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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

Slovakia's utilized agricultural area amounts to 1.9 Mha, representing 39.9% 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 cereals (24.8%), industrial crops (13.5%) and milk (12%).

Eurostat

Major land use statistics for Slovakia

Table 1.Utilized agricultural area (abbreviated as UAA)

Slovakia	2005	2007	2010	2013	2016
Utilised agricultural area UAA (1000 ha)	NA	1931	1922	1929	1919
arable land (1000 ha)	NA	1343	1354	1363	1347
permanent grass (1000 ha)	NA	528	513	514	521
permanent crops (1000 ha)	NA	25	23	20	18
kitchen gardens (1000 ha)	NA	34	31	32	32

Note:

Eurostat (FSS)

Slovakia's arable land as well as grassland have remained stable since 2007. The permanent crops area has decreased by 28% since 2007.

Animal distribution in Slovakia

Slovakia's live poultry have increased while live bovines and pigs have decreased since 2013. The livestock density index has remained stable and is lower than the EU average of 0.8

Table 2. Livestock statistics

Slovakia	2005	2007	2010	2013	2016
Livestock index	0.42	0.39	0.35	0.34	0.33
dairy cows (10^6 heads)	0.20	0.18	0.16	0.14	0.13
live bovines (10^6 heads)	0.53	0.50	0.47	0.47	0.45
live pigs (10^6 heads)	1.11	0.95	0.69	0.64	0.59
live poultry (10^6 heads)	NA	NA	12.66	11.36	12.06

Note:

Eurostat (FSS)

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

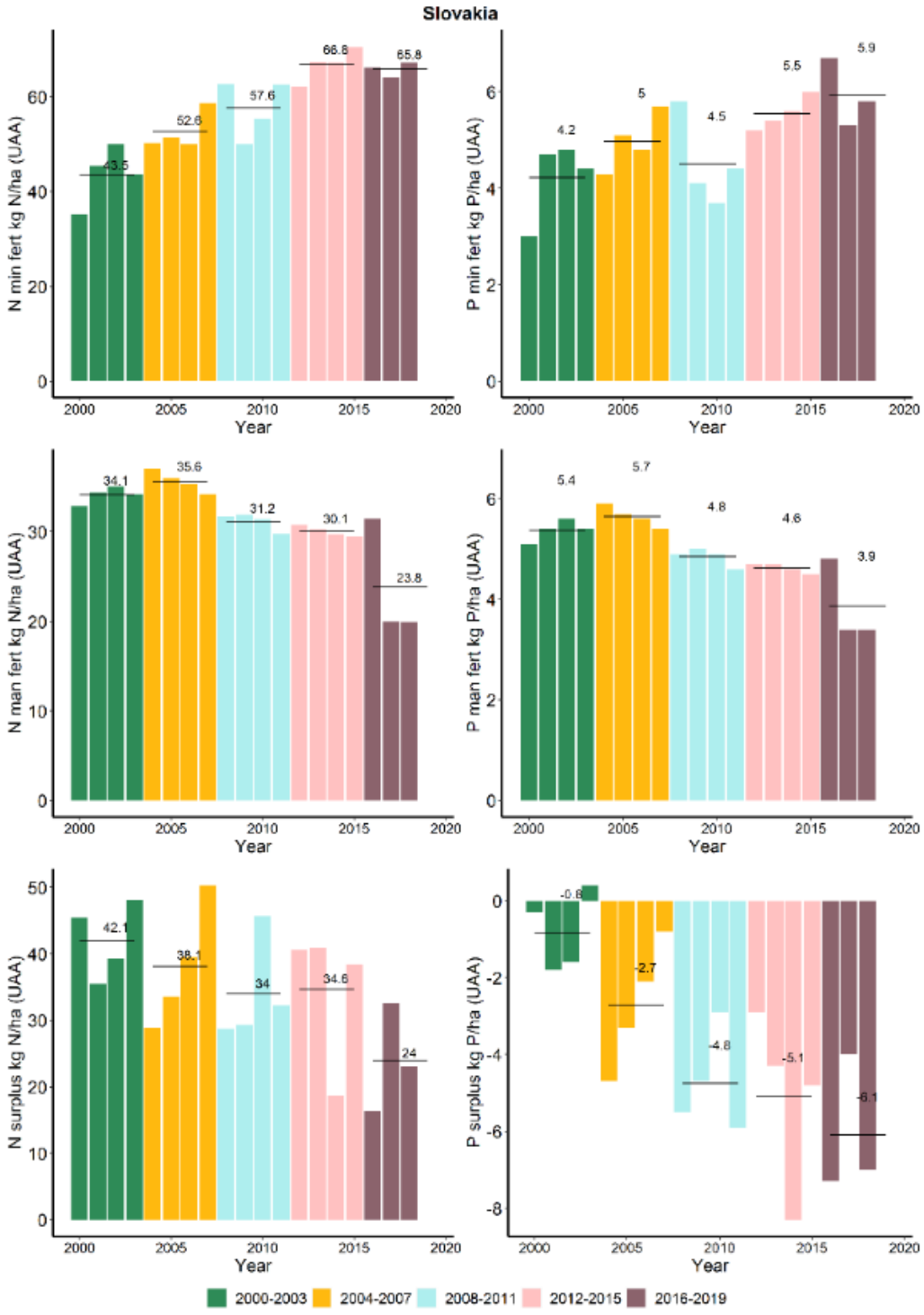


Figure 1. N and P fertilizers and gross ì surplus (kg/ha)

The gross nitrogen and phosphorus surpluses originate from EUROSTAT data for the years 2000-2018. N and P mineral fertilizers remained stable with respect to the previous reporting period, while N and P manure decreased. Both the nitrogen and phosphorus surpluses decreased from the last reporting period. 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

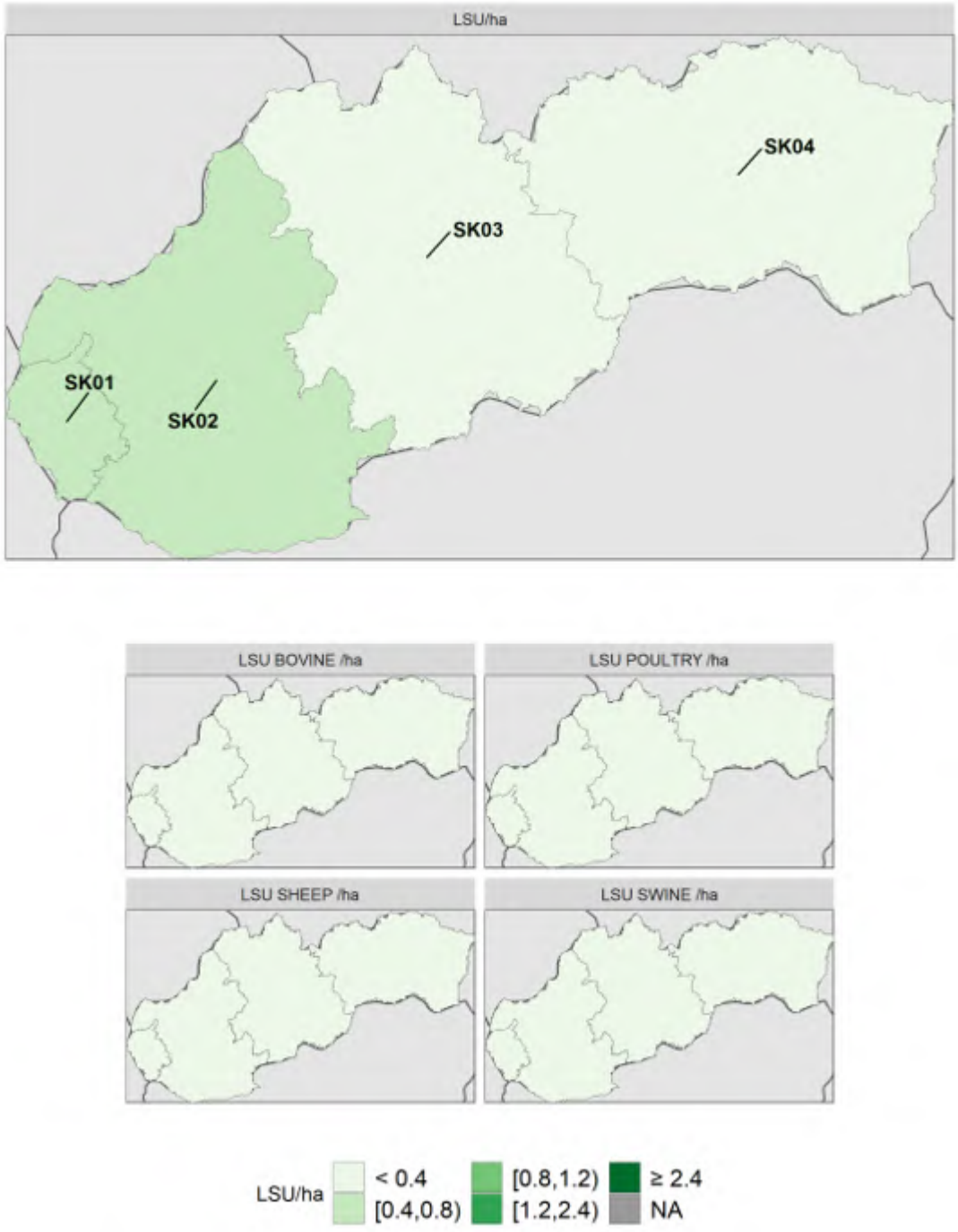


Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production is concentrated in the south western part of the Slovakia (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 groundwater monitoring network relies on the existing monitoring networks managed by the Slovak Hydro-meteorological Institute (SHMI), the Water Research Institute (WRI) and monitoring stations of Water companies. Evaluation of groundwater was carried out for the entire 2016-2019 reporting period. The revision of the Nitrate Vulnerable Zones that took place in 2016 led to a decrease of the number of the monitoring stations in the NVZ areas, and conversely to the increase in the number of monitoring facilities in the rest of the Slovak territory.

The surface water monitoring relies on Slovak water monitoring program designed to comply with the WFD requirements. Due to the different reporting cycles of the WFD and the Nitrates Directive, it was not possible to ensure monitoring of all points for the purposes of the Nitrates Directive at the same points within the 4-year cycle. Consequently, the number of points for trend evaluation is lower than the total number of monitoring points. Processing of all 2019 data needed for the evaluation of surface water quality and agricultural activities was not completed by the time of preparation of the report. Therefore, evaluation of surface water quality in this report was carried out for the 2016-2018 period.

For groundwater measurements, some stations have same coordinates due to different depths or uncertainty in the spatial location. For surface measurements, some stations have same coordinates because they are representative of different banks of a river or different horizons in water reservoir. In this case, the average values cover 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 coordinates: 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

Station Type	Description	Number of stations with measurements			Number of stations with Trends		
		2008-2011	2012-2015	2016-2019	2008-2011	2012-2015	2016-2019
0	Phreatic groundwater (shallow): 0-5 m	26	268	257	8	249	203
1a	Phreatic groundwater (deep) 5-15 m	1078	1064	1107	152	969	825
1b	Phreatic groundwater (deep) 15-30 m	117	110	130	108	91	69
1c	Phreatic groundwater (deep) >30 m	187	84	67	161	76	53
2	Captive groundwater	0	76	118	0	51	56
3	Karstic groundwater	0	115	109	0	108	92
9	Not specified	309	0	0	252	0	0
	Total	**1717**	**1717**	**1788**	**681**	**1544**	**1298**

Surface water quality monitoring network

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

Station Type	Description	Number of stations with measurements			Number of stations with Trends			Number of stations with Trophic status		
		2008-2011	2012-2015	2016-2019	2008-2011	2012-2015	2016-2019	2008-2011	2012-2015	2016-2019
4	River water	784	466	765	236	332	308	356	249	753
5	Lake/reservoir water	68	46	77	0	46	35	42	0	22
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	**852**	**512**	**842**	**236**	**378**	**343**	**398**	**249**	**775**

Groundwater Quality

Groundwater average annual nitrate concentration

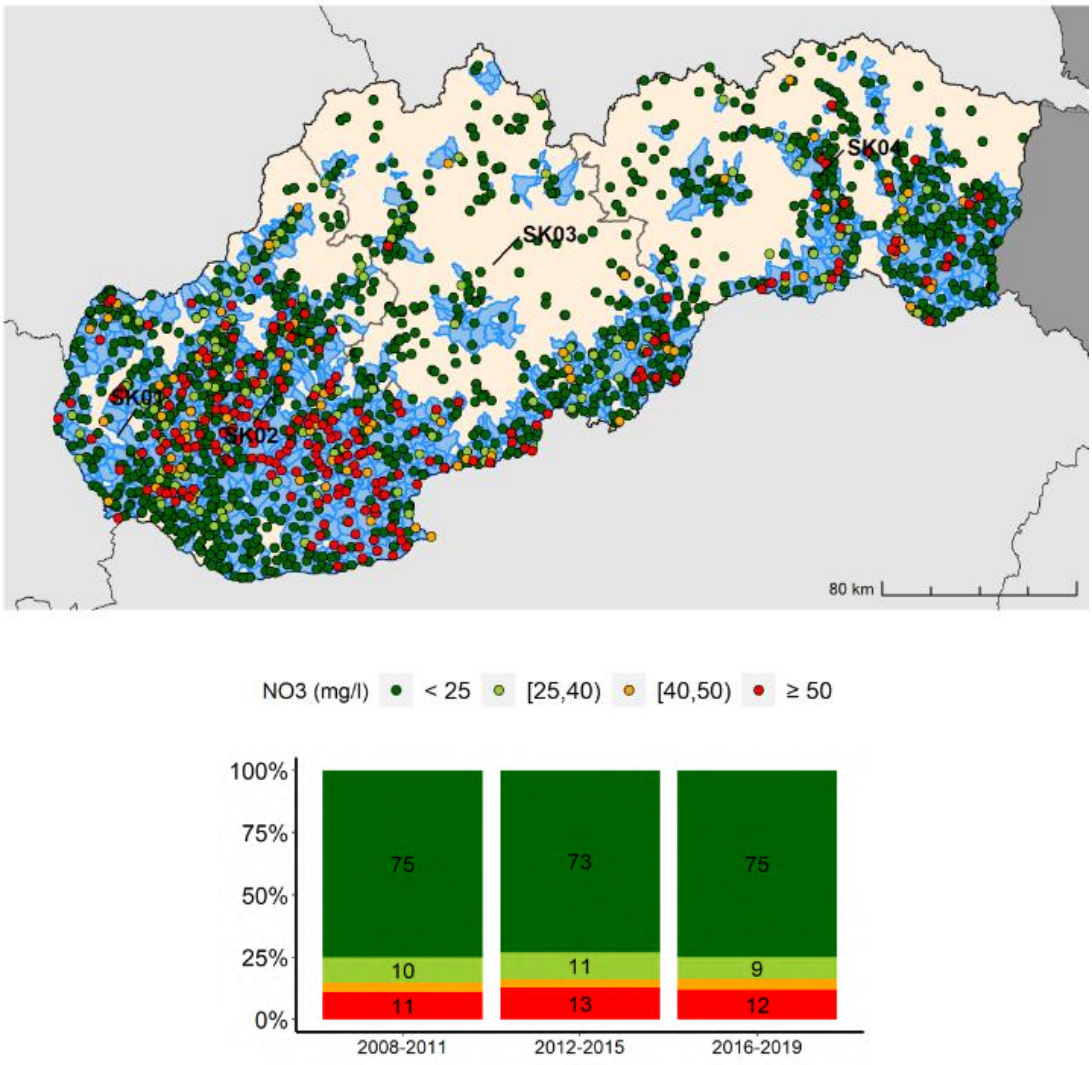


Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

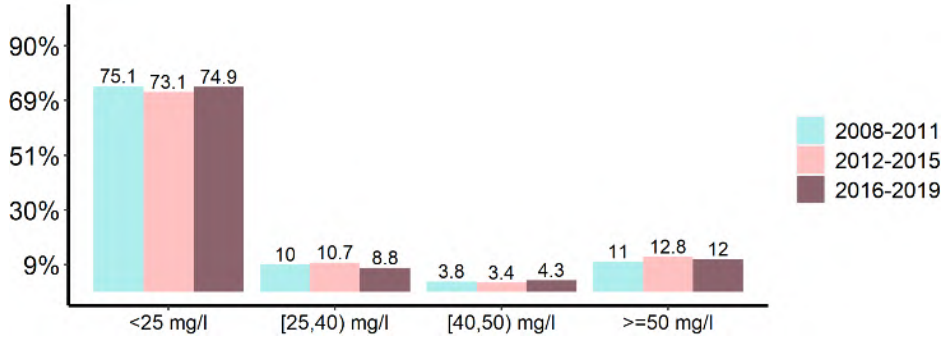


Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Groundwater average annual nitrate concentration trend

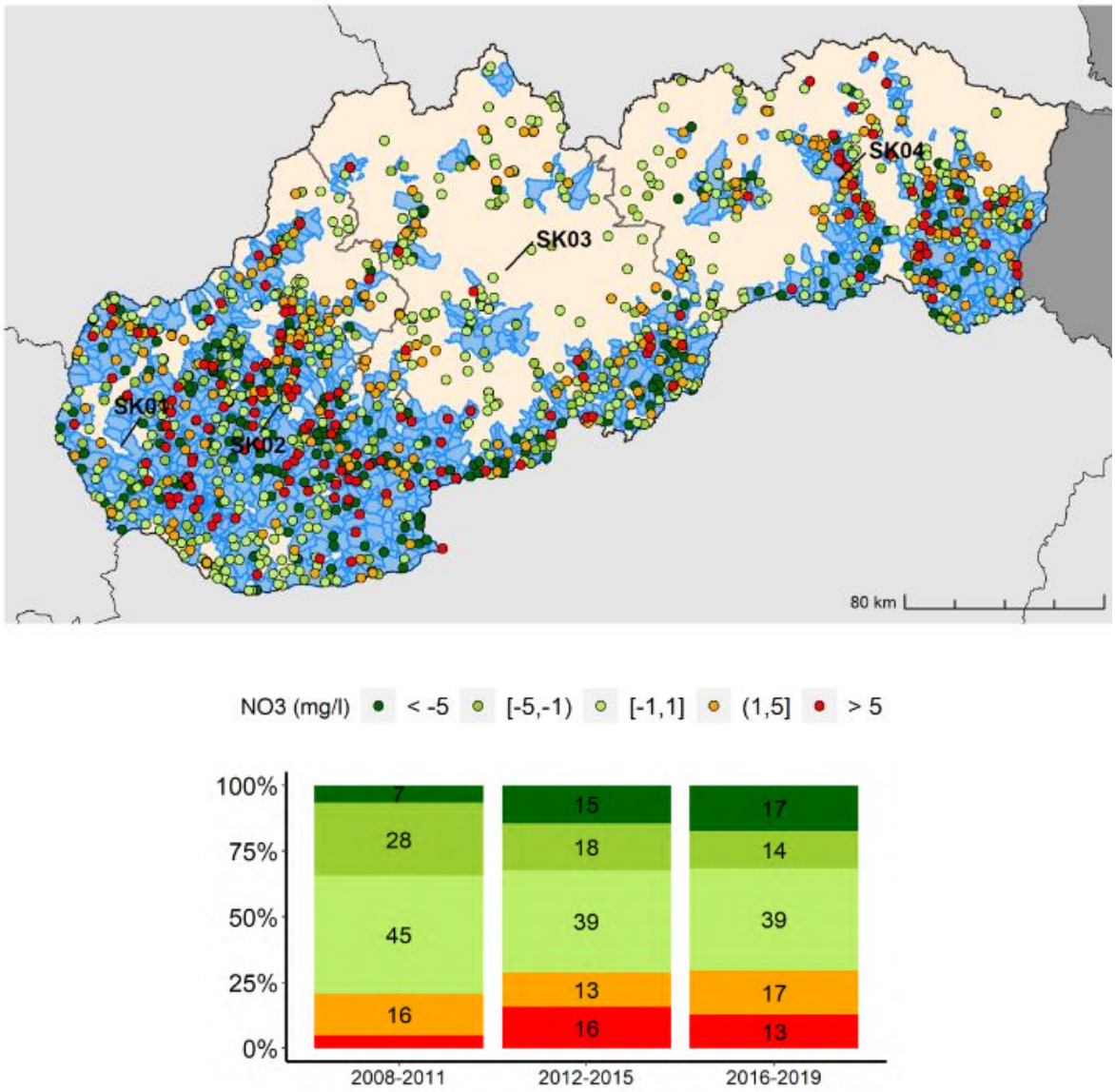


Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

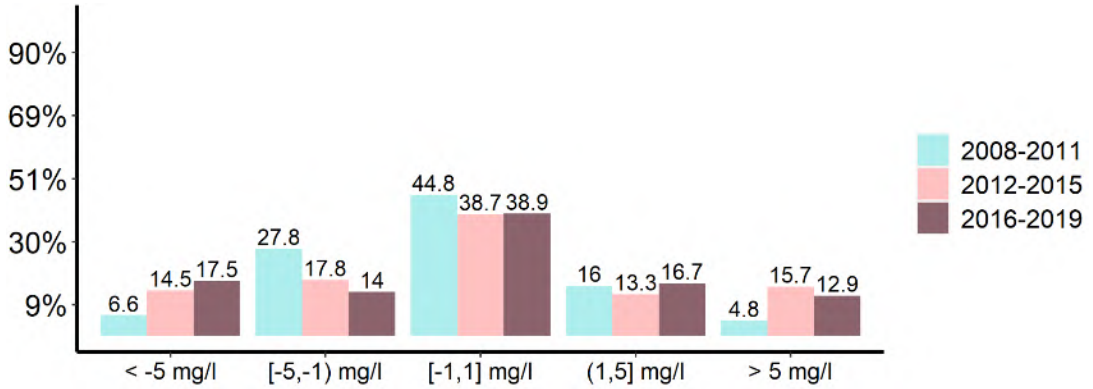
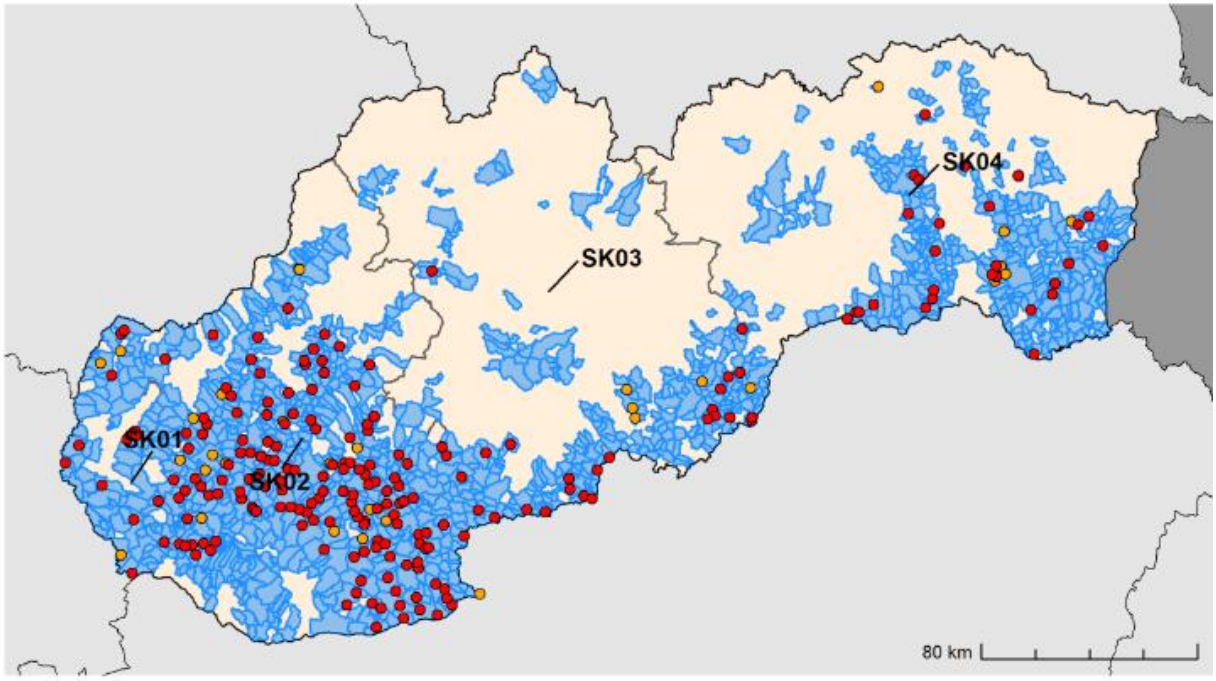


Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Groundwater hotspot

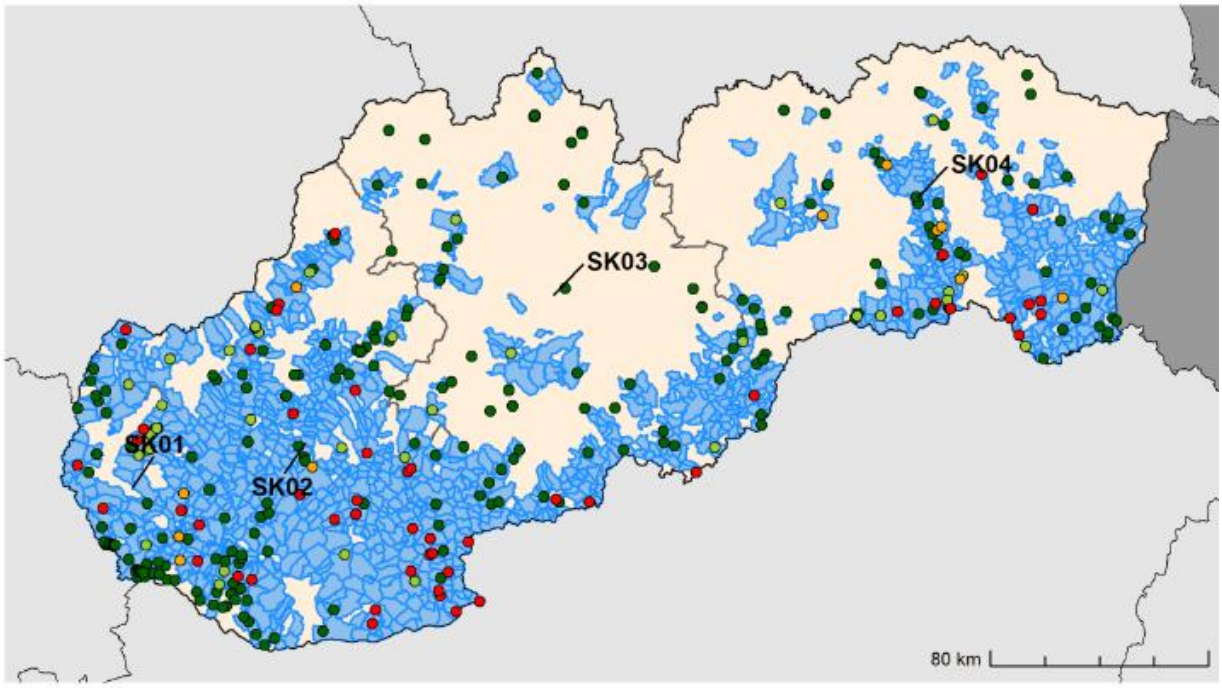


		>=40 and < 50 mg/l incr.trend		>=50 mg/l	
NUTS ID	NUTS NAME	InNVZ	OutNVZ	InNVZ	OutNVZ
SK01	Bratislavský kraj	2	0	14	0
SK02	Západné Slovensko	21	0	151	0
SK03	Stredné Slovensko	5	0	22	0
SK04	Východné Slovensko	6	0	27	0
	Total	**34**	**0**	**214**	**0**

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 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 and NVZ with Validity=1.

Groundwater stations removed



Station Type	Description	Number of removed stations		
		total removed	with measurements	with trends
0	Phreatic groundwater (shallow): 0-5 m	63	63	61
1a	Phreatic groundwater (deep) 5-15 m	240	240	199
1b	Phreatic groundwater (deep) 15-30 m	41	41	36
1c	Phreatic groundwater (deep) >30 m	32	32	31
2	Captive groundwater	20	20	16
3	Karstic groundwater	23	23	22
9	Not specified	0	0	0
	Total	**419**	**419**	**365**

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

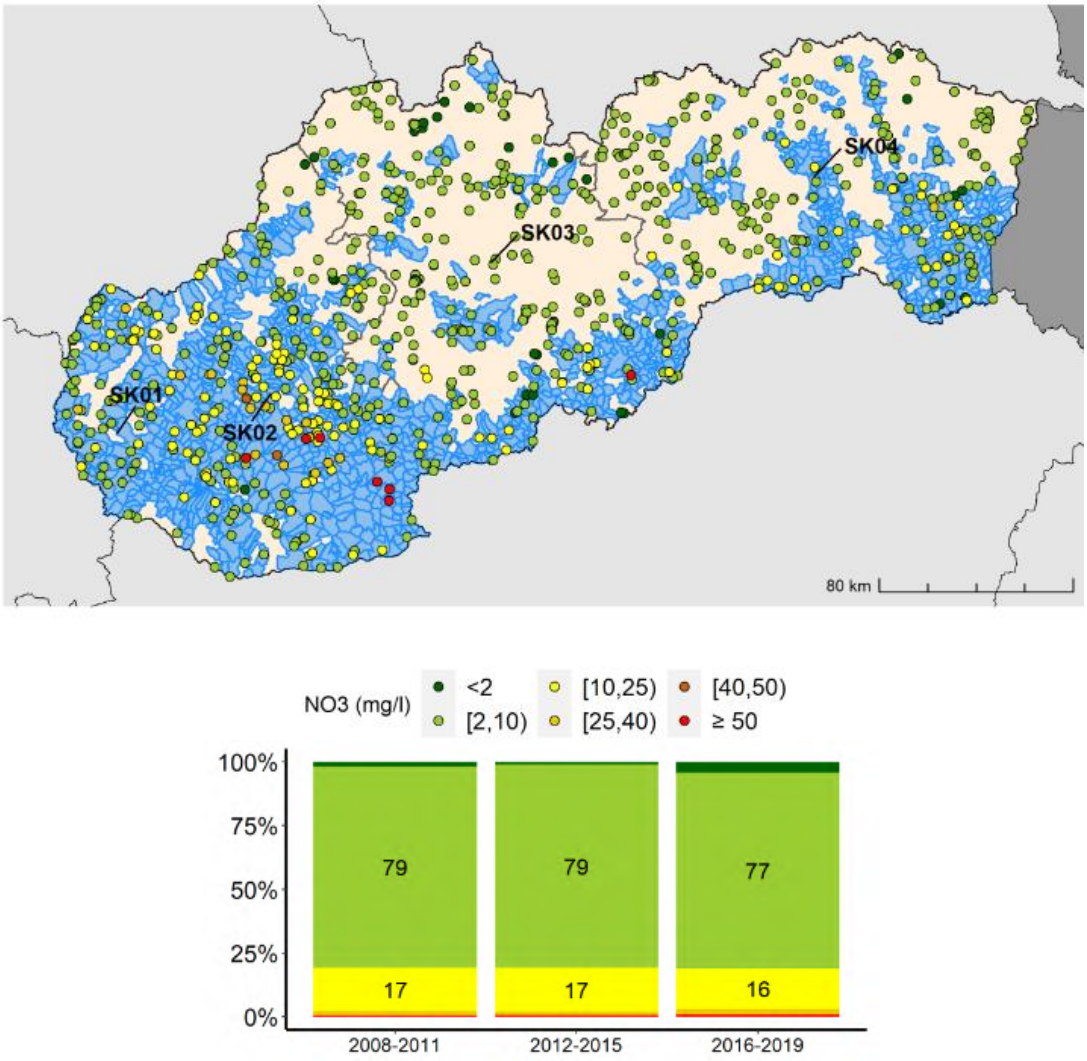


Figure 9. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

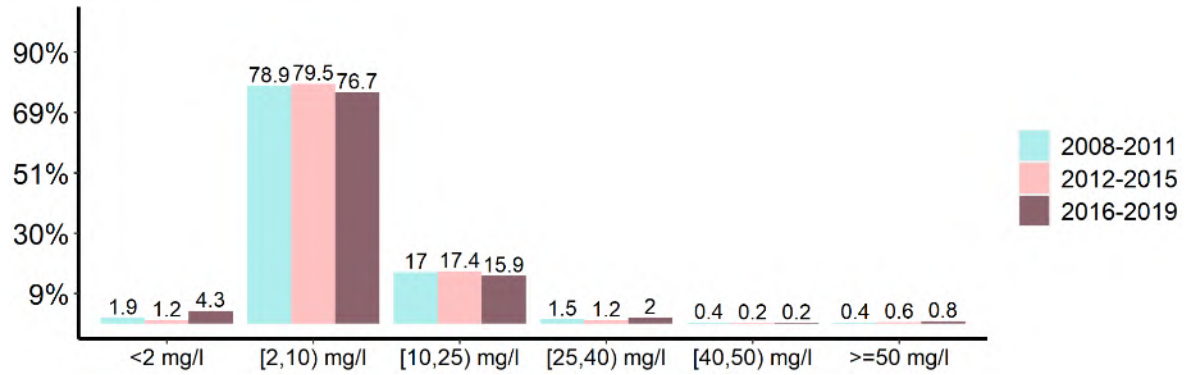


Figure 10. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Surface water average annual nitrate concentration trend

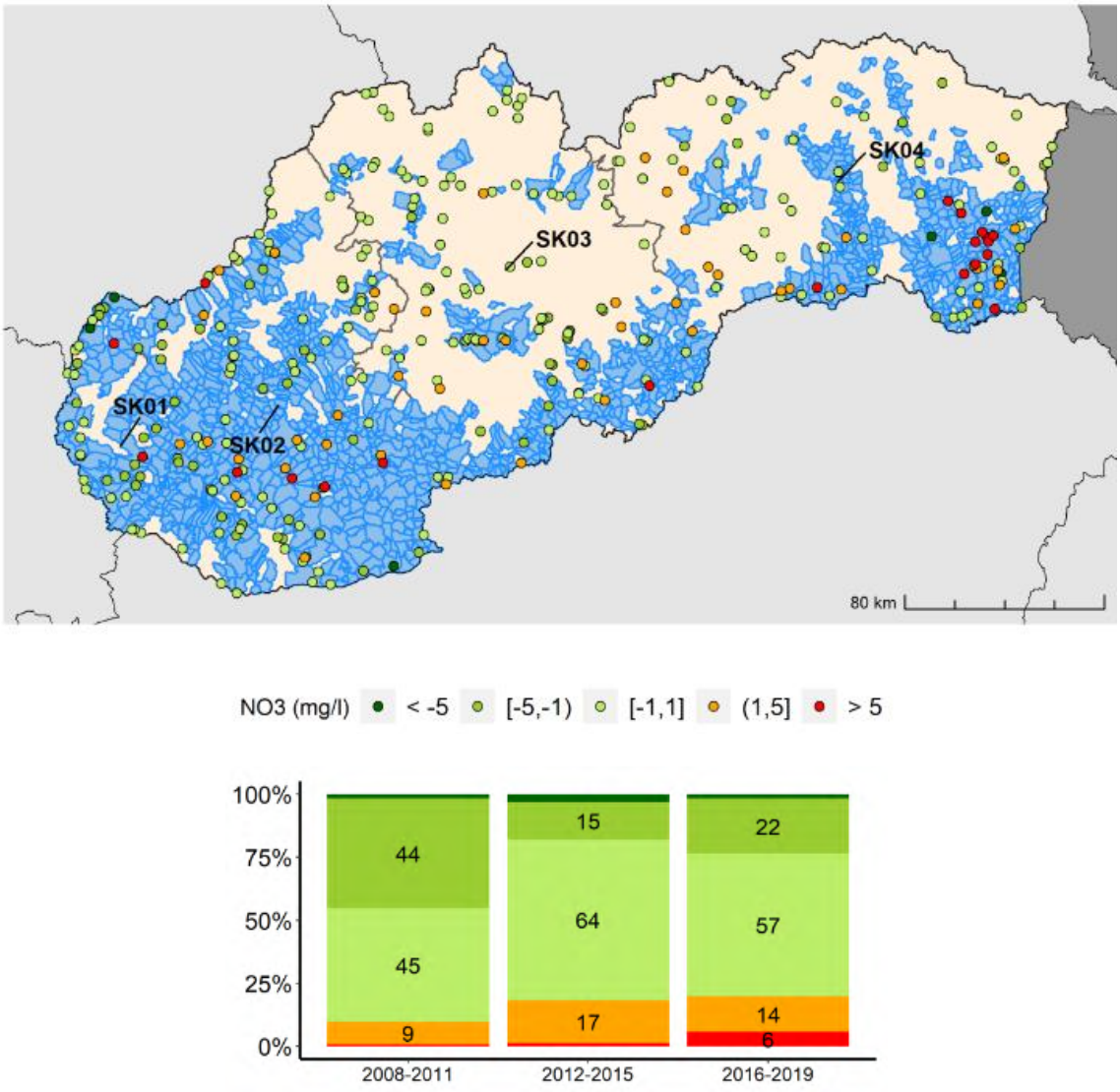


Figure 11. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

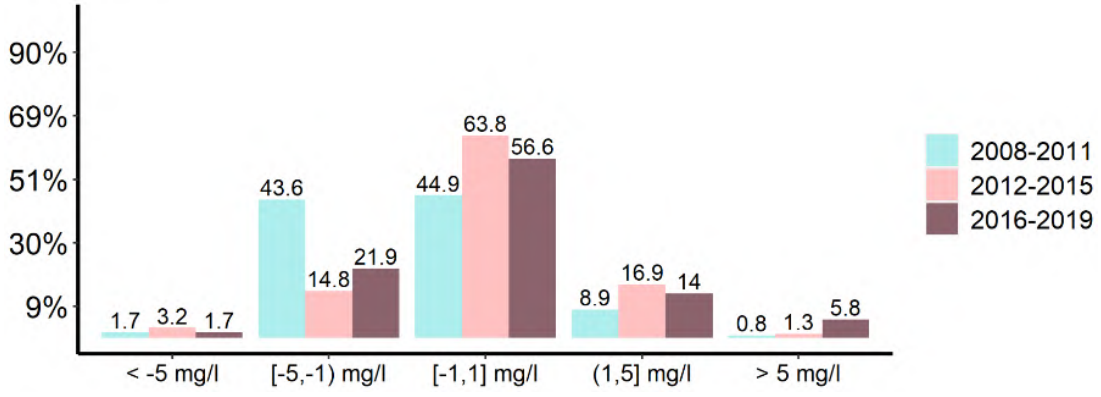
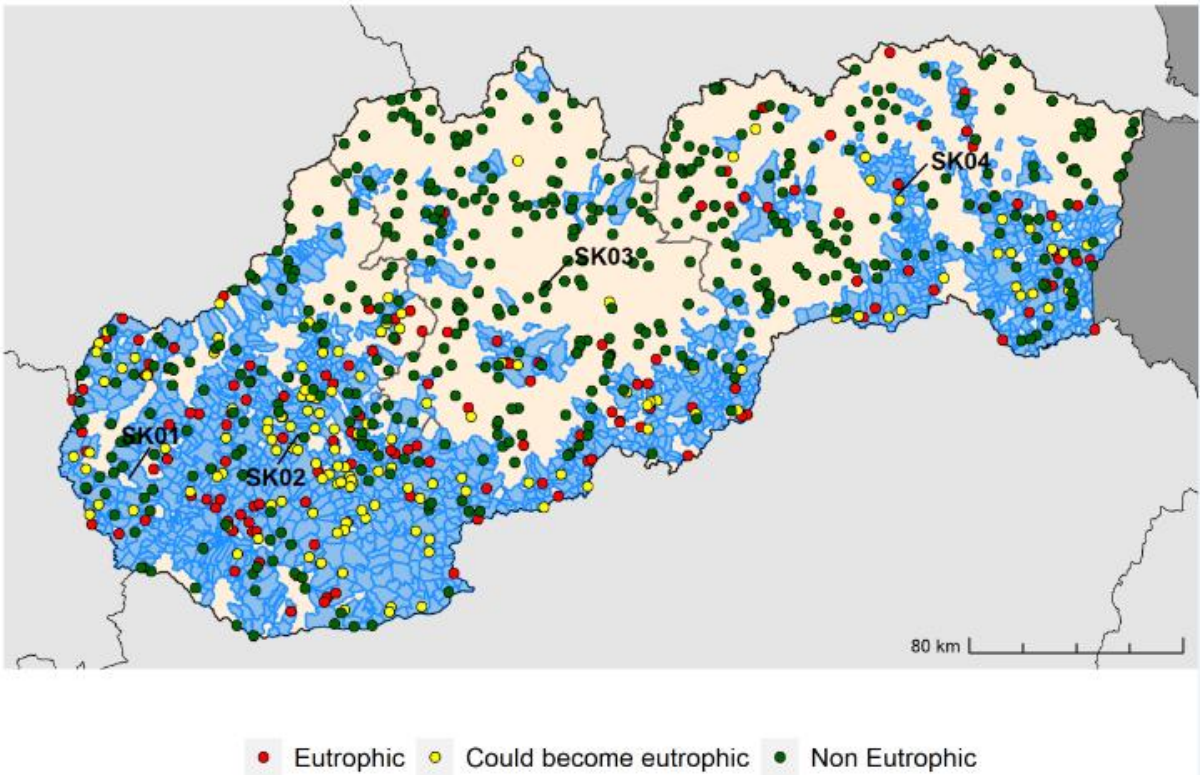


Figure 12. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Surface Water Eutrophication



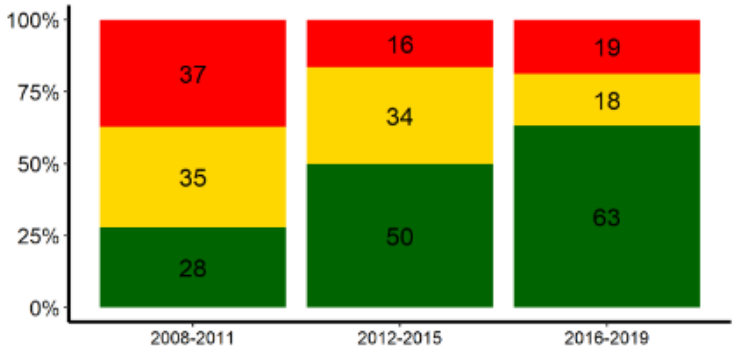


Figure 13. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis). In the map in blue the NVZ.

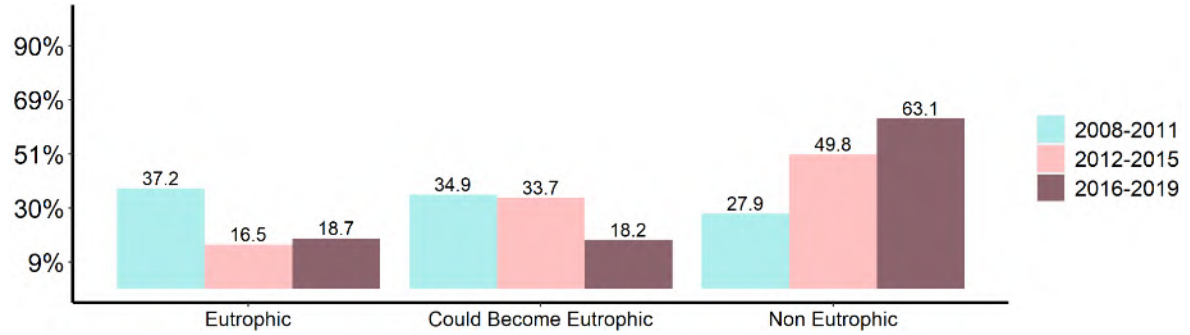
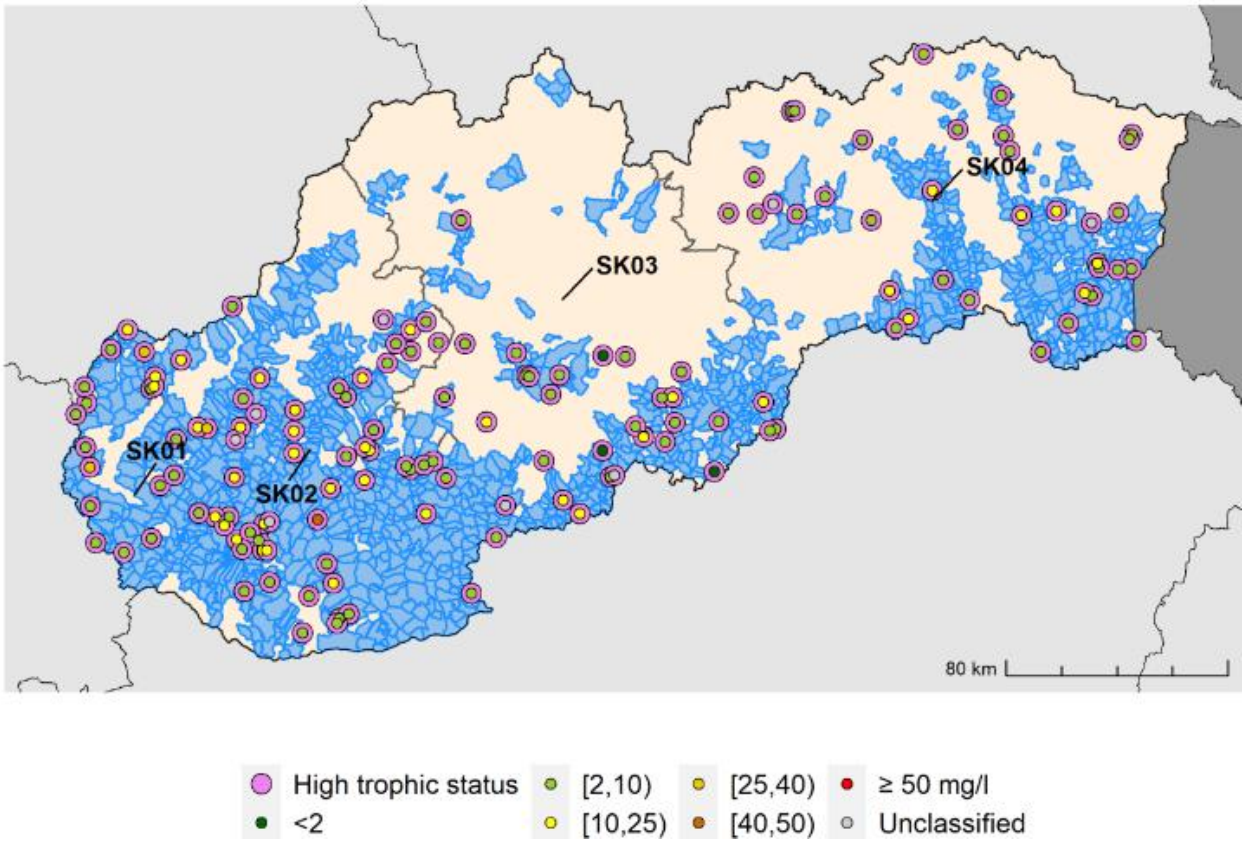


Figure 14. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis)

Surface water eutrophication in Slovakia has been evaluated using two different methodologies. In the current reporting period, 2016-2019, the Slovak methodology based on the CIS WFD Guidance document No 23 was used. For the previous reporting periods, 2012-2015 and 2008-2011, the French methodology was applied

The eutrophication assessment was based on “the French methodology” until 2012 – 2015 reporting period (“Report on the state of Nitrate directive implementation in the Slovak Republic in 2016”). “The Slovak methodology” was used since 2012 – 2015 reporting period and it has been described in detail in the “Report on the state of Nitrate directive implementation in the Slovak Republic in 2016”.

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
SK01	Bratislavský kraj	8	0	7	0	1	0	0	0
SK02	Západné Slovensko	71	0	38	25	2	1	0	5
SK03	Stredné Slovensko	30	3	20	6	0	0	0	1
SK04	Východné Slovensko	36	0	26	7	0	0	0	3
	Total	**145**	**3**	**91**	**38**	**3**	**1**	**0**	**9**

Figure 15. The SW monitoring stations with eutrophic status versus the average NO3 annual concentration. In the map in blue the NVZ.

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

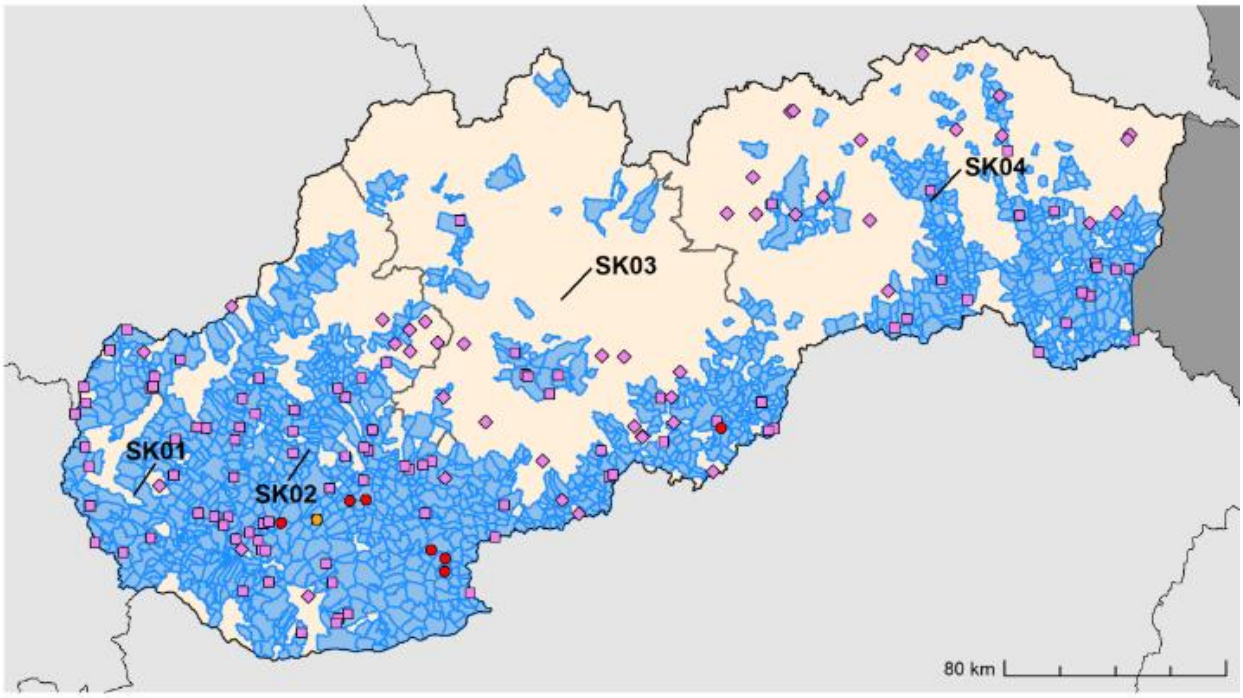
It is noteworthy that P-PO4 has also an important role in determining the trophic status since is a limiting factor for eutrophication in rivers.

The evaluation of eutrophication was conducted in accordance with the requirements laid down in the Development guide for Member States' reports and the Slovak Methodology. Data from the period 2016-2018 were reviewed to derive the appropriate indicators. The assessment of eutrophication of surface water relies on nutrients including NO3, NH4, PO4 and total P which are classified in three categories by type specific classification. The biological elements used to derive the trophic status include phytoplankton, phytobenthos, macrophytes, classified in 5 quality classes according to type-specific classification schemes based on indices calculated and the EQR.
The large majority of flowing rivers fall in the non-eutrophic classes. Eutrophic or could become eutrophic represent about 37% of all rivers. Concerning the reservoirs analyzed, they fall almost equally in the eutrophic and non-eutrophic classes.

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	135	141	477
5	Lake/reservoir water	10	0	12
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	**145**	**141**	**489**

Surface Water quality hotspot



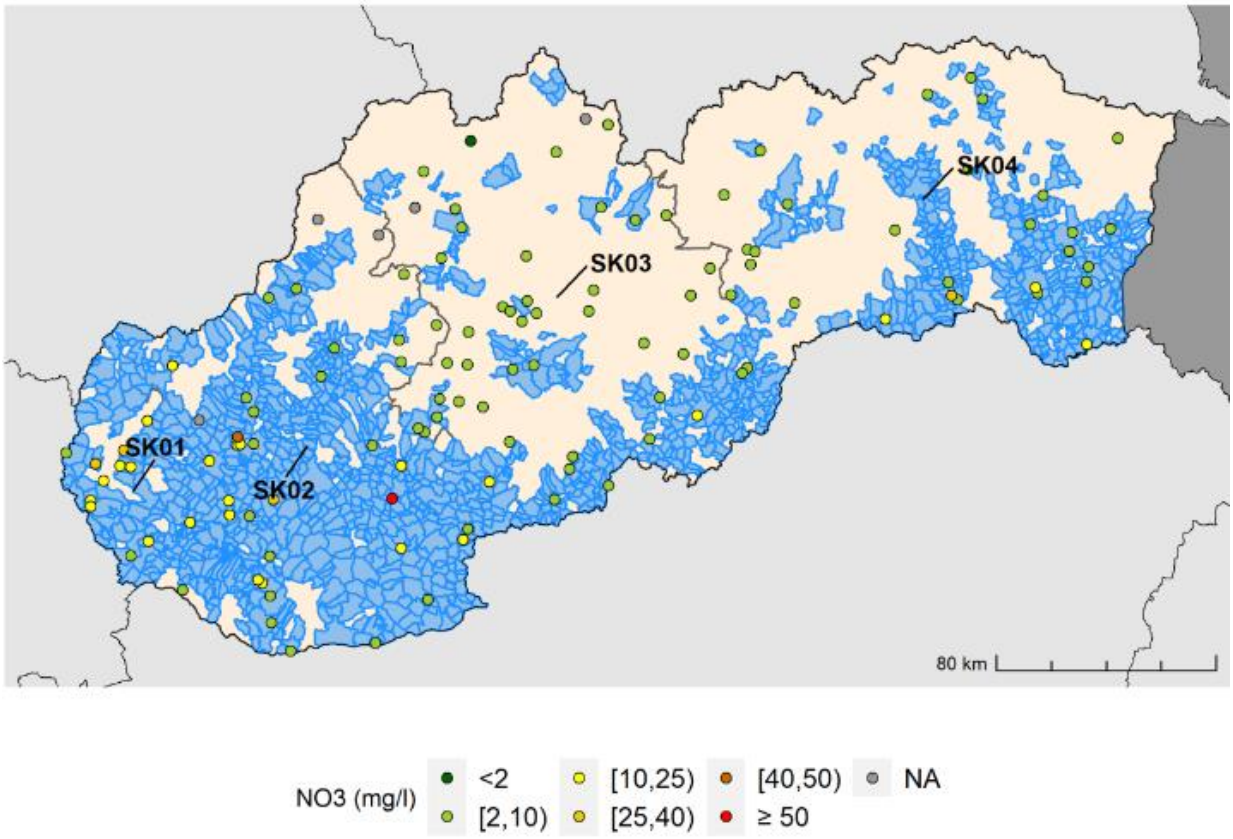
High Trophic Status InNVZ
High Trophic Status OutNVZ
[40,50) mg/l incr. trend InNVZ
[40,50) mg/l incr. trend OutNVZ
≥ 50 InNVZ
≥ 50 OutNVZ

		High trophic status		>=40 and < 50 mg/l incr.trend		>=50 mg/l	
NUTS ID	NUTS NAME	InNVZ	OutNVZ	InNVZ	OutNVZ	InNVZ	OutNVZ
SK01	Bratislavský kraj	7	1	0	0	0	0
SK02	Západné Slovensko	60	11	1	0	6	0
SK03	Stredné Slovensko	15	15	0	0	1	0
SK04	Východné Slovensko	18	18	0	0	0	0
	Total	**100**	**45**	**1**	**0**	**7**	**0**

Figure 16. SW hotspot analysis map (top graph) and distribution by NUTS2 (lower graph) of average NO3 annual concentration greater than 40 mg/l and trophic status. 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 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. We considered NVZ with Validity=1.
It is noteworthy that all monitoring stations with high trophic status outside NVZ were analysed as part of work on revision of NVZ in 2020. It is expected that there will be new NVZ designation in 2021.

Surface Water Stations Removed



Station Type	Description	Number of removed stations			
		total removed	with measurements	with trends	with trophic status
4	River water	120	115	71	50
5	Lake/reservoir water	4	4	4	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	**124**	**119**	**75**	**50**

Figure 17. SW removed stations amp (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 was drawn up in 2001. Approximately 30% of farmers farming outside vulnerable zones began voluntarily working according to the principles of the Code of Good Agricultural Practice for Water Protection in 2016-2019.

The Action Programme (AP), called “Farming Programme”, was published for the first time in 2004 and was revised on 01/01/2019. The revised Farming Programme introduces and governs, among other things, the main measures for the elements of agricultural activities described in the subsequent table. Some measures were differentiated in three categories of farming restrictions that range from low level (A) to high level (C). The categories were defined based on a set of soil, hydrology, geography, and environmental parameters. The new measures are summarized in the following table.

Table 6. Details of the Action Programme

Measure	General details in Action Programme (*)
Period of prohibition of fertiliser application	• Different dates depending on type of fertiliser, type of land and level of restrinction (Section 10c(1), Annex 2 of the Act)
Restrictions for application on sloped soils	• Different limitations depending on type of fertiliser, type of land and level of restrinction (Sections 10c(8), 10c(9), 10c(10) of the Act)
Restrictions for application on soaked, frozen, or snow-covered soils	• Not allow in these situations (Section 10c(7) of the Act)
Restrictions for application near watercourses (buffer strips)	• Different restrictions depending on type of fertiliser, type of land and level of restrinction (Section 10c(11) of the Act)
Effluent storage works	• Details reported in section 5.3 -point 5 (CGAP measures):
	• Slurry can be stored using reliable homogeniser in underground tanks, sumps, above-ground tanks and isolated depressions
	• Recommended widths when manure are placed on a slope
Capacity of manure storage	• 6 months for liquid agricultural fertilisers and for storing livestock manure (Section 10b(1) of the Act)
	• 3 months otherwise
Rational fertilisation (e.g., splitting fertilisation, limitations)	• Maximum N-total use (Section 10c(6) of the Act)
	• Maximun single dose on nitrogen in spring (Section 10c(6))
Crop rotation, permanent crop enhancement	• Use suitable equipment for evenly application of fertilisers in agricultural land (Section 10c(7) of the Act)
	• Ensure without delay the sowing of a succeeding crop in the recovery of permanent grassland and after ploughing in clover (Section 10c(7) of the Act)
	• In dry weather conditions use irrigation water (Section 10c(7) of the Act)
Vegetation cover in rainy periods, winter	• 47.5% of arable land left bare in winter (average 2016-2019)
Fertilisation plans, spreading records	• Not specified
Other measures	• Plan on the use of nitrogen fertilising substances (Section 10c(5) of the Act)
	• Inventory on storage capacity, livestock number and technique of housing and fertiliser consumption (Section 9(1)(f) of the Act)
	• Harmful substances must not be dissipated or leak into the surrounding area (Section 9(3) of the Act)
Date for application limit of 170 kg N/ha/year:	• 2010 (dates of last revision CGAP)

(*) Act No 394/2015 amending Act No 136/2000 on fertilisers, as amended

CGAP- Code of Good Agricultural Practice – Protection of Water Resources. Bratislava: Ministry of Agriculture, September 2001

The economic efficiency of the new measures was expressed as the costs spent on measures scaled to a kilogram of retained (non-leached) nitrogen and the environmental effects of the measures were based on an expert estimate. The costs of implementation of the individual measures are specified in the sense of the Rural Development Programme of the Slovak Republic 2014-2020. The implemented measures contribute not only to lower nitrogen losses from soil but are accompanied also by other positive effects on the environment (protection of agricultural land from erosion, reduction in the amount of agrochemicals applied, greater biodiversity and others). These effects are not included in the costs and economic efficiency of the measures.

Controls

Checks of the compliance with the conditions of the Farming Programme are conducted by the Central Control and Testing Institute in Agriculture (CCTIA). An average of 79% of the farmers located in vulnerable zones were subject to a yearly administrative check concerning the use of fertilizers. About 8% of the farmers located in vulnerable zones were subject to a physical check. The level of compliance is high. The highest non-compliance occurred in less than 1% of the farmers concerning the measure “Land use and agricultural practices, including crop rotation systems (records, fertilization plans)”.

Designation of NVZ

Slovakia has revised the nitrate vulnerable zones in 2016 using a new methodology. The extent of NVZs went from 22328 km^2 to 20938 km^2. The proportion of utilized agricultural areas in vulnerable zones went from 61.3% to 62.0%.

Forecast of Water Quality

This is the second time the Slovak Republic conducts a forecast of water quality. The forecast for groundwater is based on a linear trend analysis of the average annual concentration at monitoring stations with long-term time series (at least 8 years). Based on this linear regression, a time by which a station will fall under the 50 mg/ is calculated l. About 70.1% of the stations evaluated (568 stations) were classified as posing no problem as they already dropped below 50 mg/l and are stabilized or the concentration is even on a decline. About 21% of the stations are expected not to reach the desired threshold by 2034 and are all located in NVZ areas.

Analyzing time series of surface water nitrate concentration for the period 2007-2018 led to the conclusion that the short-term development of nitrate nitrogen concentration for outlet monitoring sites of the Slovak Danube river basin district would remain at the actual levels unless shifts linked to anthropogenic activities occur.

Summary

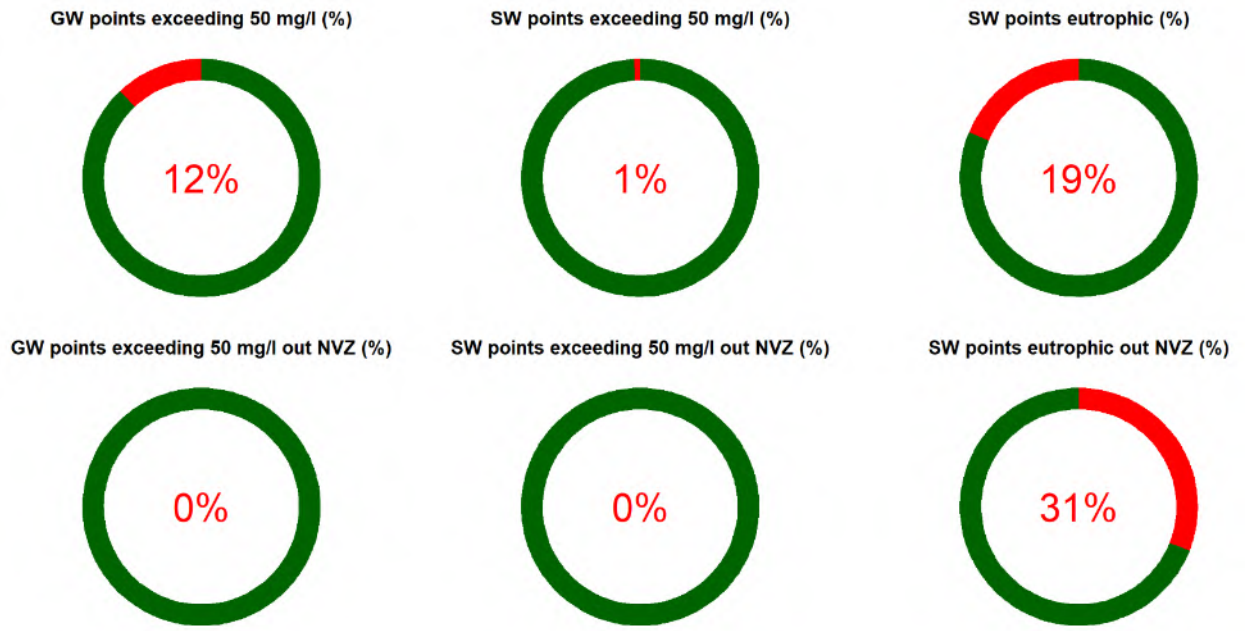


Figure 18. The summary plot for the period 2016-2019

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

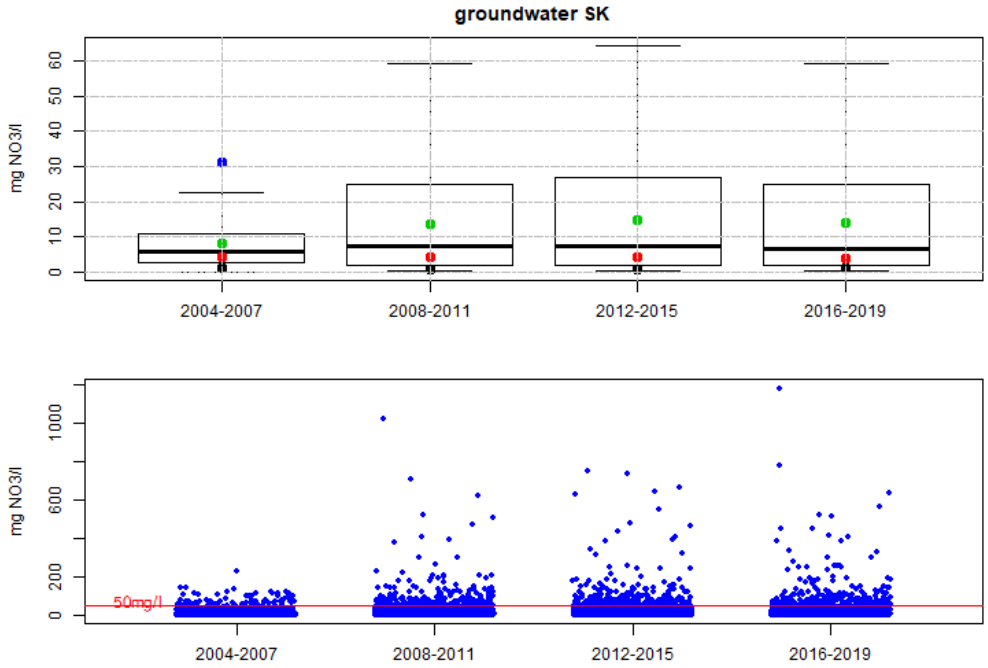


Figure 19. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period, for groundwater stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

The highest GW concentrations above 250 mg/L are under control and will be part of a task to be taken by Water Research Institute under Ministry of Environment

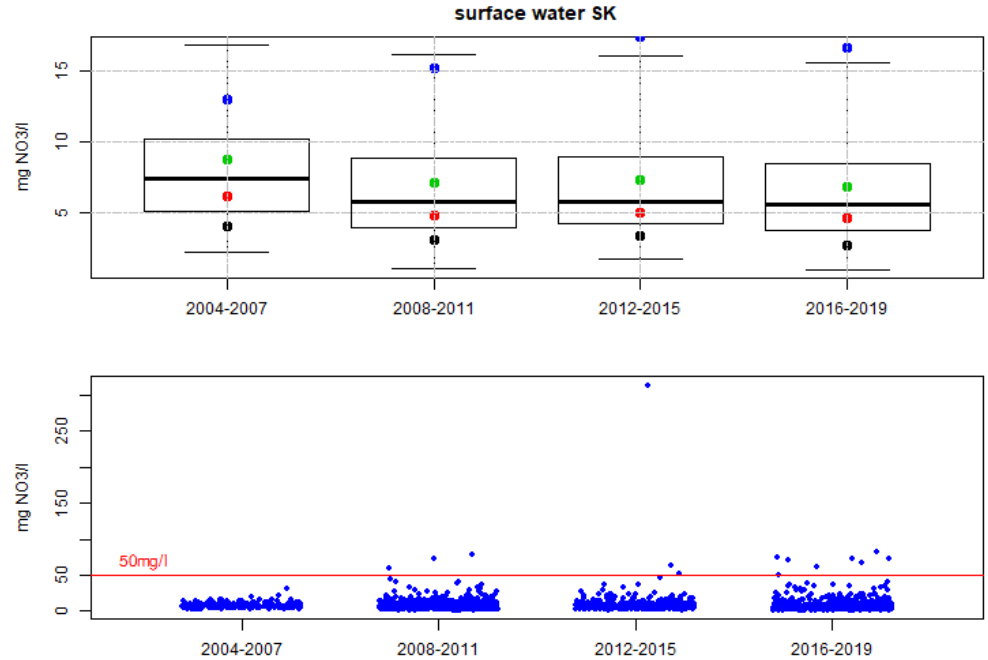


Figure 20. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period, for surface water stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

Conclusions and recommendations

Slovakia has a low livestock density, a low surplus of nitrogen and a high deficit for phosphorus.

There is a well-elaborated network of monitoring stations. The groundwater quality is generally good. However, there are a number of hotspots, with a nitrate concentration above 50 mg/l and/or increasing trend. A number of surface waters are eutrophic or are at risk to become eutrophic.

A number surface waters found to be eutrophic are located outside the NVZ.

The action programme was revised in 2019.

The Commission recommends Slovakia to verify the designation of NVZ considering that not all the surface waters found to be eutrophic are included in the NVZ.