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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

Croatia's utilized agricultural area amounts to 1.5 Mha, representing 27.6% of the total land area and has increased by 18.8% since 2013. The major outputs of the agricultural industry include in a decreasing order cereals (17.1%), industrial crops (10.3%) and forage plants (9.4%).

Eurostat

Major land use statistics for Croatia

Table 1.Utilized agricultural area (abbreviated as UAA)

Croatia	2005	2007	2010	2013	2016
Utilised agricultural area UAA (1000 ha)	NA	1202	1334	1301	1546
arable land (1000 ha)	NA	847	900	875	872
permanent grass (1000 ha)	NA	270	345	350	600
permanent crops (1000 ha)	NA	80	84	73	72
kitchen gardens (1000 ha)	NA	5	5	NA	2

Note:

Eurostat (FSS)

Croatia's arable land has remained stable since 2013. The permanent grass land area has increased by 55% since 2007.

Animal distribution in Croatia

Table 2. Livestock statistics

Croatia	2005	2007	2010	2013	2016
Livestock index	NA	0.90	0.78	0.55	0.48
dairy cows (10^6 heads)	NA	0.22	0.21	0.17	0.15
live bovines (10^6 heads)	0.47	0.47	0.44	0.44	0.44
live pigs (10^6 heads)	1.21	1.35	1.23	1.11	1.16
live poultry (10^6 heads)	NA	NA	13.47	13.63	10.39

Note:

Eurostat (FSS)

Croatia's has seen a decrease in all livestock. The livestock density index has continued its steady decrease since 2007. It is below the EU average of 0.8 since 2010.

European Commission

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

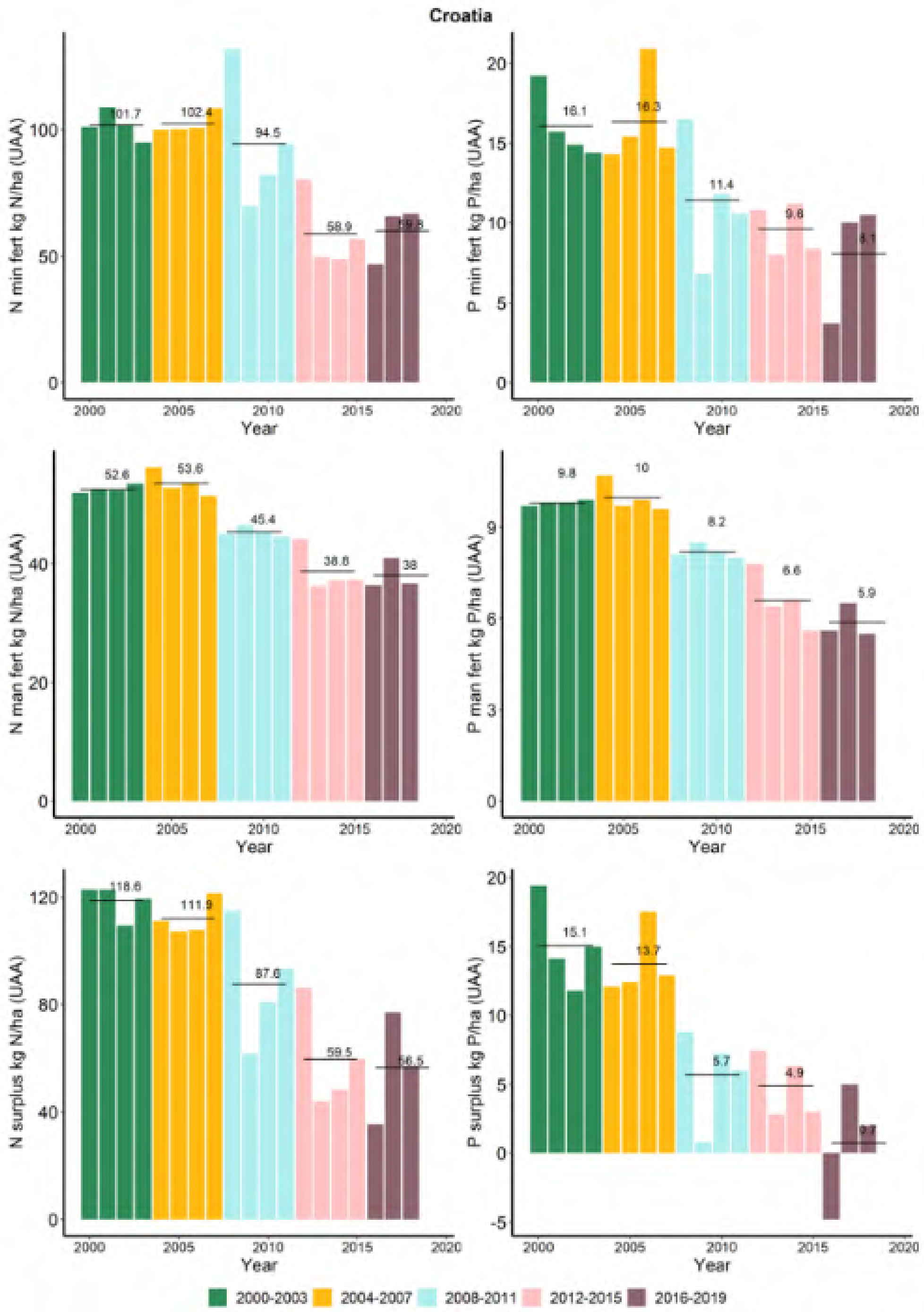


Figure 1. N and P fertilizers and gross surplus (kg/ha)

Nitrogen and phosphorus fertilizer and gross surplus data originate from EUROSTAT data for the years 2000-2017. Data for year 2018 have been retrieved from the Croatian Bureau of Statistics. The consumption of inorganic nitrogen and phosphorus has decreased since the 2004-2007 reporting period. Both nitrogen and phosphorus from manure have decreased since the 2004-2007 reporting period. Both the nitrogen and phosphorus surpluses continue to decrease since the 2000-2003 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

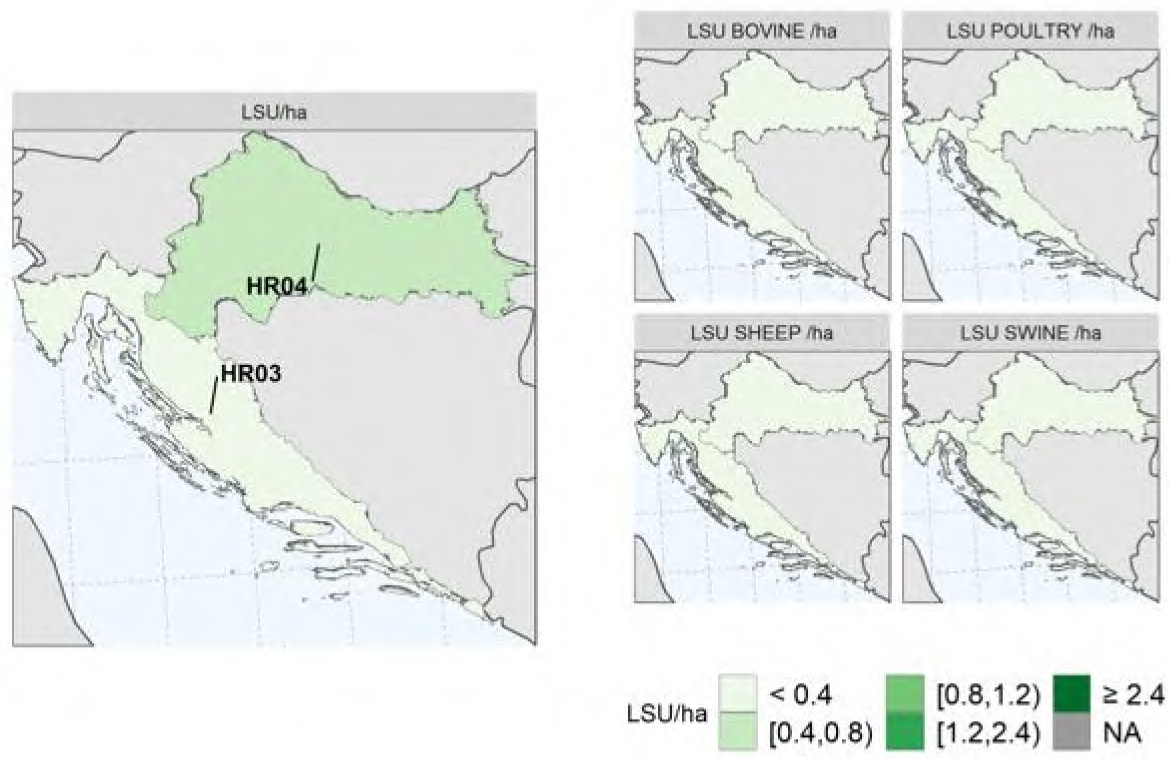


Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production density is low for all animal types (total LSU and LSU by animal type were retrieved individually from EUROSTAT, year 2016, February 2021).

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 legal basis, as well as the scope, type and methodology of water testing in Croatia are laid down in the Water Act (NN No 66/19) and in the Decree establishing water quality standards (NN No 96/2019). Monitoring is the responsibility of Croatian Waters, in line with a monitoring plan adopted by that agency.

Water monitoring in vulnerable zones is conducted as part of surveillance and operational monitoring and focuses on indicators in surface and groundwater, in accordance with the "status and trends of aquatic environment and agricultural practice" guide. Nitrates in groundwater are tested less frequently than in surface waters. Samples are collected in the shallower and deeper parts of unconfined and confined aquifers.

For groundwater measurements, some stations have same coordinates due to different depths. 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

		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	0	68	85	0	0	79
1a	Phreatic groundwater (deep) 5-15 m	0	33	25	0	0	25
1b	Phreatic groundwater (deep) 15-30 m	0	6	6	0	0	6
1c	Phreatic groundwater (deep) >30 m	0	7	3	0	0	3
2	Captive groundwater	0	1	1	0	0	0
3	Karstic groundwater	0	11	12	0	0	10
9	Not specified	0	0	0	0	0	0
	Total	**0**	**126**	**132**	**0**	**0**	**123**

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	0	60	71	0	0	60	0	60	71
5	Lake/reservoir water	0	4	4	0	0	4	0	4	4
6	Transitional water	0	0	6	0	0	0	0	0	6
7	Coastal water	0	0	5	0	0	0	0	0	5
8	Marine water	0	0	0	0	0	0	0	0	0
9	Not specified	0	0	0	0	0	0	0	0	0
	Total	**0**	**64**	**86**	**0**	**0**	**64**	**0**	**64**	**86**

Groundwater Quality

Groundwater average annual nitrate concentration

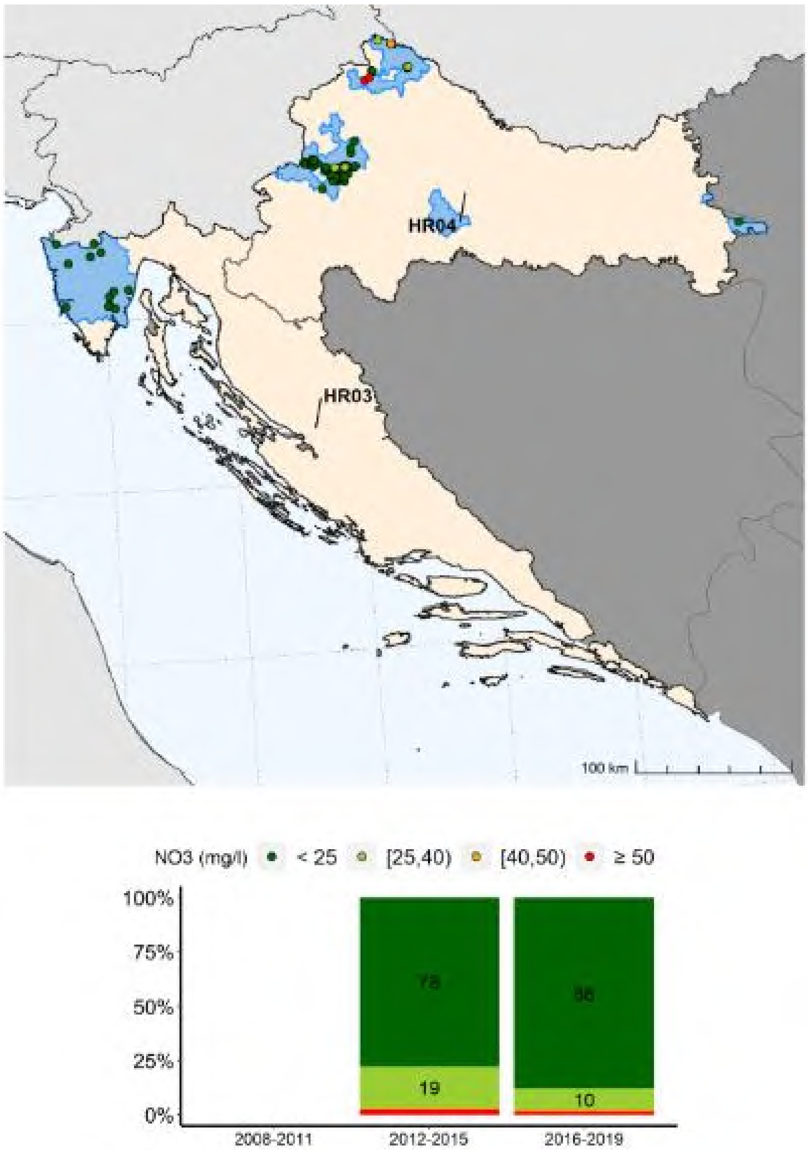


Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

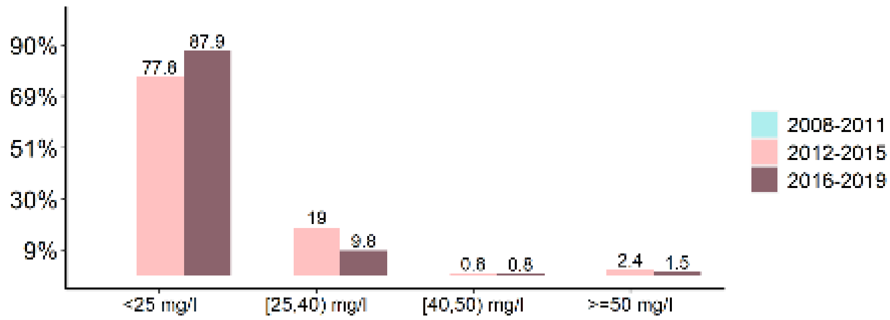


Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis). *

Groundwater average annual nitrate concentration trend

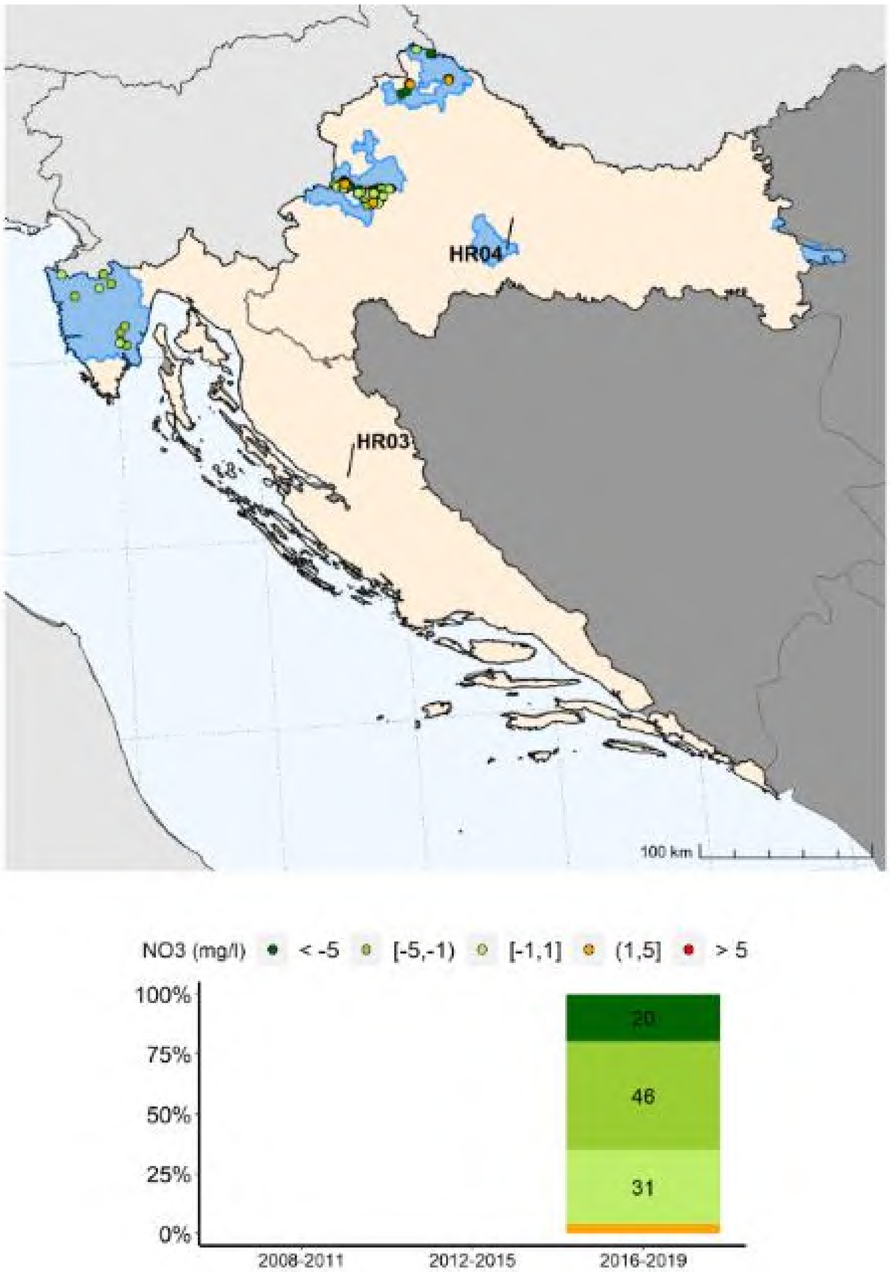


Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

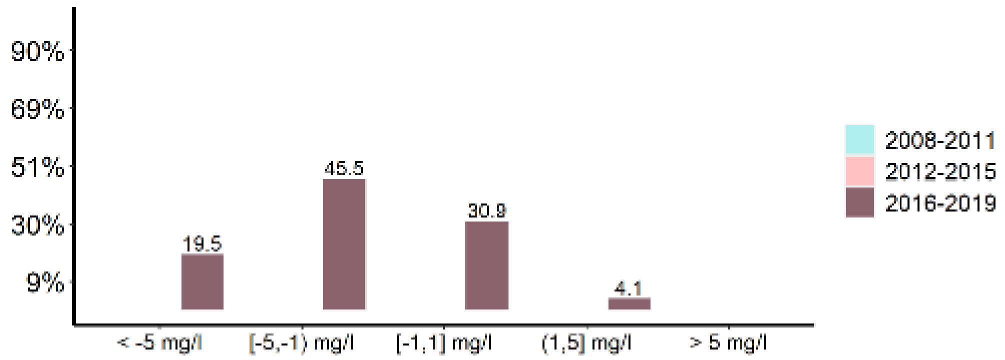


Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Groundwater hotspot

NO3 (mg/l) [40,50) incr. trend InNVZ [40,50) incr. trend OutNVZ ≥ 50 InNVZ ≥ 50 OutNVZ

		>=40 and < 50 mg/l incr.trend		>=50 mg/l	
NUTS ID	NUTS NAME	InNVZ	OutNVZ	InNVZ	OutNVZ
HR04	Kontinentalna Hrvatska	0	0	2	0
	Total	**0**	**0**	**2**	**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 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	1	1	0
1a	Phreatic groundwater (deep) 5-15 m	0	0	0
1b	Phreatic groundwater (deep) 15-30 m	0	0	0
1c	Phreatic groundwater (deep) >30 m	0	0	0
2	Captive groundwater	1	1	0
3	Karstic groundwater	1	1	0
9	Not specified	0	0	0
	Total	**3**	**3**	**0**

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

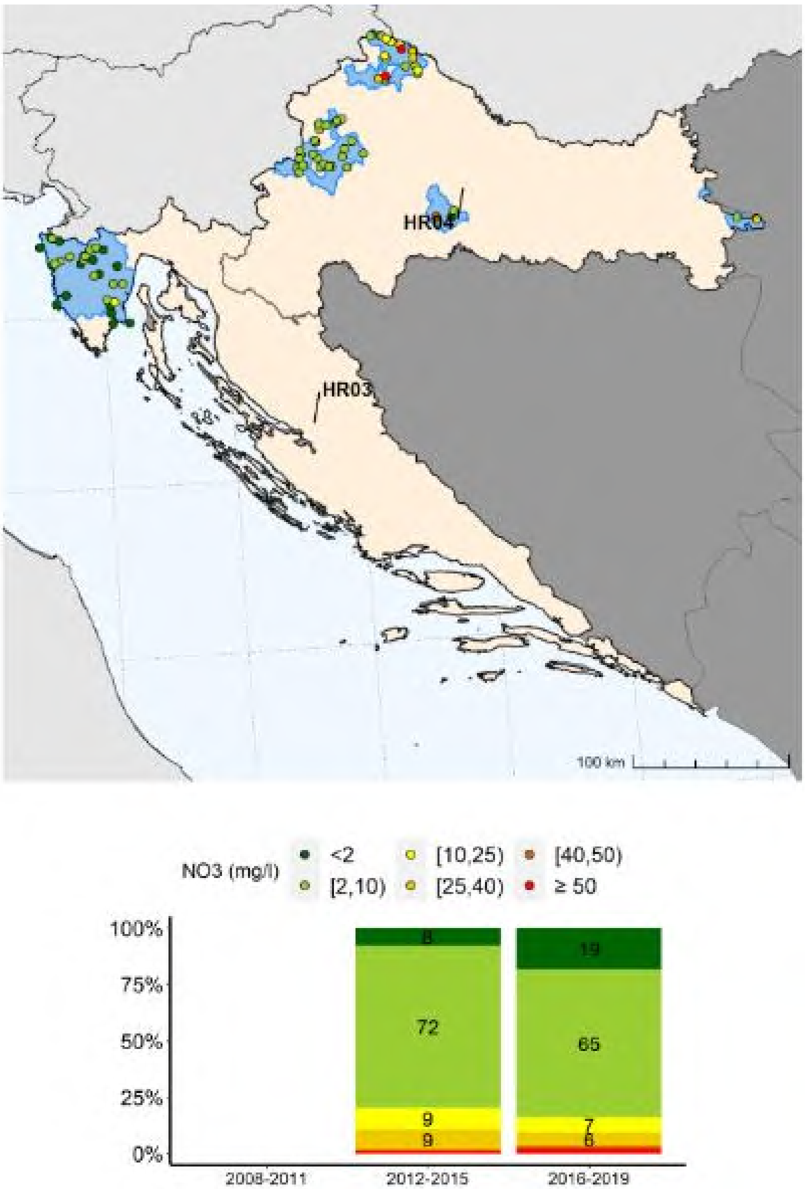


Figure 9. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

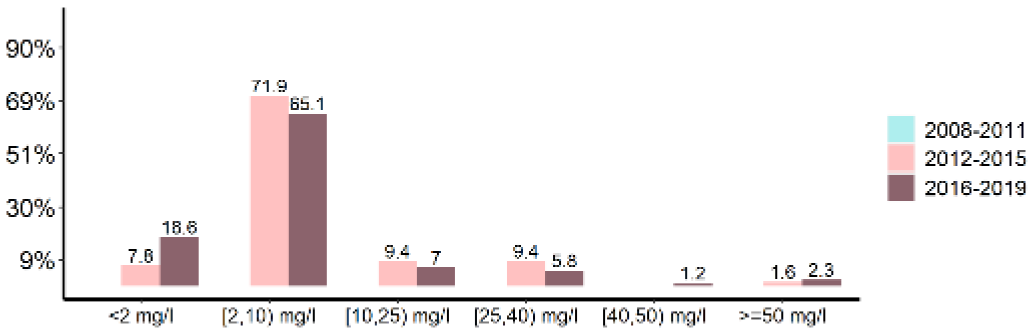


Figure 10. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Surface water average annual nitrate concentration trend

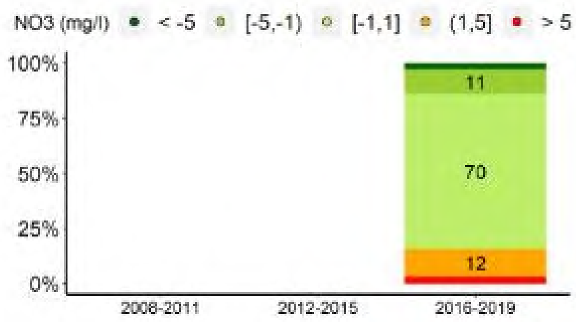


Figure 11. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). In the map in blue the NVZ.

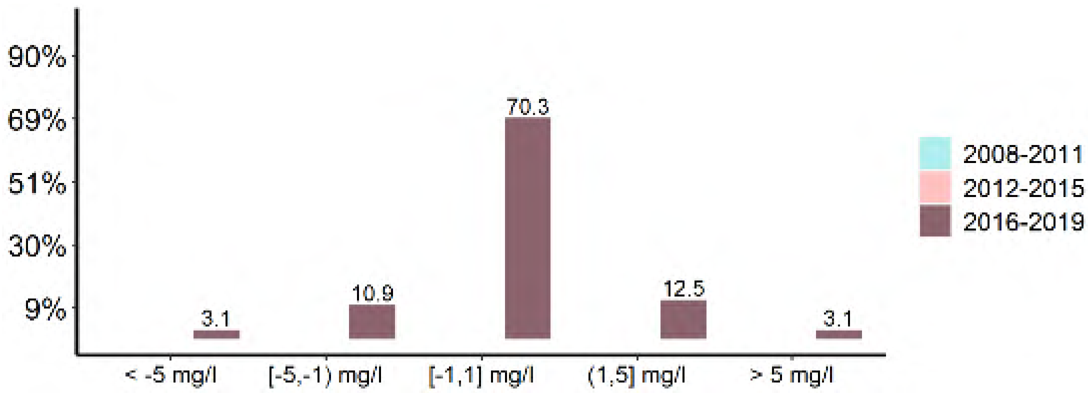


Figure 12. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Surface Water Eutrophication

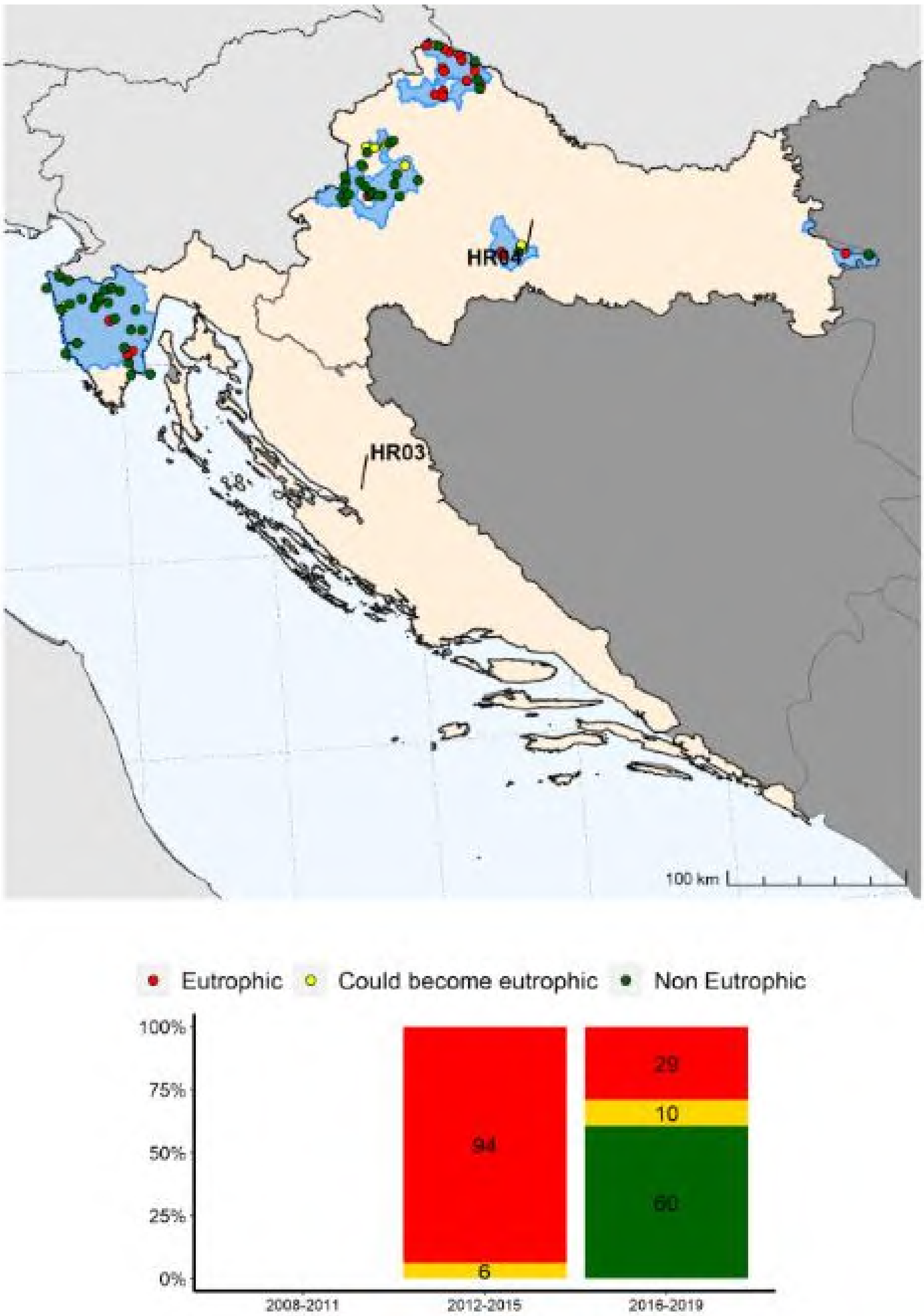


Figure 13. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis). In the map in blue the NVZ.

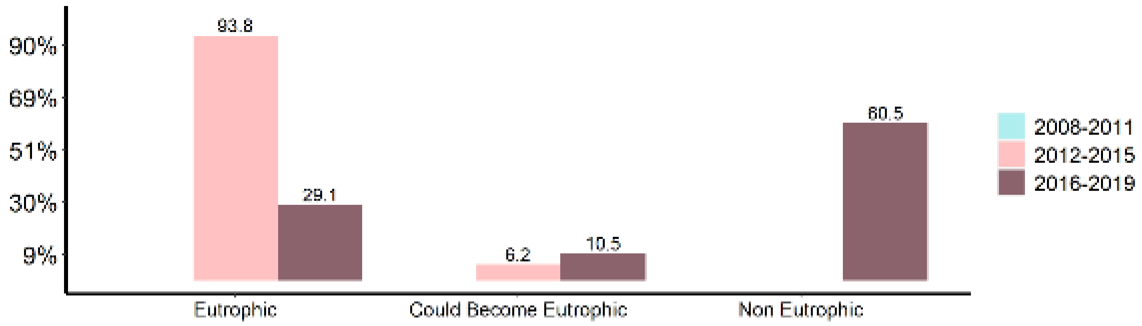
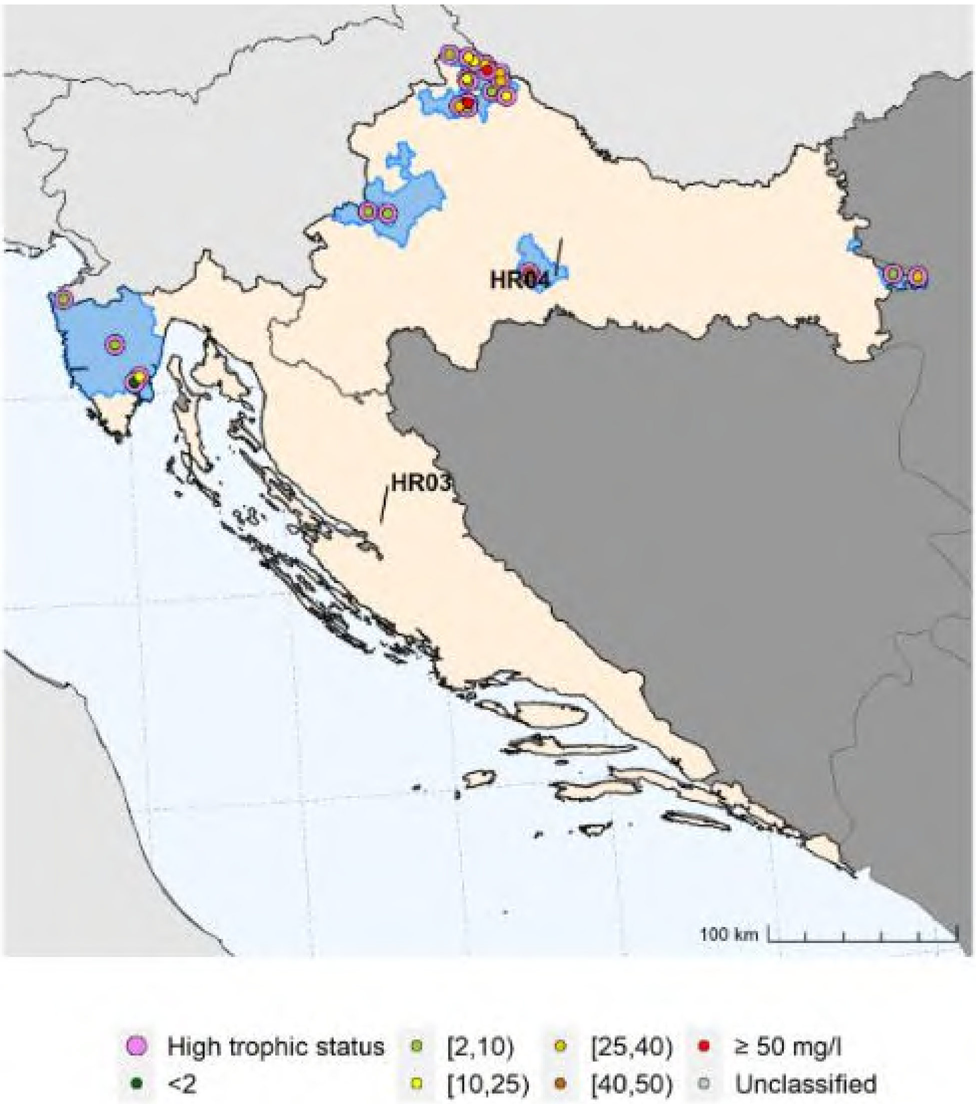


Figure 14. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis)

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
HR03	Jadranska Hrvatska	2	0	1	1	0	0	0	0
HR04	Kontinentalna Hrvatska	21	0	8	5	5	1	2	0
NO_NUTS	SALINE	2	1	1	0	0	0	0	0
	Total	**25**	**1**	**10**	**6**	**5**	**1**	**2**	**0**

Figure 15. The SW monitoring stations with eutrophic status versus the average NO3 annual concentration. In the map in blue the NVZ. The "high trophic status" refers to Eutrophic status.

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 highest trophic status and the corresponding stations by classes of NO3 concentration. Only the NUTS of interest are reported.

The indicators of eutrophication for rivers are nitrate, total phosphorus and chlorophyll a, while lake-related indicators are total phosphorus and chlorophyll a.

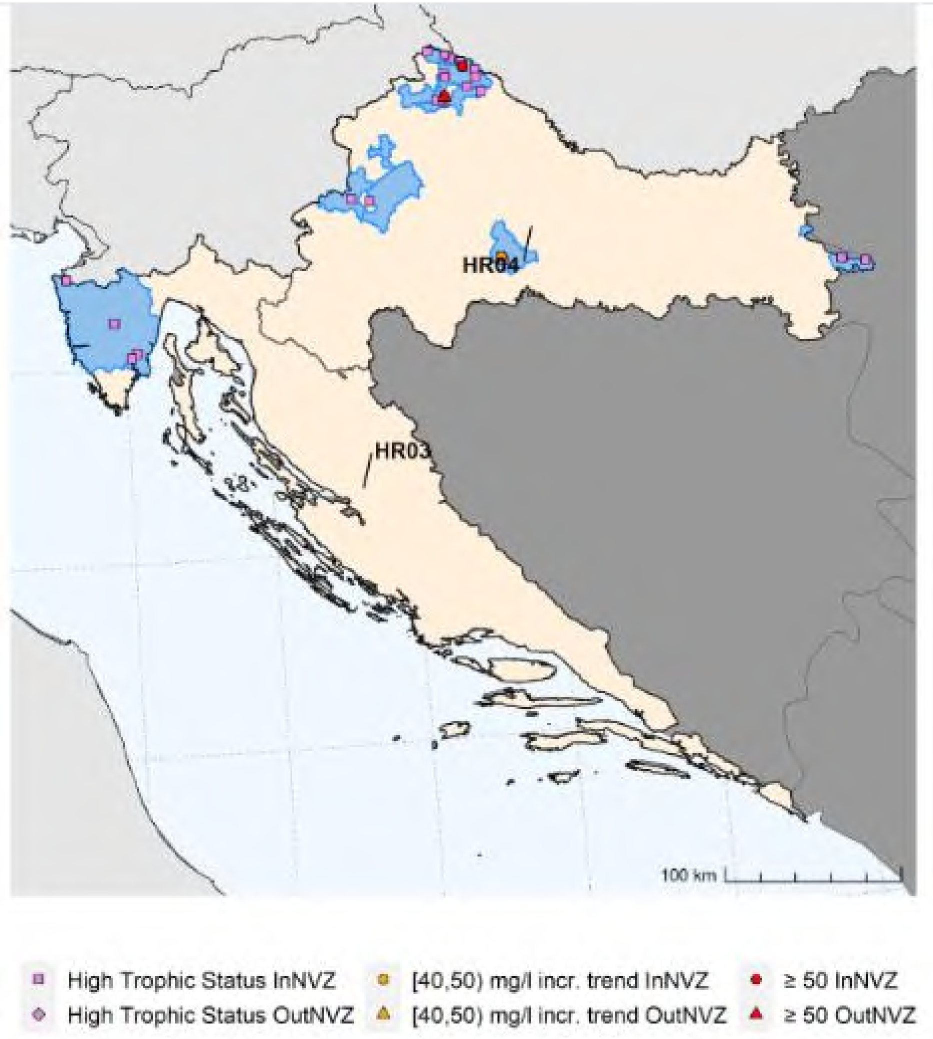
It is noteworthy that the Faculty of Science of the University of Zagreb launched a study on the development of criteria for determining the trophic degrees of lakes and rivers water bodies. The study served as the basis for the assessment of river eutrophication in vulnerable zones in this reporting period. The approach and the classification system applied in the study will be incorporated into the Decree establishing water quality standards to be used in the development of the River Basins Management Plan 2022 - 2027.

Given that there are two clearly distinct biogeographical regions in Croatia, namely the Pannonian and the Dinaric ecoregions, the limits used to determine the trophic degree of rivers waters are split into two groups. Both indicators (total nitrogen and total phosphorus) are examined together in the assessment of the trophic status. Where the trophic degree of the two indicators differs, the assessment is made based on the less favourable indicator.

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	23	8	40
5	Lake/reservoir water	0	0	4
6	Transitional water	2	1	3
7	Coastal water	0	0	5
8	Marine water	0	0	0
9	Not specified	0	0	0
	Total	**25**	**9**	**52**

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
HR03	Jadranska Hrvatska	2	0	0	0	0	0
HR04	Kontinentalna Hrvatska	20	1	1	0	1	1
NO_NUTS	SALINE	2	0	0	0	0	0
	Total	**24**	**1**	**1**	**0**	**1**	**1**

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 "high trophic status" refers to Eutrophic 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 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.

Measures in the Action Programme

The First Action Programme for the protection of waters against pollution caused by nitrates from agricultural sources (NN No 15/13) was adopted in accordance with Article 5 of Council Directive 91/676/EEC. The Action Programme, which entered into force on the date of Croatia's accession to the European Union, covers a period of four years from the date of its entry into force.

In 2017, the Second Action Programme for the protection of waters against pollution caused by nitrates from agricultural sources (NN No 60/17) was adopted for a period of four years. It entered into force on 1 July 2017.It is noteworthy that in accordance with the provisions of Article 5(4) of the Nitrates Directive, the Second Action Programme sets the new limit values for the application of nitrogen from livestock manure at 170 kg N/ha per year, compared to 210 kg N/ha per year in the First Action Programme. See details in the table below.

The conditions and measures laid down in the Programme are binding on agricultural holdings with agricultural land and/or facilities located within the areas designated as nitrates vulnerable zones under the Decision NN No 130/12. The conditions and measures laid out in the Programme are considered as recommendations for agricultural holdings with agricultural land and/or facilities outside nitrates vulnerable zones. The details of the Action Programme are reported in Table 6.

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

Table 6. Details of Action Programme

Measure	General details in Action Programme (*)
Period of prohibition of fertiliser application	• Fertilisation with slurry and liquid manure on any part of the agricultural land irrespective of the soil cover between 15 September and 15 February (Article 10 of AP)
	• Fertilisation with slurry and liquid manure by spreading it on the surface of the soil without input into the soil on any part of agricultural land between 1 May and 1 September (Article 10 of AP)
Restrictions for application on sloped soils	• Prohibited on sloping ground in proximity to watercourses with an angle of more than 10%, at less than 10 m from the outer edge of the bed of a watercourse (Article 11 of AP)
Restrictions for application on soaked, frozen, or snow-covered soils	• Prohibited on water-saturated, snow-covered, frozen and flooded soil (Article 11 of AP)
Restrictions for application near watercourses (buffer strips)	• > 20 m from the outer edge of the bed of a lake or other standing water body
	• > 3 m from the outer edge of the bed of a watercourse 5 m wide or wider
Effluent storage works	• In Table 4. of the II. Action Programme the requirement for manure storage vessels is prescribed according to the type of the farm animal and type of manure
Capacity of manure storage	• The storage capacity is prescribed for the 6 months period. The period for manure storing is not prescribed. However, it is recomended to use composted manure on agricultural soil (Article 13 of AP)
	• The size of storage vessels for livestock manure depends on the type of farm animal and the form of livestock manure (Article 13 of AP)
Rational fertilisation (e.g., splitting fertilisation, limitations)	• Limit values and calculation of the annual nitrogen input into soil (Article 9 of AP)
	• Maximum amount of livestock manure permitted by type of livestock manure (Table 2 of the AP Annex). The chemical analysis of livestock manure for the following parameters is carried out at least twice a year, prior to the application of livestock manure on agricultural land
Crop rotation, permanent crop enhancement	• Planned crop rotation
Vegetation cover in rainy periods, winter	• A minimum amount of vegetation cover should be maintained
Fertilisation plans, spreading records	• Fertilisation plan drawn up taking into consideration the requirements of the plant and the properties of the soil and fertilise
Other measures	• Other preventive measures are listed in Article 8 of AP
Date for application limit of 170 kg N/ha/year:	• 1 July 2017

(*) Second Action Programme for the protection of waters against pollution caused by nitrates from agricultural sources (NN No 60/17)

Controls

Agricultural producers are subject to the inspection of compliance with the provisions the Action Programme within the scope of the Water Act and to the control of cross-compliance with SMR1 and GAEC1 rules. During the current reporting period, an average of 27% of the farmers located in vulnerable zones, or a group of vulnerable zones, were subjected to administrative inspection.

Designation of NVZ

Under the Decision designating vulnerable zones in the Republic of Croatia (NN No 130/2012), the zones designated as being vulnerable to nitrates account for around 10% of Croatia's total land area. The NVZ area did not change with respect to the previous report period and it is about 5090 km^2.

Forecast of Water Quality

The effects of climate change, which are already identifiable and measurable, make it difficult to predict the future quality of surface waters and groundwater. A study interpreting the analysis of climate change for the purposes of water management planning conducted by the Croatian Meteorological and Hydrological Service[1] predicts a greater increase in temperature in the Adriatic river basin district during the warm months (April-November) than in the territory of the River Sava sub-basin, as well as those of the River Drava and the River Danube sub-basin. During the cold season, river sub-basin districts in inland areas will experience higher temperatures, with those in the River Sava sub-basin exceeding those in the sub-basin of the River Drava and the River Danube.

Also, precipitation in the warm season is expected to fall, more so in the south of the country than in the north, while northern parts of the country are likely to see more pronounced precipitation than southern ones in the colder season.

Given that the expected effects of climate change on water regime point to greater vulnerability of water resources to water pollution, and thus to water pollution caused by nitrates from agricultural sources, a revision of vulnerable zones will be undertaken in the next period, taking into account increased risks associated with the synergies between climate change and agricultural practice.

[1] https://www.voda.hr/sites/default/files/dokumenti/interpretacija_analize_klimatskih_promjena_za_planske_potrebe_upravljanja_vodama.pdf

Summary

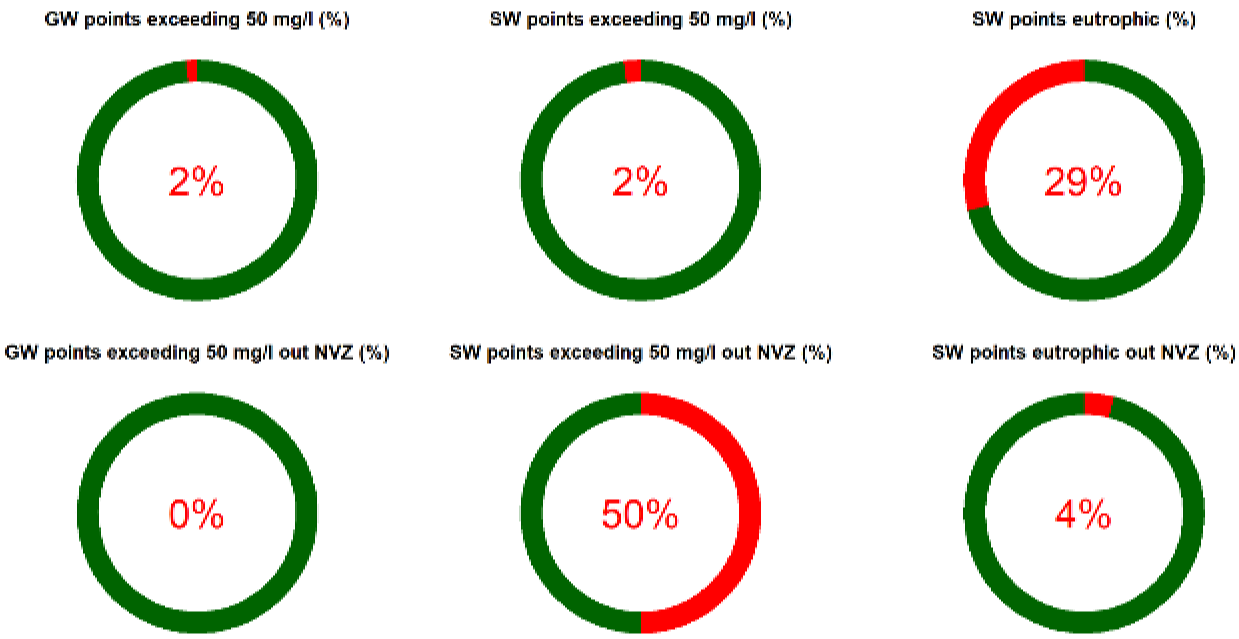


Figure 17. The summary plot for the period 2016-2019

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 (one station in this case) with respect to the total of stations exceeding 50 mg/ (two stations in this case), and the percentage of SW eutrophic stations that are outside NVZ with respect to the total that are eutrophic.

Long term analysis

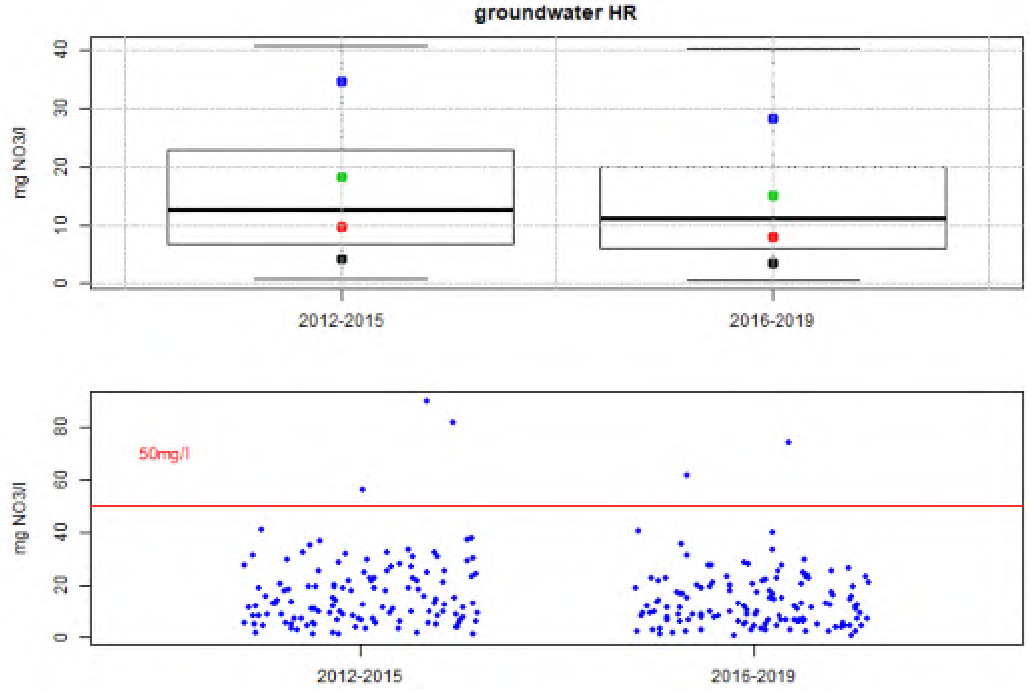


Figure 18. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for groundwater stations. RPs represent the reporting periods, RP7 being the last period (2016-2019). The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

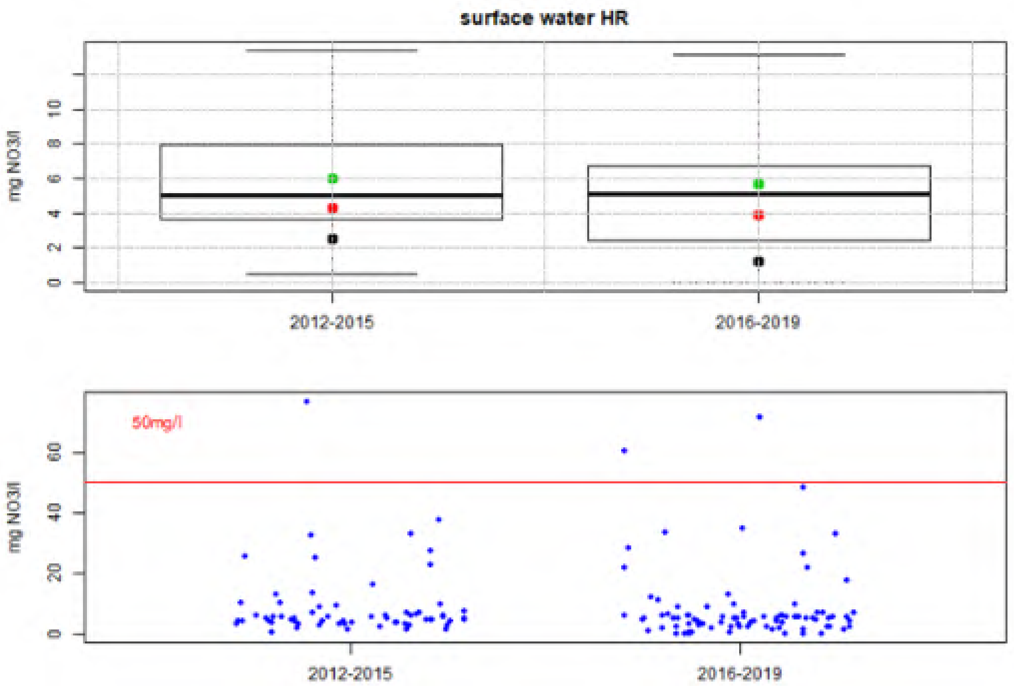


Figure 19. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for surface water stations. RPs represent the reporting periods, RP7 being the last period (2016-2019). The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

Conclusions and recommendations

Croatia has a low livestock density, the surplus of nitrogen is about the EU average, while there is a low surplus of phosphorus.

There is a well-elaborated network of monitoring stations in NVZ, but no monitoring station outside these NVZs. The groundwater quality is generally good. However, a high number of surface waters are eutrophic.

A revised action programme was published in 2017.

The Commission recommends Croatia to expend its water monitoring network to include monitoring stations outside NVZ in order to follow possible nitrates pollution development in these zones.