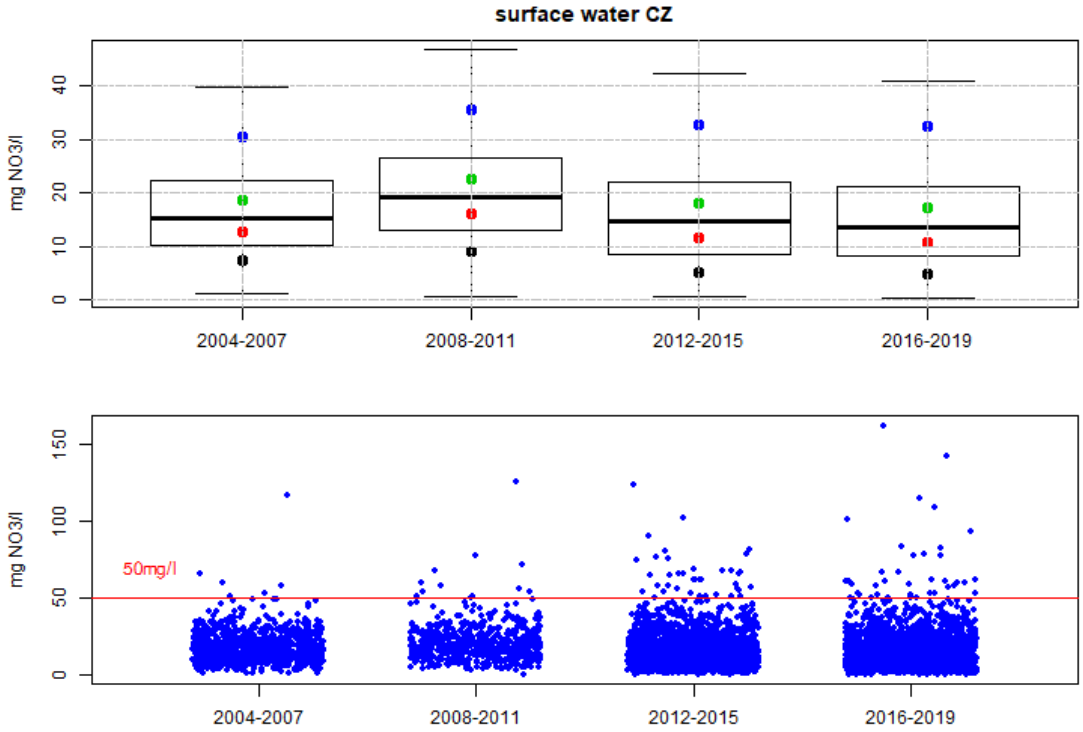


Figure 20. Time series of box whisker plots along with the distribution of average NO3 annual concentrations for each reporting period for surface water stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

Conclusions and recommendations

The Czech Republic has a low livestock density and the surplus of nitrogen is above the EU average, while there is a deficit for phosphorus.

There is a well-elaborated network of monitoring stations. There are a large number of groundwater hotspots, with a nitrate concentration > 50 mg/l. The nitrate concentrations in surface waters are increasing and a very high number of the surface waters are found to be eutrophic.

A high number of polluted ground waters and of surface waters found to be eutrophic are located outside the NVZ.

A revised action programme was published in 2018.

The Commission recommends Czech Republic to revise the designation of NVZ to include areas that drain into waters that are eutrophic and where the agricultural pressure is significant, and to revise its action programme in particular to reduce and prevent the contamination of surface waters.