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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



Cyprus's utilised agricultural area amounts to $112 \cdot 10^3$ ha, representing 12.1% of the total land area and has remained stable since 2007. The outputs of the agricultural industry are largely dominated by milk (25.1%).

Eurostat

Major land use statistics for Cyprus

Table 1.Utilized agricultural area (abbreviated as UAA)

Cyprus	2005	2007	2010	2013	2016
Utilised agricultural area UAA (1000 ha)	NA	150	115	107	112
arable land (1000 ha)	NA	112	83	79	84
permanent grass (1000 ha)	NA	2	2	2	1
permanent crops (1000 ha)	NA	35	30	26	26
kitchen gardens (1000 ha)	NA	0	0	0	0

Note:

Eurostat (FSS)

Arable land increased by 6% from 2013. The permanent grass area has decreased by 50% since 2013. The area dedicated to permanent crops has decreased by 25.7% since 2007.

Animal distribution in Cyprus

The number of dairy cows has increased while the number of live pigs continued its steady decrease since 2007. The livestock density index is at its lowest since 2006. However, it is higher than the EU average of 0.8.

Table 2. Livestock statistics

Cyprus	2005	2007	2010	2013	2016
Livestock index	1.61	1.69	1.70	1.60	1.54
dairy cows (10^6 heads)	0.02	0.02	0.02	0.02	0.03
live bovines (10^6 heads)	0.06	0.06	0.06	0.06	0.06
live pigs (10^6 heads)	0.43	0.47	0.46	0.36	0.35
live poultry (10^6 heads)	NA	NA	3.22	1.85	2.60

Note:

Eurostat (FSS)

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

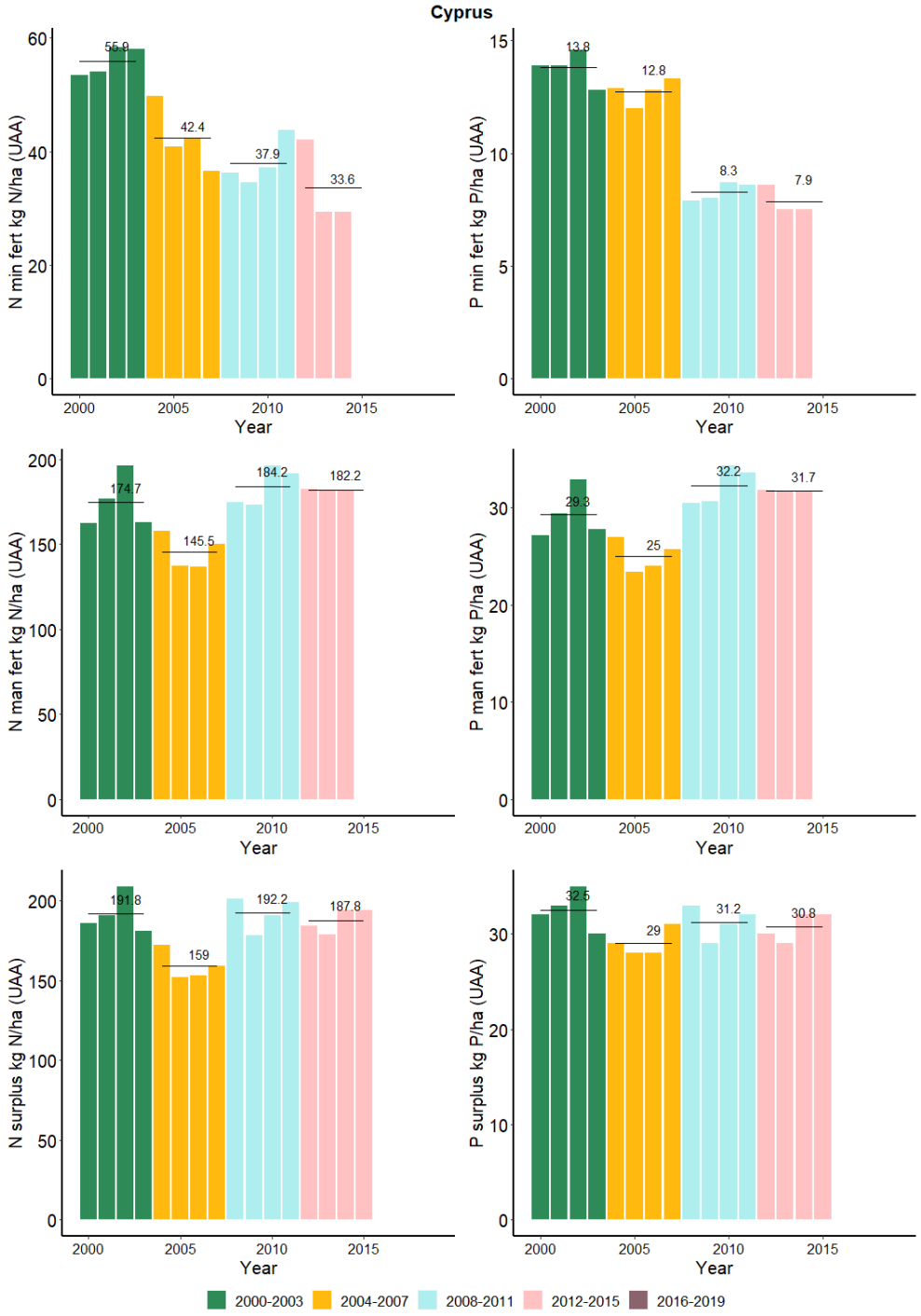


Figure 1. N and P fertilizers and gross surplus (kg/ha)

The gross nitrogen and phosphorus surpluses originate from EUROSTAT data for the years 2000-2015. The use of inorganic nitrogen and phosphorus fertilizers has decreased for the three previous reporting periods covering the years 2000-2015. The usage of manure has remained from the last reporting period. The nitrogen surplus decreased for the 2012-2015 reporting period by 2%. The phosphorus surplus remains stable around 30 kg/ha. 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

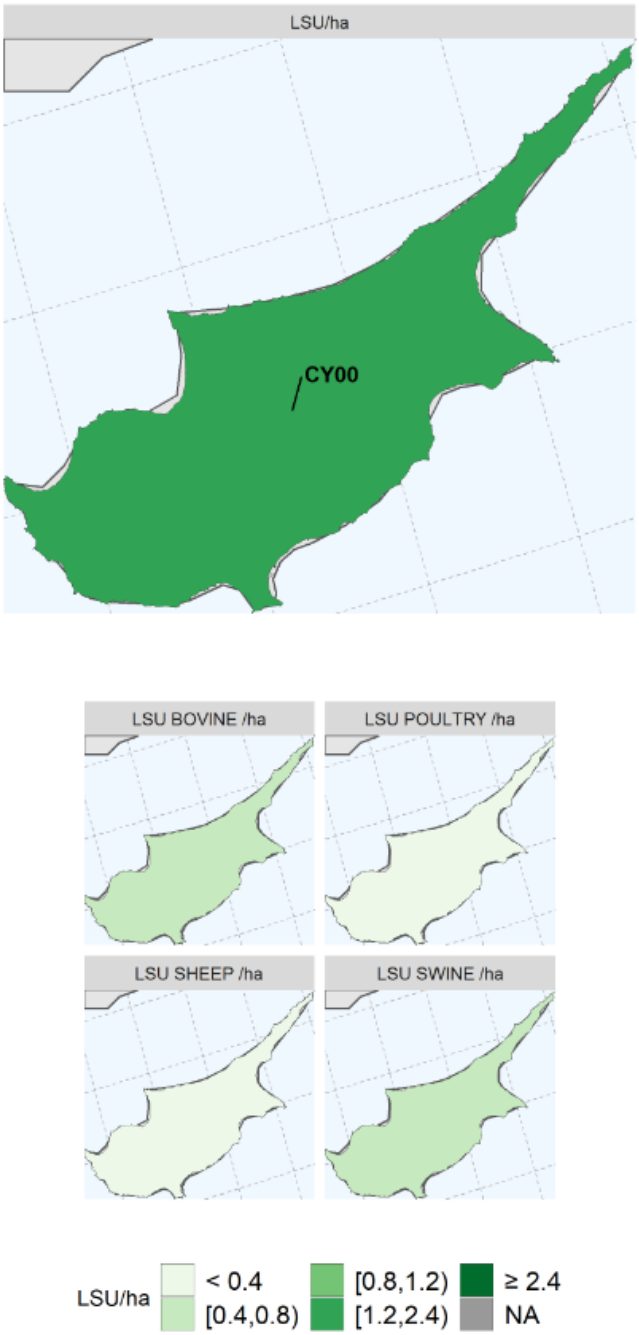


Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production is mostly dominated by bovine and swine breeding (total LSU and LSU by animal type where 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

It must be noted that the Directive applies only in the areas of the Republic of Cyprus in in which the Government of the Republic of Cyprus exercises effective control and in the areas of the British Sovereign Bases. There were changes in the groundwater monitoring network due to the restructuring of the network that started early during this reporting period. No changes were reported for the surface and coastal waters monitoring.

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	0	3	0	0	0
1a	Phreatic groundwater (deep) 5-15 m	2	5	15	0	3	2
1b	Phreatic groundwater (deep) 15-30 m	61	57	57	58	56	51
1c	Phreatic groundwater (deep) >30 m	39	38	35	34	32	33
2	Captive groundwater	44	48	116	34	45	100
3	Karstic groundwater	3	4	15	0	3	5
9	Not specified	95	78	0	95	71	0
	Total	**244**	**230**	**241**	**221**	**210**	**191**

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	10	13	13	10	10	13	0	11	13
5	Lake/reservoir water	0	0	0	0	0	0	0	0	0
6	Transitional water	0	0	0	0	0	0	0	0	0
7	Coastal water	0	16	16	18	16	16	0	0	16
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	**10**	**29**	**29**	**28**	**26**	**29**	**0**	**11**	**29**

Groundwater Quality

Groundwater average annual nitrate concentration

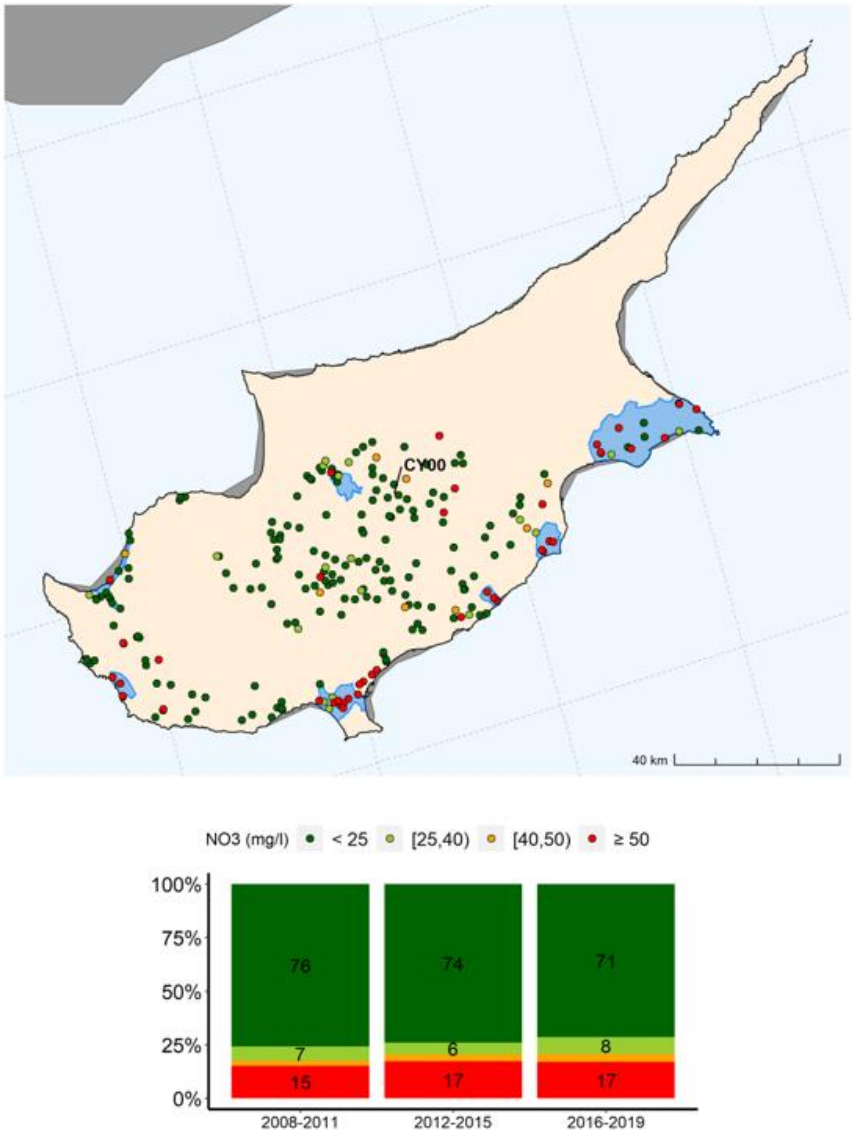


Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

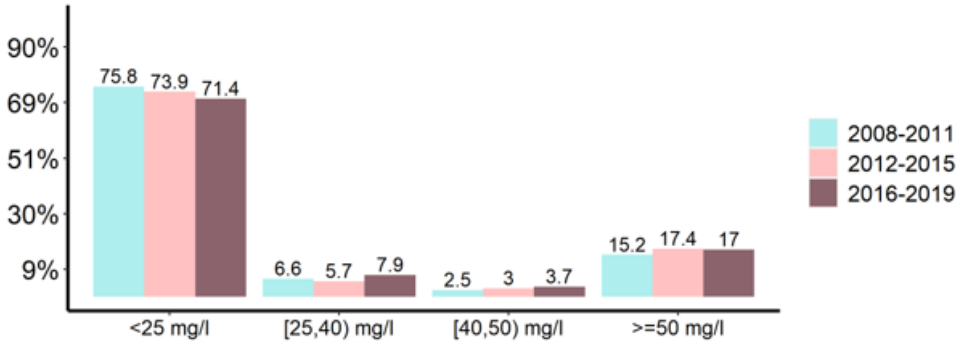


Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Groundwater average annual nitrate concentration trend

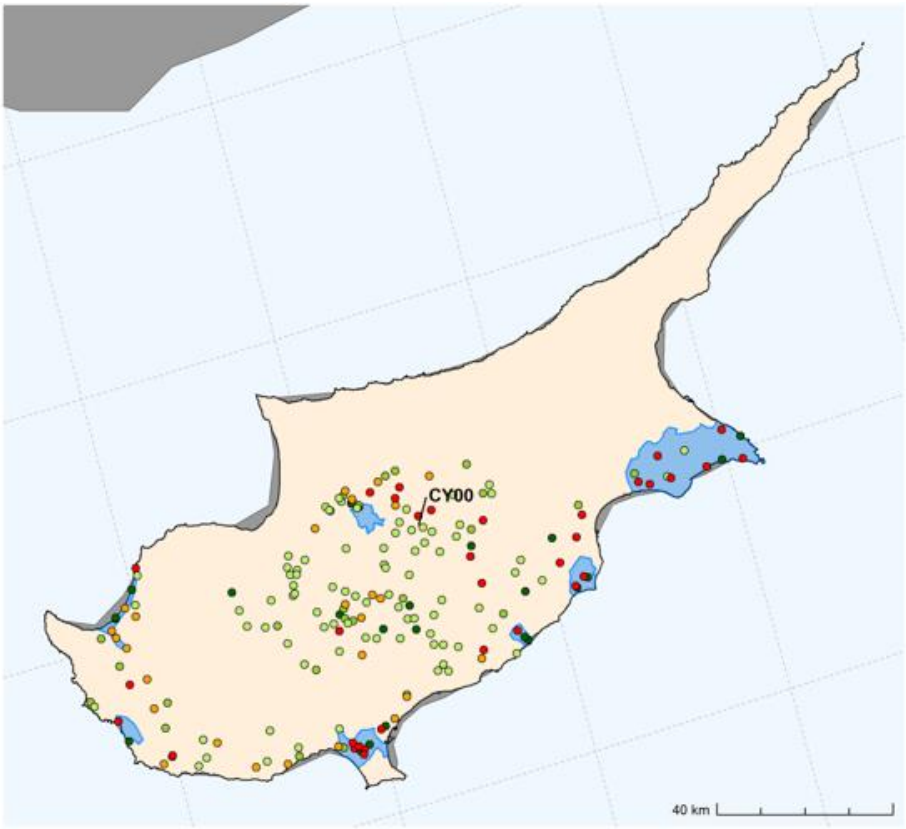


Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). In the map in blue the NVZ.

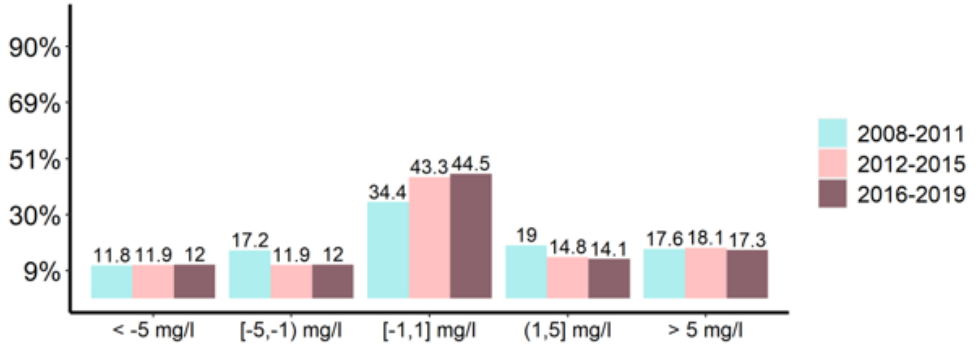
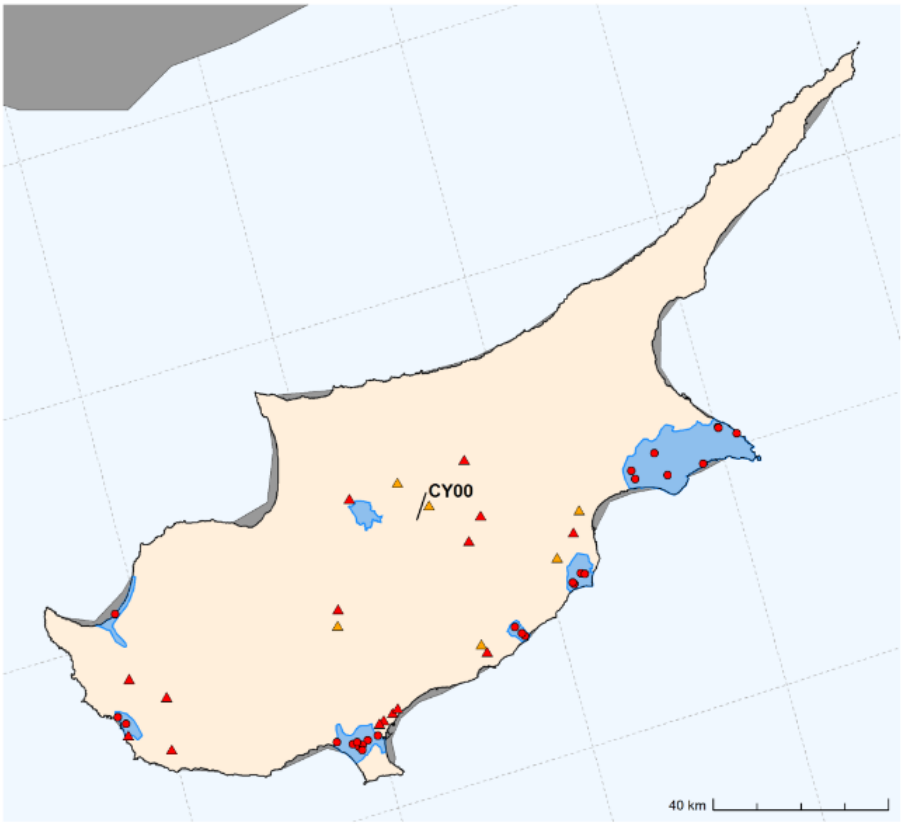


Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Groundwater hotspot

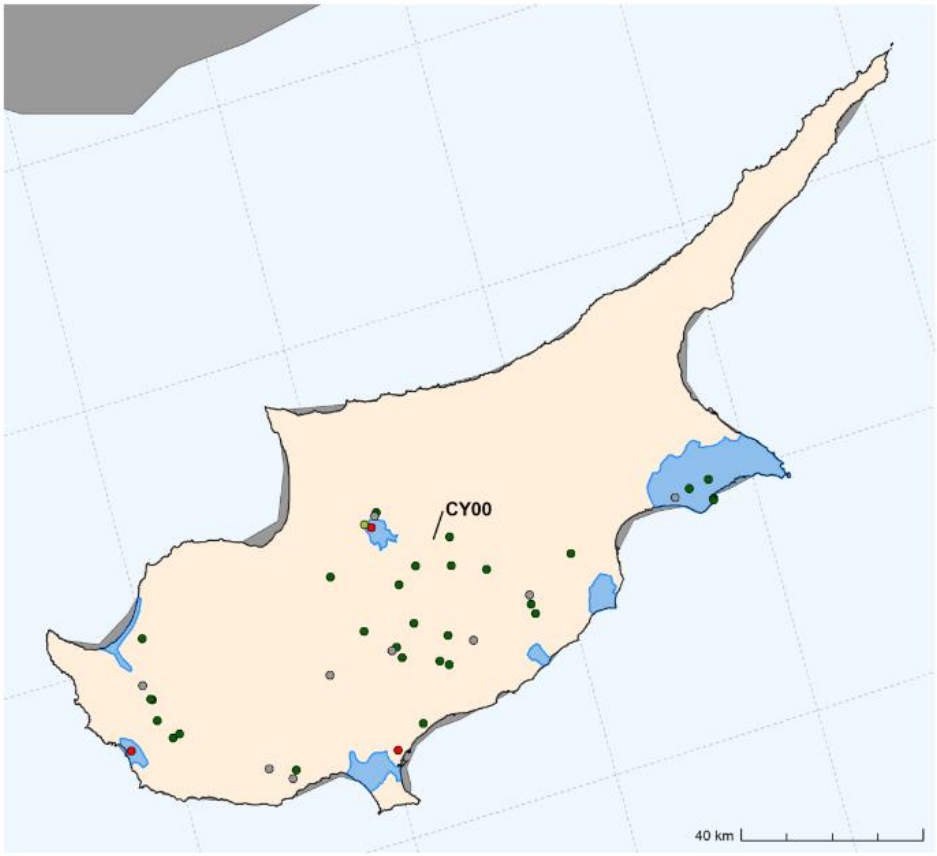


		>=40 and < 50 mg/l incr.trend		>=50 mg/l	
NUTS ID	NUTS NAME	InNVZ	OutNVZ	InNVZ	OutNVZ
CY00	Kýpros	0	6	26	15
	Total	**0**	**6**	**26**	**15**

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	0	0	0
1a	Phreatic groundwater (deep) 5-15 m	3	3	2
1b	Phreatic groundwater (deep) 15-30 m	6	5	5
1c	Phreatic groundwater (deep) >30 m	6	4	4
2	Captive groundwater	27	21	20
3	Karstic groundwater	0	0	0
9	Not specified	0	0	0
	Total	**42**	**33**	**31**

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

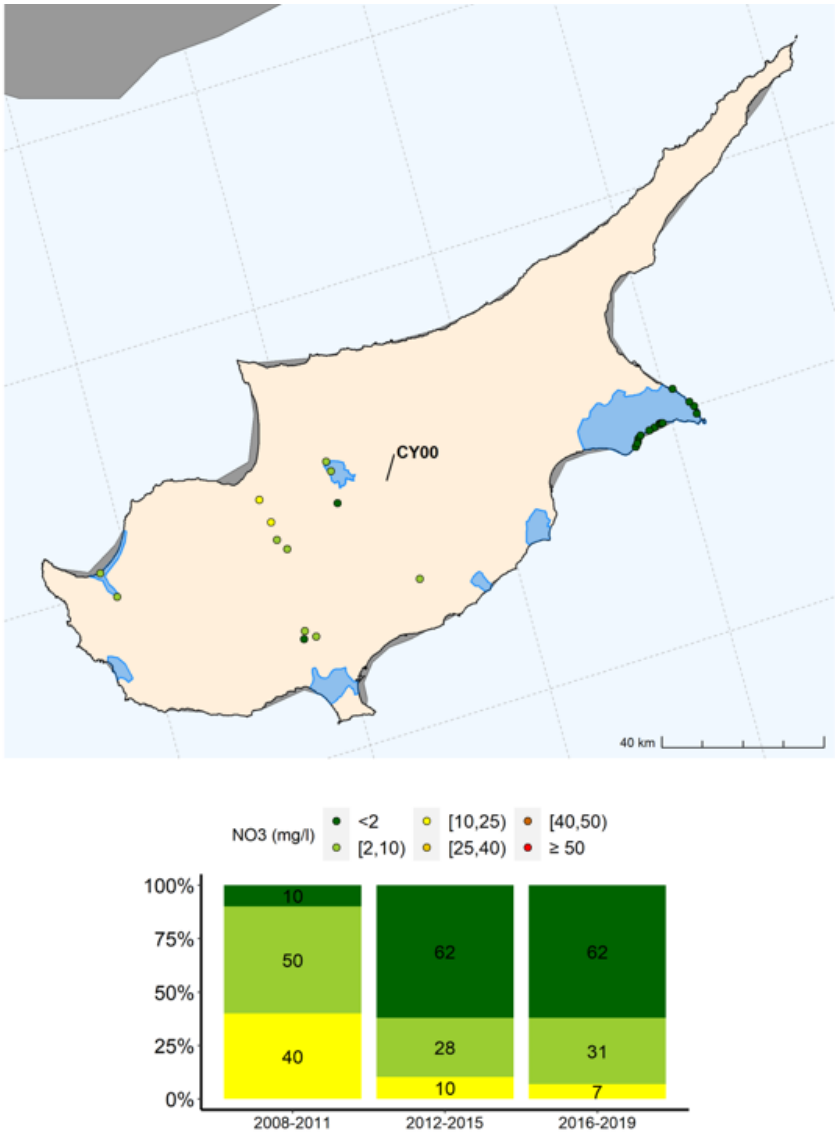


Figure 9. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). In the map in blue the NVZ.

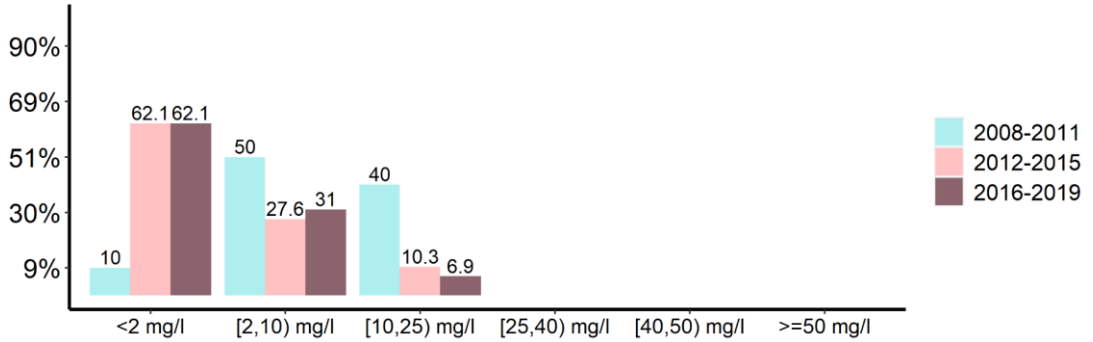


Figure 10. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

Surface water average annual nitrate concentration trend

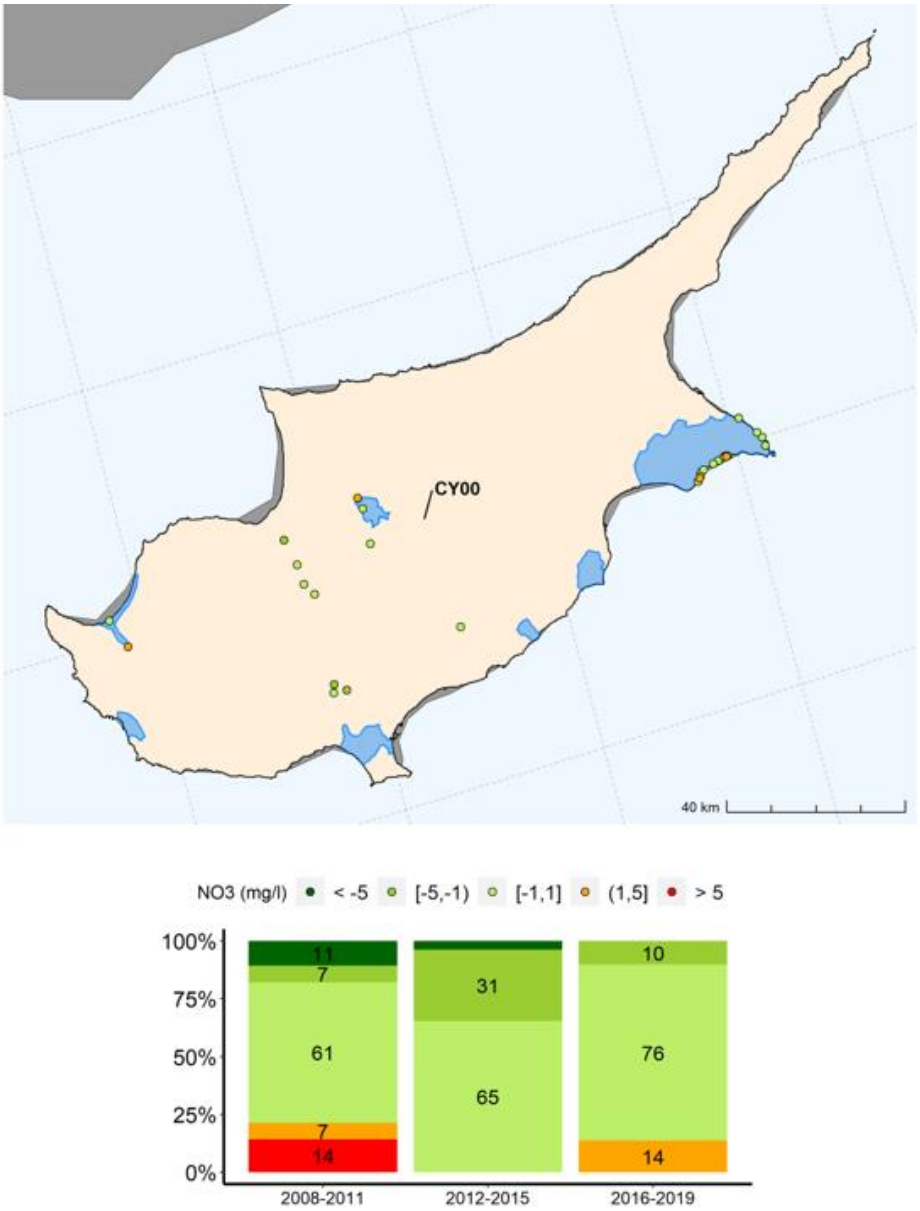


Figure 11. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

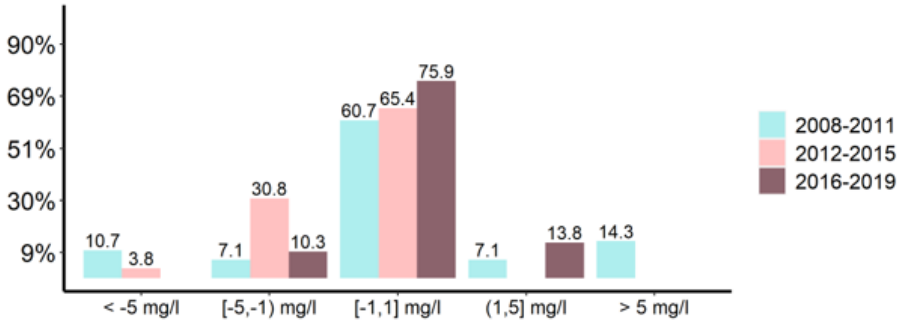


Figure 12. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

Surface Water Eutrophication

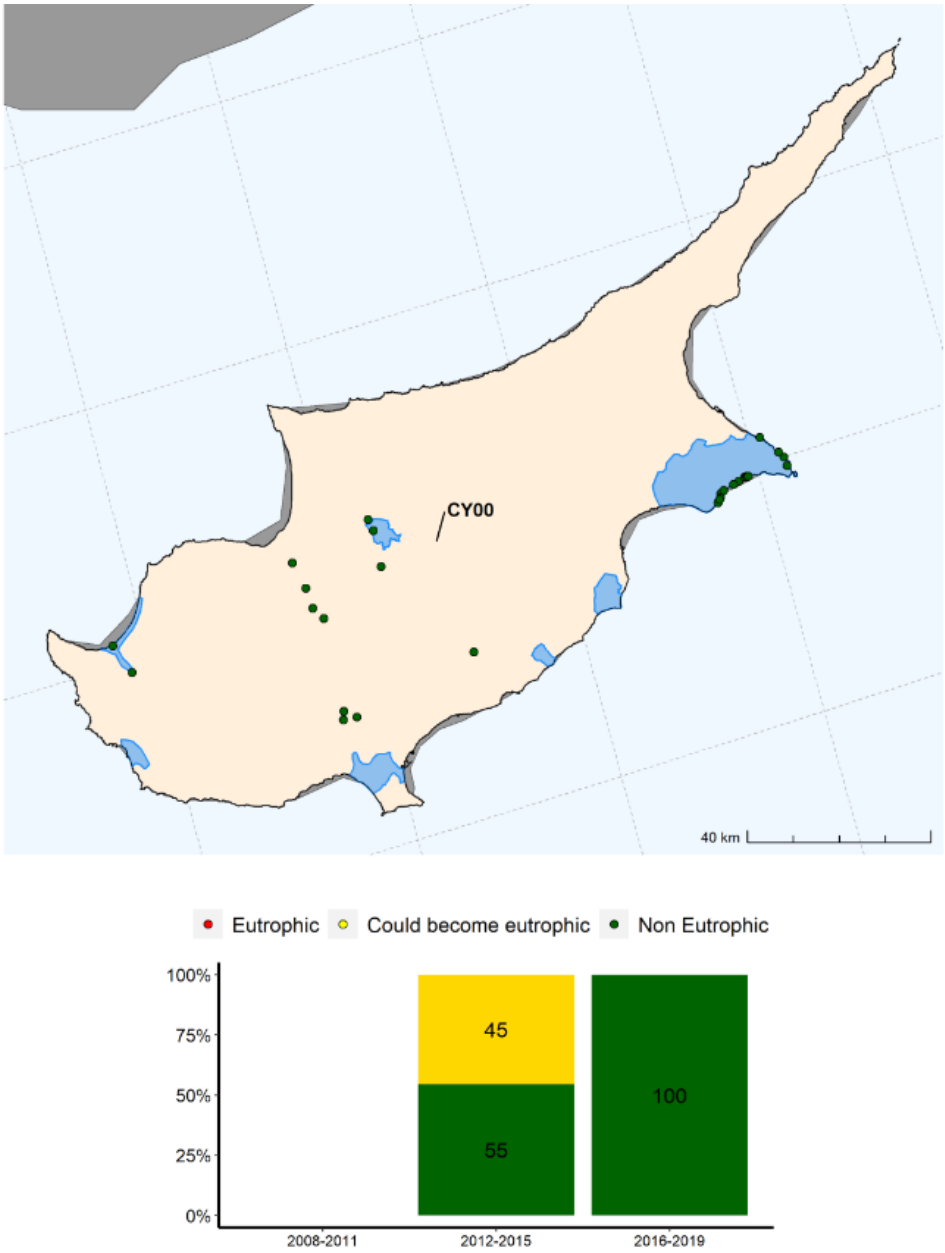


Figure 13. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis). In the map in blue the NVZ.

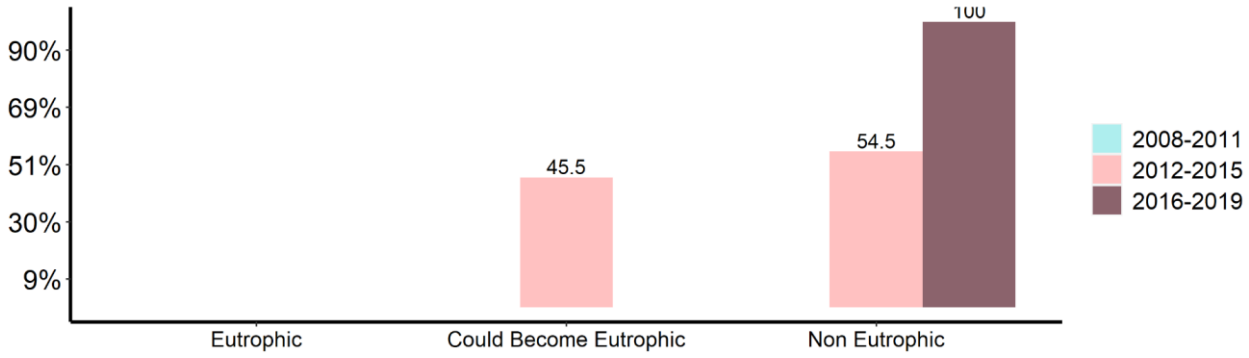


Figure 14. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis)

The strong variation in the flow of water and the lack of flow for most of the year in the majority of rivers, makes it difficult to monitor a number of parameters, e.g. chlorophyll-a. Therefore, it is impossible for surface waters to create a reliable eutrophication model or to adopt models similar to those existing and used in Central European countries. Other analyses were carried out including biochemical oxygen demand (BOD5), total nitrogen (N-tot) and ortho-phosphorus (P-PO4). In terms of water classification, the waters that showed a mean ortho-phosphorus concentration (PO4-) below the oligotrophic/mesotrophic limit (0.1 mg/l) were classified as ultra-oligotrophic and those that showed a mean ortho-phosphorus concentration (PO4-) above the oligotrophic/mesotrophic limit (0.1 mg/l) were classified as mesotrophic. The oligotrophic mesotrophic classes were then reclassified as non-eutrophic to be consistent with the WFD classification system. For coastal water monitored determinands included nitrate, chlorophyll-a and orthophosphate concentrations. All river and coastal waters were found to be non-eutrophic. Idem for coastal water, where no eutrophication was detected.

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	0	0	13
5	Lake/reservoir water	0	0	0
6	Transitional water	0	0	0
7	Coastal water	0	0	16
8	Marine water	0	0	0
9	Not specified	0	0	0
	Total	**0**	**0**	**29**

Measures in the Action Programme

The first Code of Good Agricultural Practice (CAGP) was drawn up in 2002 on the basis of Decree RAA 407/2002 and was revised in 2007 on the basis of Decree RAA 263/2007. Currently, the Cypriot authorities are in the process of revising the Code of Good Agricultural Practice. The Action Programme (AP) was published for the first time on 30/01/2004 and was revised on 10/08/2012 and 17/07/2013 before the last revision done on 06/06/2014 by the Decree RAA 281/2014. The measures include the proper storage and controlled use of fertilizers and livestock manure the use of streamlined irrigation systems, the preparation of irrigation programmes. It also includes closed periods for using nitrogen fertilizers, providing farmers and livestock farmers with detailed and constant information. In particular, inorganic fertilizers and manure must be stored in closed safe storage facilities located at least 50 m far from surface waters and 300 m far from springs or boreholes used for water supply purposes. The use of fertilizers is also prohibited in areas within 50 m of surface waters and 300 m from spring and boreholes used for water supply. The use of crop rotation is recommended in order to reduce the use of fertilizers. The details are reported in the following table.

Table 6. Details of the Action Programme

Measure	General details in Action Programme
Period of prohibition of fertiliser application	• From 1st of November until 31st of January the next year (Part 1, Section A1 of Action Plan)
Restrictions for application on sloped soils	• On sloped soils with slope above 10% (Part 1, Section A1 of Action Plan)
Restrictions for application on soaked, frozen, or snow-covered soils	• See Part 1, Section A1 of Action Plan
Restrictions for application near watercourses (buffer strips)	• > 10 m from path ways where there is water flow
	• > 50 m from lakes, rivers where there is water flow
	• > 300 m from springs for drinking
	(Part 1, Sections A1, B1.1, B1.2, of Action Plan)
Effluent storage works	• > 50 m from surface waters
	• > 300 m from springs for drinking
	(Part 1, Section B3.1 of Action Plan)
Capacity of manure storage	• Six months (Part 1, Section B3.1 and B.3.2 of Action Plan)
Rational fertilisation (e.g., splitting fertilisation, limitations)	• See Table in Annex III including limitations for every crop
Crop rotation, permanent crop enhancement	• Crop rotation is recommended with examples in the A.P. (Part 1, Section A.1 of Action Plan)
Vegetation cover in rainy periods, winter	• For 2016-2019 is 0,3%
	• 7,2% of cultivated areas without plant cover in the winter season (section 8.5.5 MS Report) was for the previous report
Fertilisation plans, spreading records	• The Action Plan includes examples in Annex I
Other measures	• Integrated information programme
	• Analyses of Nitrogen concentration in wastewater per 100 livestock farms: 40
	• Streamlined irrigation systems and the preparation of irrigation programs
Date for application limit of 170 kg N/ha/year:	• Not specified

Cost effectiveness analysis was not reported. The measures are applied equally in all NVZs. Cyprus did not report changes on the measures with respect to the reporting period 2012-2015. Cypriot authorities have discontinued the soil analysis on grounds that it was difficult to draw any conclusions regarding the excessive use of fertilizers. The interruption of the nitrate soil analysis concerned those carried out by the Department of Agriculture for monitoring purposes. The obligation of soil and water analysis by farmers remains in force and is carried out normally.

In addition, it was not possible to calculate the amount of nitrogen from inorganic fertilizers. Nevertheless, the farmers are required by the Action Program to carry out soil analysis in order to be able to calculate the quantities of fertilizers they can apply according to their Nitrogen crops needed.

Controls

Administrative controls carried out during the 2016-2919 amounted to 515 (a yearly average of 129 controls). About 16% of the controls resulted in penalties. The main problems associated with the implementation of the action plan are linked to the amount applied of manure and mineral nitrogen.

Designation of NVZ

Cyprus has increased its designated nitrate vulnerable zones from the last reporting period from 444 km^2 to 457 km^2.

Forecast of Water Quality

There is no information given concerning the forecast of water quality since due to complex climatic, agronomic and complex hydrogeological conditions it is difficult to correctly estimate developments in terms of nitrate concentrations in groundwater.

Summary

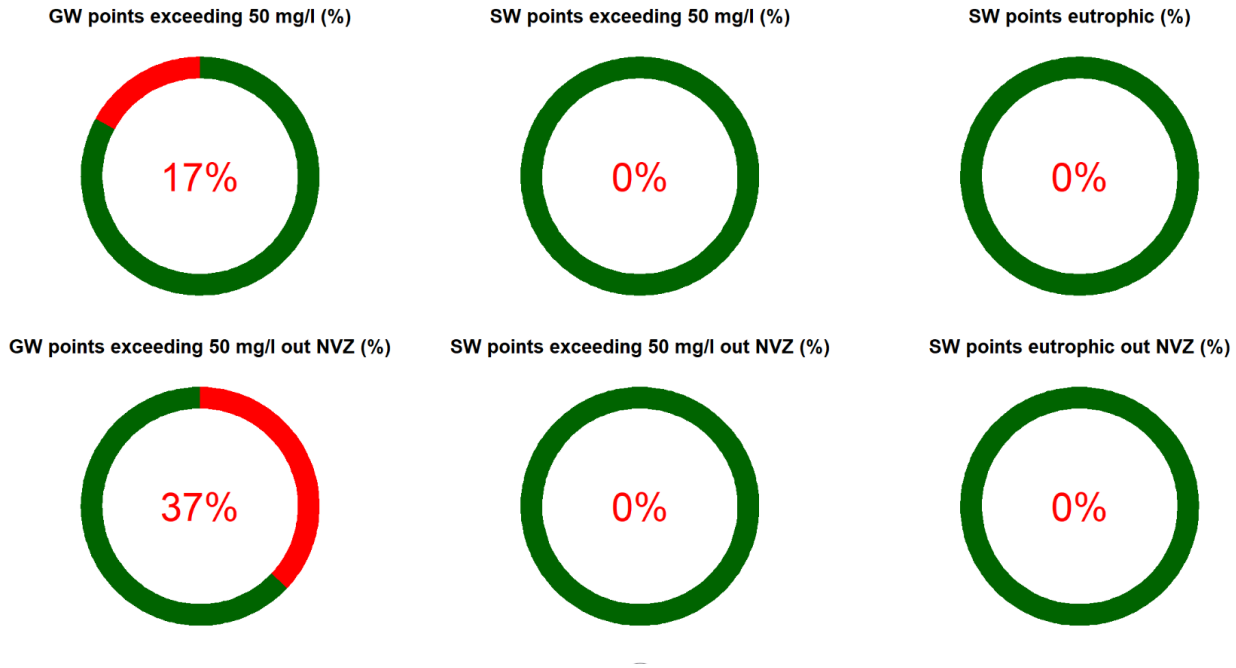


Figure 15. The summary plot for the period 2016-2019

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

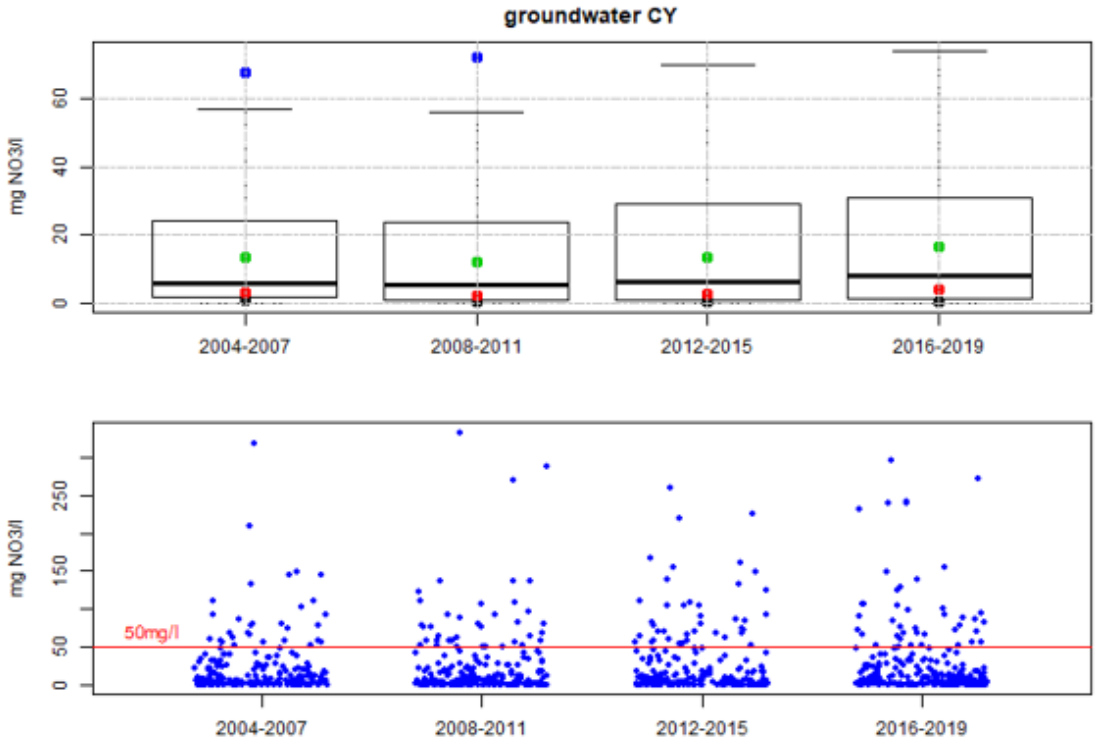


Figure 16. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for groundwater stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

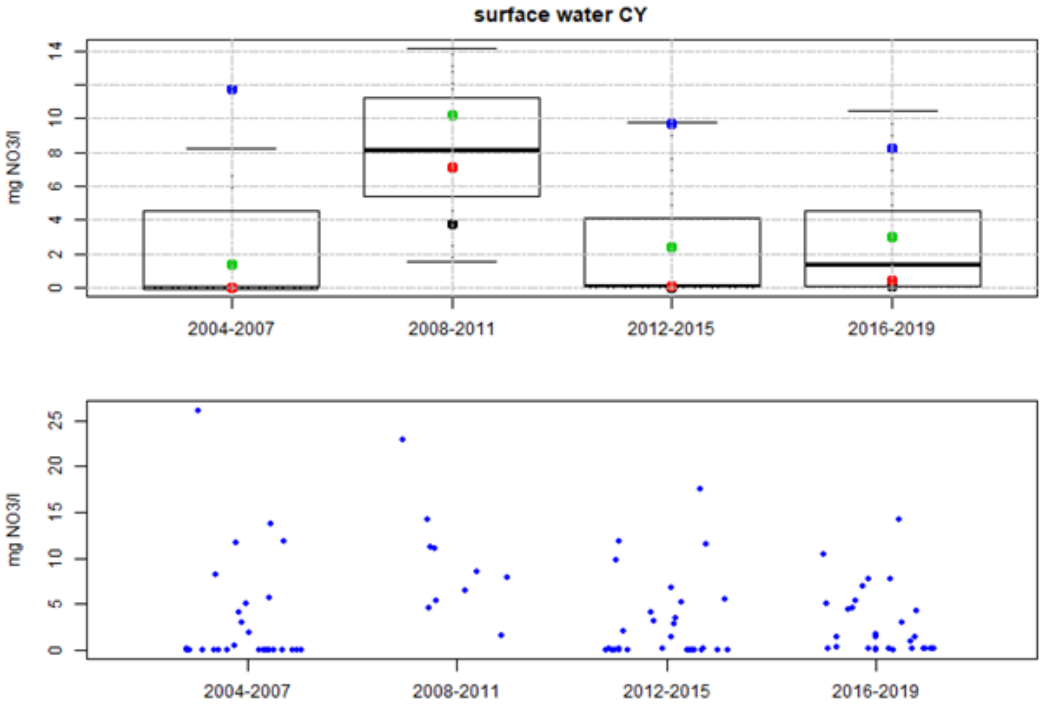


Figure 17. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period for surface water stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

Conclusions and recommendations

Cyprus has a high livestock pressure, the nutrient surpluses are high EU for nitrogen and 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 > 50 mg/l and/ or with a strong increasing trend. Surface waters, on the other hand, remain of good quality.

A very high number of groundwater hotspots are located outside the NVZ.

Cyprus did not review its action programme since 2014.

There is no information given concerning the forecast of water quality.

The Commission recommends Cyprus to revise the designation of NVZ, to review its action programme in particular to reduce the high nutrients surpluses and to reduce and prevent the contamination in groundwater hotspots where agriculture pressure is significant. Cyprus should also provide a forecast of the water quality.