EUROPEAN
COMMISSION

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PART 20/38

# 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

Greece's utilized agricultural area amounts to 5.3 Mha, representing 40.8% 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 fruit (20.5%), vegetable and horticultural plants (16.7%) and other crops/crop products (16.1%).

Eurostat

## Major land use statistics for Greece

Table 1.Utilized agricultural area (abbreviated as UAA)

| Greece | 2005 | 2007 | 2010 | 2013 | 2016 |
|---|---|---|---|---|---|
| Utilised agricultural area UAA (1000 ha) | NA | 3969 | 5426 | 5213 | 5260 |
| arable land (1000 ha) | NA | 2027 | 1864 | 1896 | 1978 |
| permanent grass (1000 ha) | NA | 840 | 2451 | 2092 | 2021 |
| permanent crops (1000 ha) | NA | 1101 | 1110 | 1225 | 1252 |
| kitchen gardens (1000 ha) | NA | 12 | 9 | 9 | 9 |

*Note:*

Eurostat (FSS)

Greece's arable land has decreased since 2010. Permanent grass has decreased since 2013 while the area of permanent crops has increased.

## Animal distribution in Greece

All Greece's livestock beside poultry have decreased since the previous reporting period. The livestock density index (livestock unit per hectare of Utilized Agricultural Area) has also remained stable and is lower than the EU average of 0.8.

Table 2. Livestock statistics

| Greece | 2005 | 2007 | 2010 | 2013 | 2016 |
|---|---|---|---|---|---|
| Livestock index | 0.62 | 0.64 | 0.46 | 0.44 | 0.46 |
| dairy cows ($10^6$ heads) | 0.15 | 0.15 | 0.14 | 0.13 | 0.11 |
| live bovines ($10^6$ heads) | 0.66 | 0.68 | 0.68 | 0.65 | 0.55 |
| live pigs ($10^6$ heads) | 0.95 | 1.04 | 1.09 | 1.03 | 0.74 |
| live poultry ($10^6$ heads) | NA | NA | 36.76 | 27.88 | 30.39 |

*Note:*

Eurostat (FSS)

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

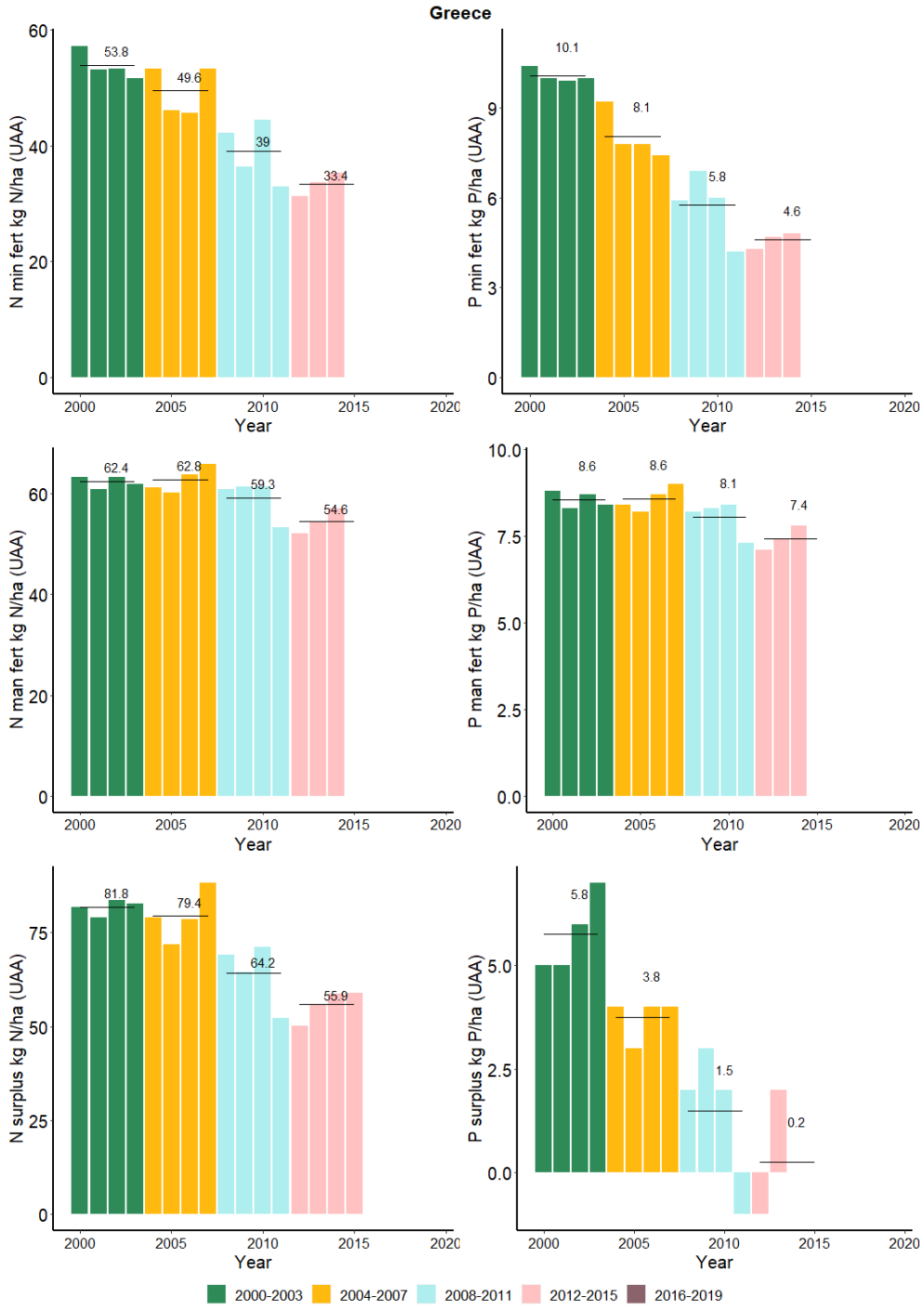



Figure 1. N and P fertilizers and gross surplus (kg/ha)

The gross nitrogen and phosphorus surpluses originate from EUROSTAT data for the years 2000-2015. N and P mineral fertilizers, manure and surplus decreased from the last reporting periods and generally, there is a continuing reduction. 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

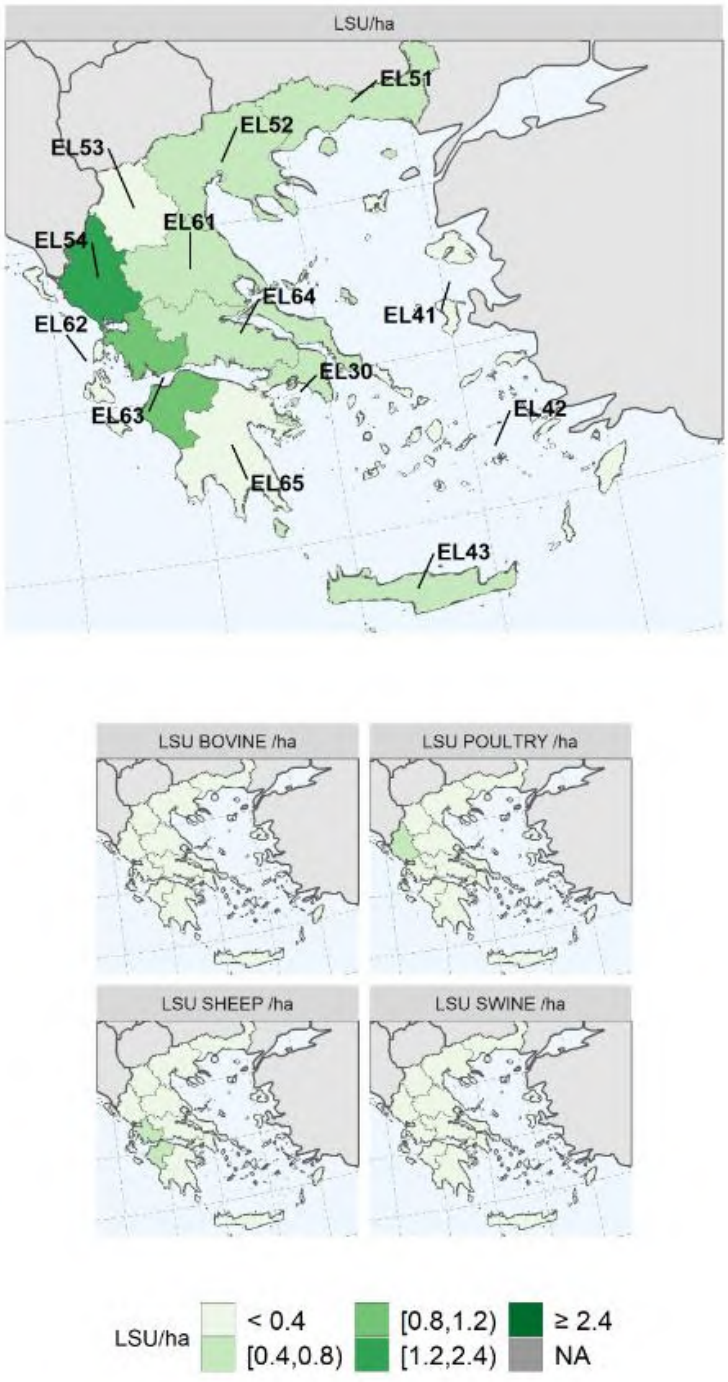



Figure 2. Map of livestock unit distribution, year 2016 (Source: Eurostat, February 2021)

Animal production is concentrated in western part of the Greece and is dominated by sheep and poultry (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 monitoring of inland, transitional, coastal and ground waters in Greece is under the responsibility of the National Monitoring Network (NMM) who reports to the Ministry of Environment and Energy. The National Monitoring Network operates since 2012, and no measurements were performed in the period 2016-2017. As of 2018, the monitoring sites and measurements of the NMN have been modified both for surface and groundwater bodies to align with the requirements of the Water Framework Directive. Operational stations that constitute the majority of the network for rivers and transitional waters are monitored every year, once in spring and once in summer. Surveillance stations are also monitored twice a year but for only one year.

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 | 57 | 355 | 18 | 56 | 0 | 0 |
| 1a | Phreatic groundwater (deep) 5-15 m | 60 | 241 | 174 | 60 | 0 | 0 |
| 1b | Phreatic groundwater (deep) 15-30 m | 37 | 164 | 335 | 37 | 0 | 0 |
| 1c | Phreatic groundwater (deep) >30 m | 140 | 318 | 413 | 140 | 0 | 0 |
| 2 | Captive groundwater | 60 | 0 | 313 | 60 | 0 | 0 |
| 3 | Karstic groundwater | 16 | 0 | 511 | 16 | 0 | 0 |
| 9 | Not specified | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total** | **370** | **1078** | **1764** | **369** | **0** | **0** |

## 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 | 78 | 426 | 232 | 78 | 0 | 0 | 78 | 426 | 231 |
| 5 | Lake/reservoir water | 27 | 53 | 52 | 26 | 0 | 0 | 26 | 53 | 46 |
| 6 | Transitional water | 11 | 0 | 32 | 11 | 0 | 0 | 11 | 0 | 0 |
| 7 | Coastal water | 0 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 49 |
| 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** | **116** | **479** | **365** | **115** | **0** | **0** | **115** | **479** | **326** |

# Groundwater Quality

## Groundwater average annual nitrate concentration

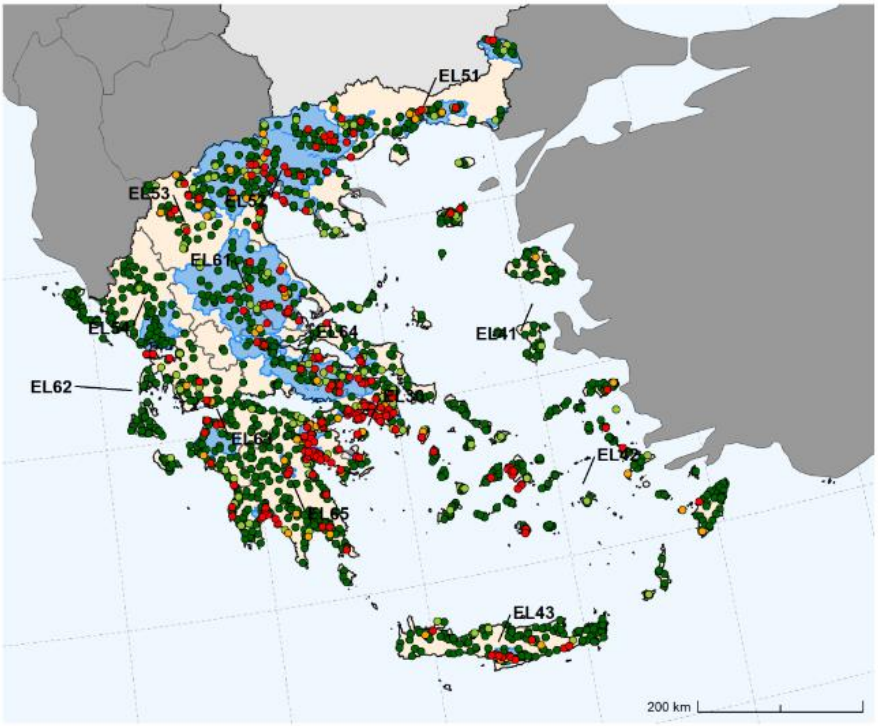



Figure 3. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ

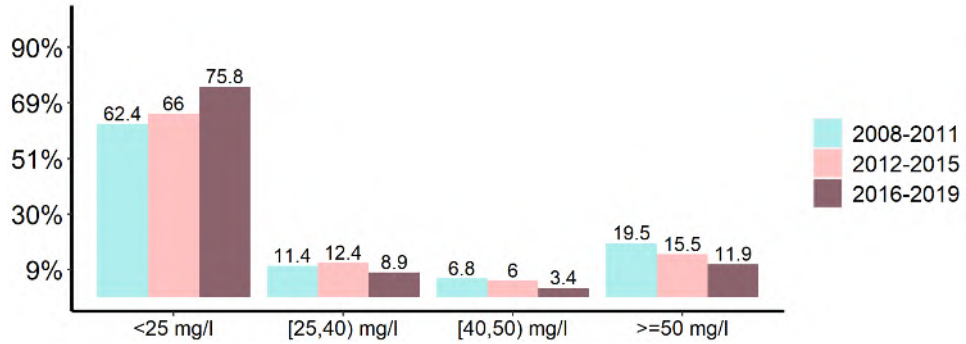



Figure 4. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

## Groundwater average annual nitrate concentration trend

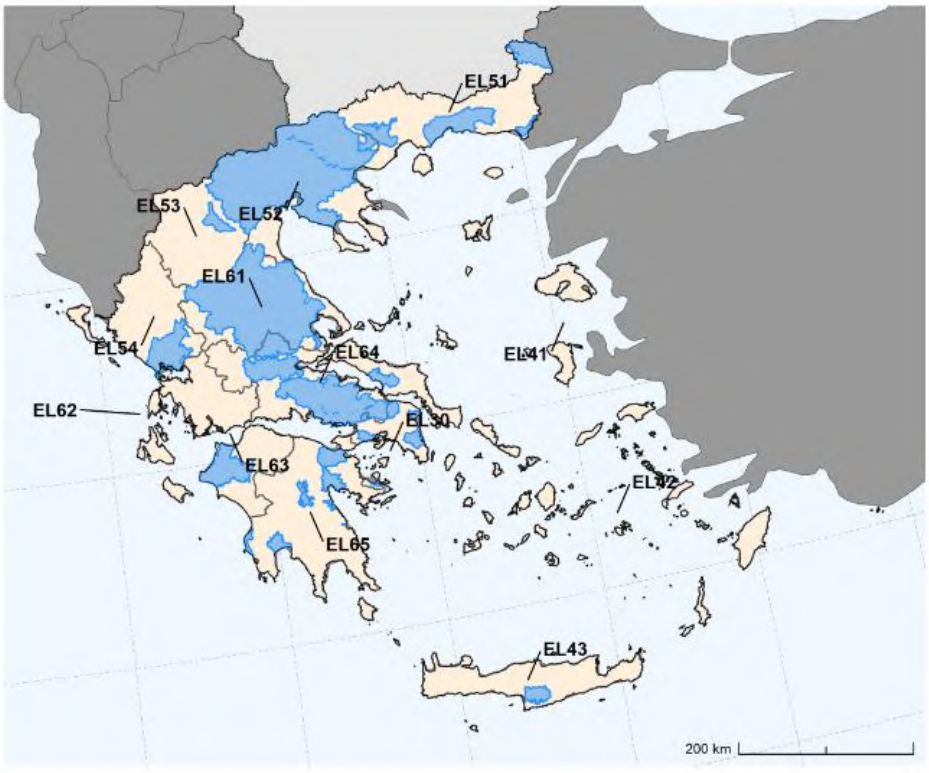



Figure 5. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). In the map in blue the NVZ.

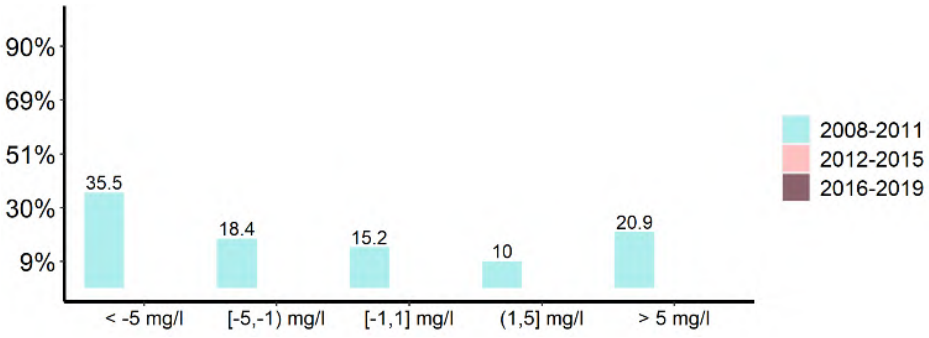
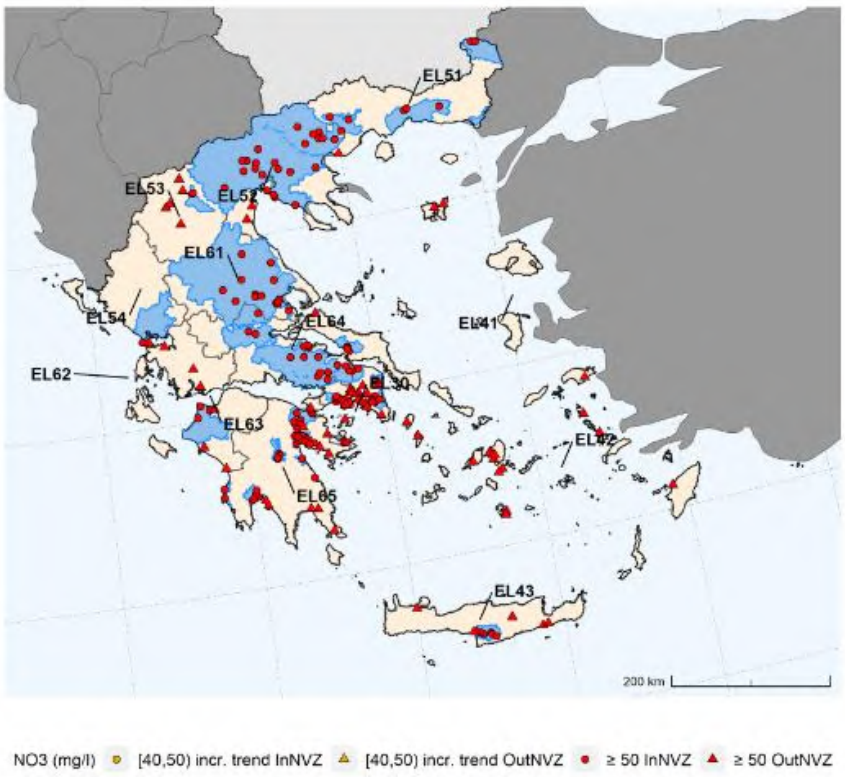



Figure 6. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

## Groundwater hotspot




| | | >=40 and < 50 mg/l incr.trend | | >=50 mg/l | |
|---|---|---|---|---|---|
| NUTS ID | NUTS NAME | InNVZ | OutNVZ | InNVZ | OutNVZ |
| EL30 | Attiki | 0 | 0 | 19 | 23 |
| EL41 | Voreio Aigaio | 0 | 0 | 0 | 3 |
| EL42 | Notio Aigaio | 0 | 0 | 0 | 18 |
| EL43 | Kriti | 0 | 0 | 5 | 7 |
| EL51 | Anatoliki Makedonia, Thraki | 0 | 0 | 7 | 1 |
| EL52 | Kentriki Makedonia | 0 | 0 | 24 | 2 |
| EL53 | Dytiki Makedonia | 0 | 0 | 2 | 5 |
| EL54 | Ipeiros | 0 | 0 | 1 | 1 |
| EL61 | Thessalia | 0 | 0 | 14 | 0 |
| EL63 | Dytiki Ellada | 0 | 0 | 3 | 7 |
| EL64 | Sterea Ellada | 0 | 0 | 22 | 1 |
| EL65 | Peloponnisos | 0 | 0 | 35 | 10 |
| | **Total** | **0** | **0** | **132** | **78** |

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.

# Surface Water Quality

## Surface water average annual nitrate concentration

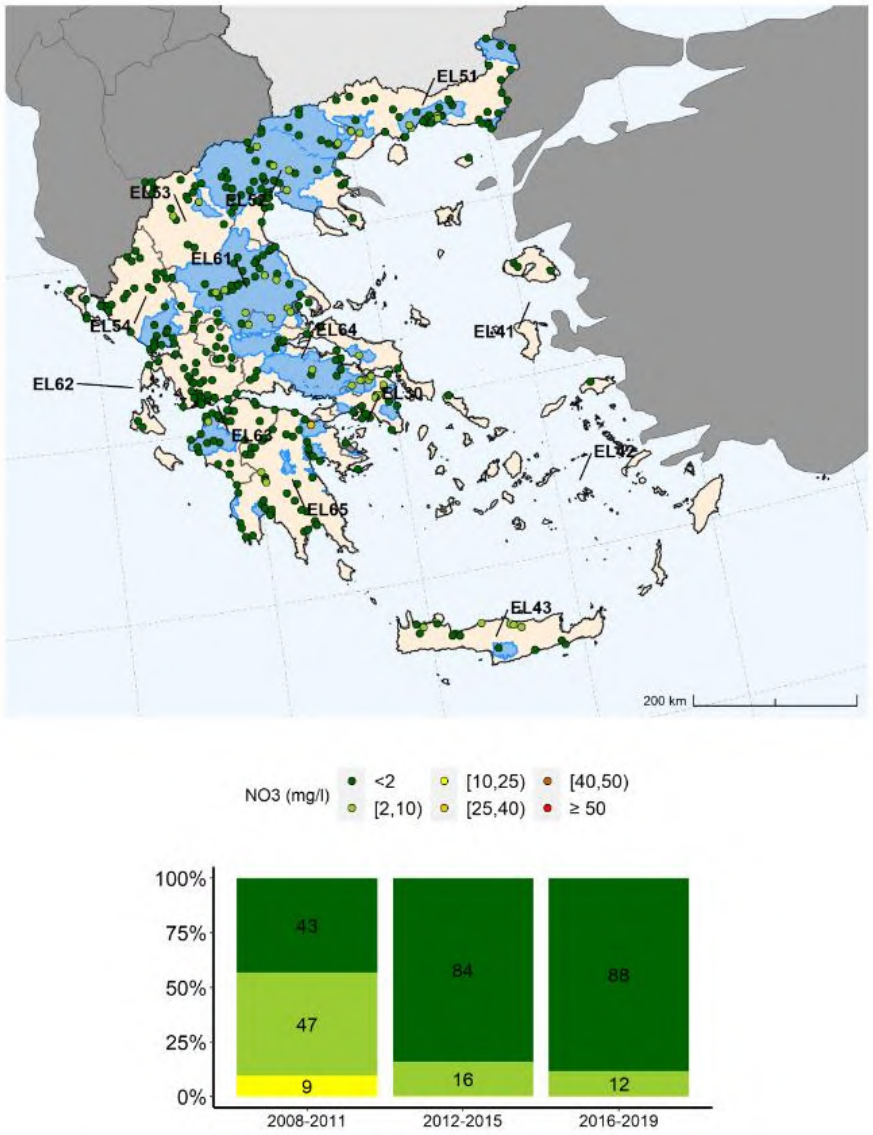



Figure 8. Spatial distribution of average NO3 annual concentration (map) and corresponding percentage of monitoring points per classes of concentration by reporting period (x axis). In the map in blue the NVZ.

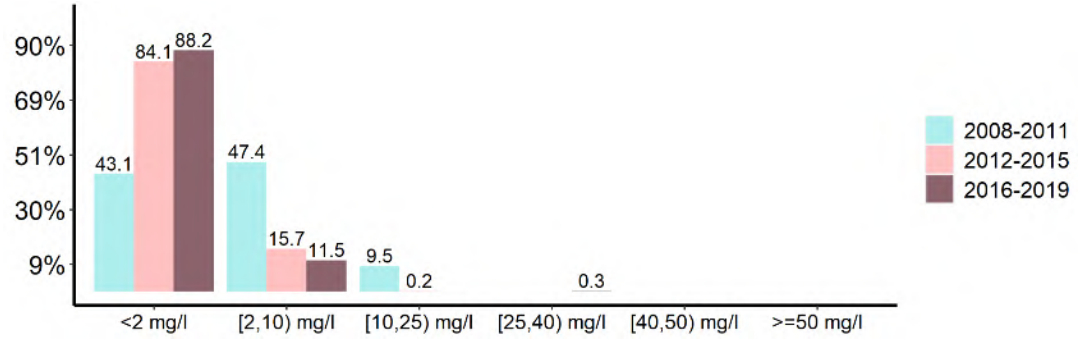



Figure 9. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual concentration (x axis)

## Surface water average annual nitrate concentration trend

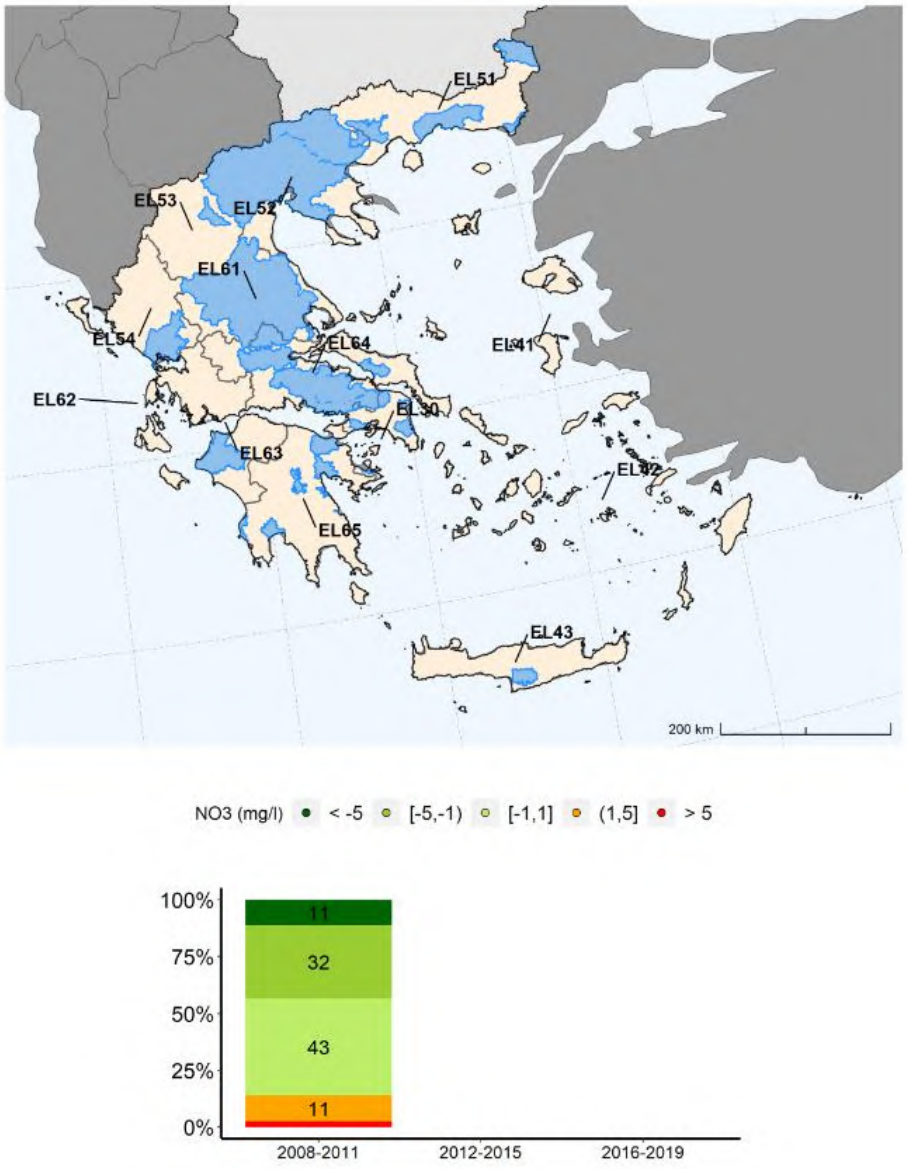



Figure 10. Spatial distribution of average NO3 annual trends (map) and corresponding percentage of monitoring points per classes of trends by reporting period (x axis). The percentages below 5% are not labelled, see the next plot for more information. In the map in blue the NVZ.

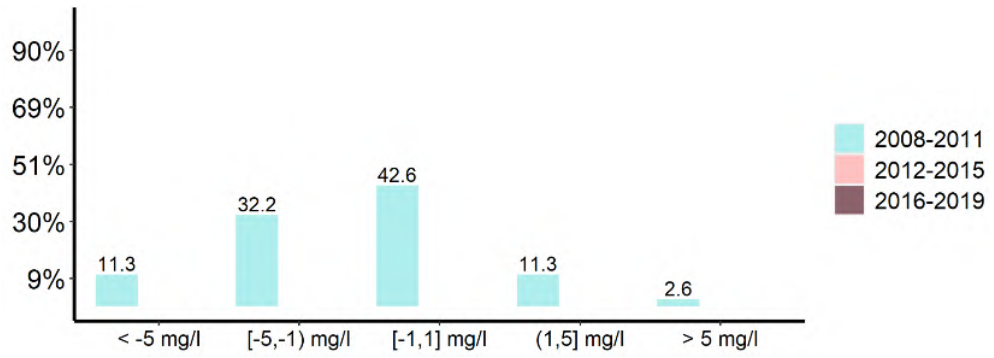



Figure 11. Comparison of percentage of monitoring points in the three reporting periods by classes of average NO3 annual trends (x axis)

## Surface Water Eutrophication

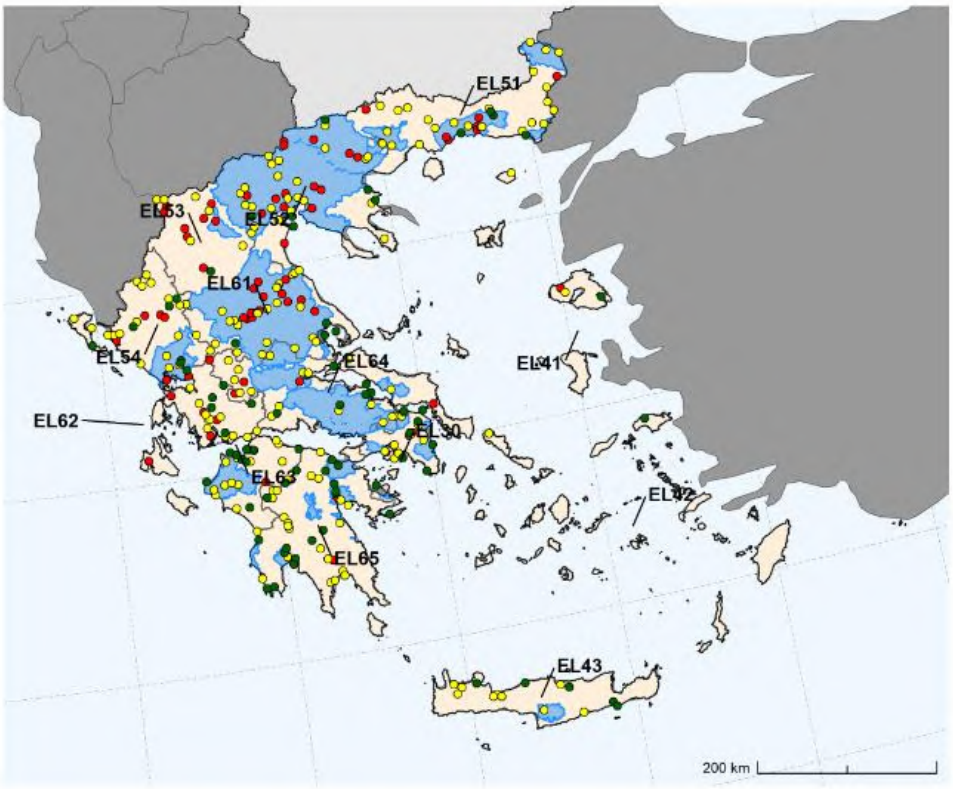



Figure 12. Spatial distribution of eutrophic status (map) and corresponding percentage of monitoring points per classes of status by reporting period (x axis). In the map in blue the NVZ.

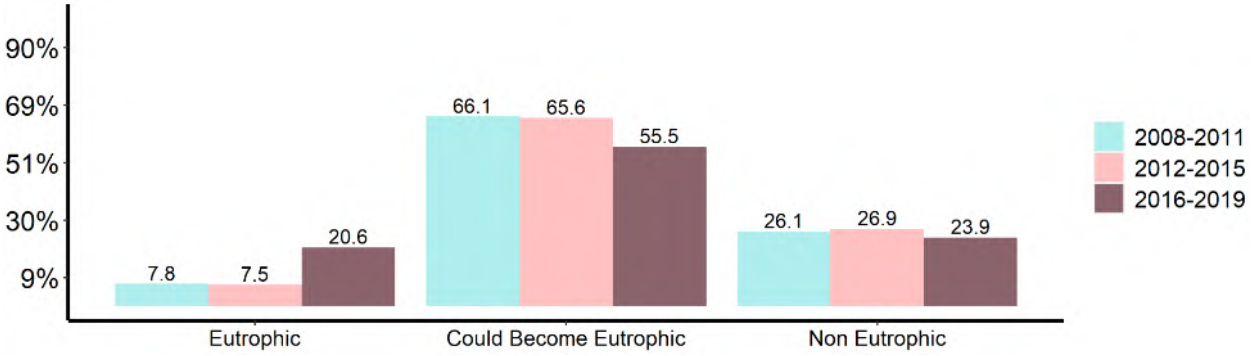
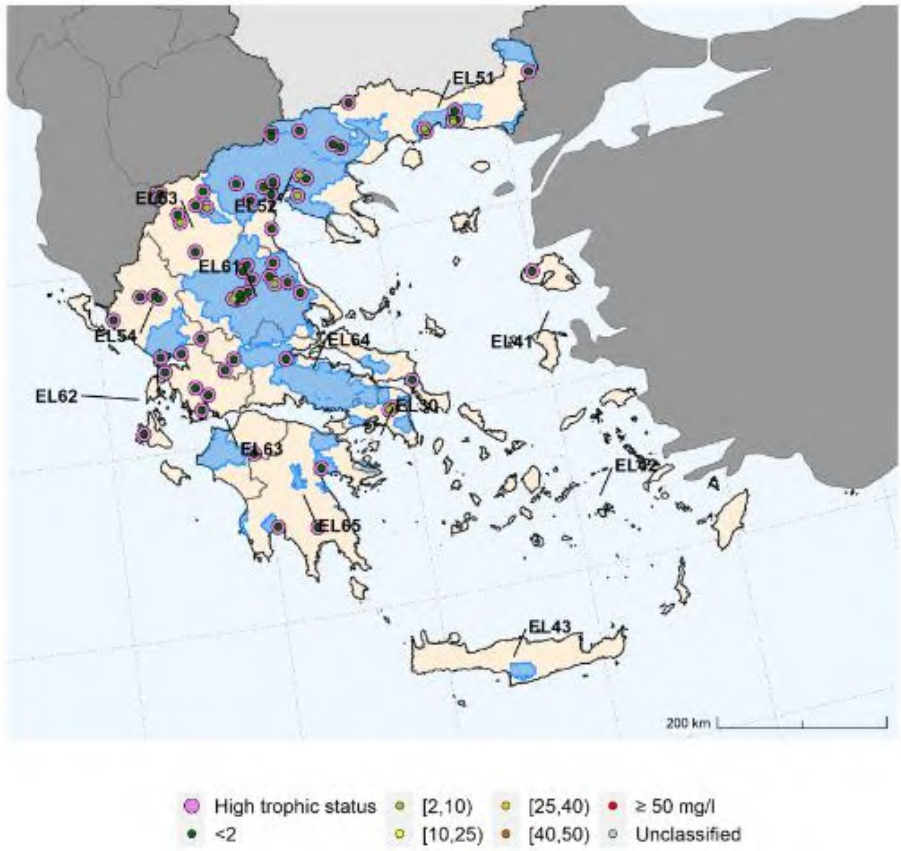



Figure 13. Comparison of percentage of monitoring points in the three reporting periods by classes of status (x axis)

## 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 |
| EL30 | Attiki | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| EL41 | Voreio Aigaio | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| EL51 | Anatoliki Makedonia, Thraki | 8 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| EL52 | Kentriki Makedonia | 15 | 13 | 2 | 0 | 0 | 0 | 0 | 0 |
| EL53 | Dytiki Makedonia | 8 | 6 | 2 | 0 | 0 | 0 | 0 | 0 |
| EL54 | Ipeiros | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| EL61 | Thessalia | 14 | 12 | 2 | 0 | 0 | 0 | 0 | 0 |
| EL63 | Dytiki Ellada | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| EL64 | Sterea Ellada | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| EL65 | Peloponnisos | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| NO_NUTS | SALINE | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total** | **67** | **55** | **12** | **0** | **0** | **0** | **0** | **0** |

Figure 14. The SW monitoring stations with eutrophic status versus the average NO3 annual concentration. In the map in blue the NVZ.

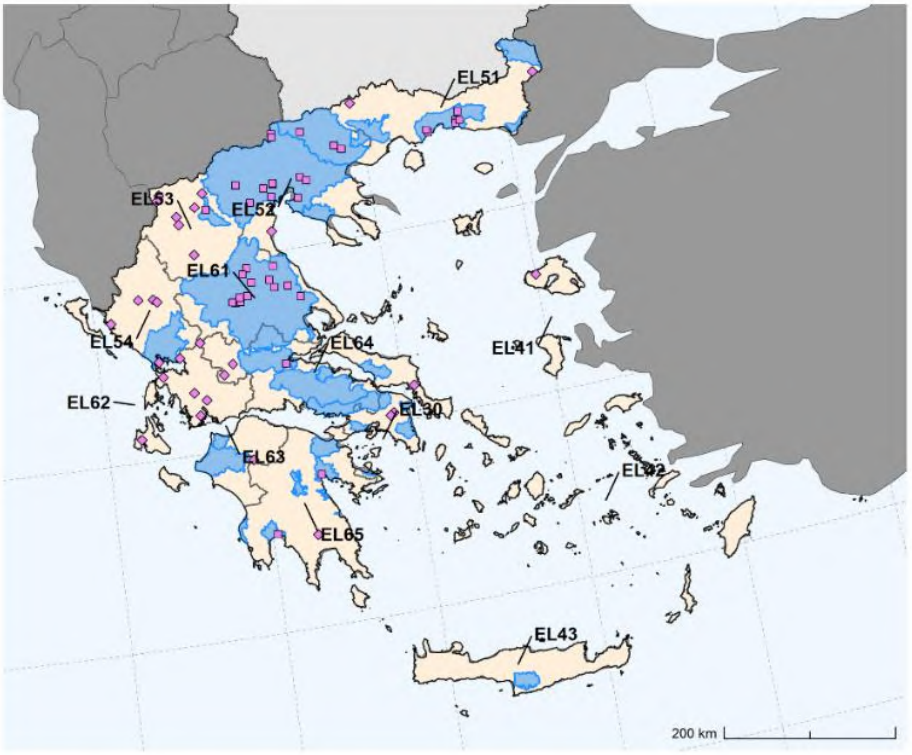
The analysis shows all the SW monitoring stations with the higher trophic status and the corresponding value of NO3 concentration. The map shows the spatial distribution of these points, and the table reports the number of stations with measurements with highest trophic status and the corresponding stations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

The trophic state of surface water bodies was assessed based on a criterion used by Greece to designate a water body as eutrophic, in combination with the physicochemical parameter classification criteria used in River Basin Management Plans (1st Review). The parameters taken into consideration for the classification of rivers include NO3, NH4, total P and BOD5 concentrations. For lakes the classification uses NO3, total P and chlorophyll-a concentrations. The classification of coastal waters relies on NO3, chlorophyll-a and NH4 concentrations. The majority of rivers fall in the category "could become eutrophic". The "could become eutrophic" class for rivers is mostly controlled by NO3 and BOD5 concentrations. The large majority of lake stations fall in the categories "could become eutrophic" or "eutrophic". Lakes fall in the eutrophic class mostly because of high chlorophyll-a and total P concentrations. Most of coastal water monitoring stations falls in the category "non-eutrophic". While the "eutrophic" and "could become eutrophic" classes for coastal waters are controlled by the higher chlorophyll-a concentration.

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 | 45 | 148 | 38 |
| 5 | Lake/reservoir water | 18 | 17 | 11 |
| 6 | Transitional water | 0 | 0 | 0 |
| 7 | Coastal water | 4 | 16 | 29 |
| 8 | Marine water | 0 | 0 | 0 |
| 9 | Not specified | 0 | 0 | 0 |
| | **Total** | **67** | **181** | **78** |

## 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 |
| EL30 | Attiki | 0 | 2 | 0 | 0 | 0 | 0 |
| EL41 | Voreio Aigaio | 0 | 1 | 0 | 0 | 0 | 0 |
| EL51 | Anatoliki Makedonia, Thraki | 6 | 2 | 0 | 0 | 0 | 0 |
| EL52 | Kentriki Makedonia | 14 | 1 | 0 | 0 | 0 | 0 |
| EL53 | Dytiki Makedonia | 1 | 7 | 0 | 0 | 0 | 0 |
| EL54 | Ipeiros | 0 | 3 | 0 | 0 | 0 | 0 |
| EL61 | Thessalia | 13 | 1 | 0 | 0 | 0 | 0 |
| EL63 | Dytiki Ellada | 0 | 5 | 0 | 0 | 0 | 0 |
| EL64 | Sterea Ellada | 1 | 3 | 0 | 0 | 0 | 0 |
| EL65 | Peloponnisos | 2 | 1 | 0 | 0 | 0 | 0 |
| NO_NUTS | SALINE | 0 | 4 | 0 | 0 | 0 | 0 |
| | **Total** | **37** | **30** | **0** | **0** | **0** | **0** |

Figure 15. 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.

# Measures in the Action Programme

The first Code of Good Agricultural Practice (CGAP) was drawn up in 2000 and a new code was published in 2015. The Code includes compulsory measures for producers with holdings in vulnerable zones, in order to ensure compliance with the requirements and obligations laid down in Annexes II and III to the Directive. Among the measures, a particular attention is dedicated to good agricultural practices for surface irrigation.

The mandatory provisions of the CGAP have been incorporated into the cross-compliance document for the 2014-2020 Programming Period and are, therefore, part of the environmental standards producers must comply with in order to be entitled to direct payments and financial support under the Common Agricultural Policy (CAP).

The new Action Programme (AP) was drawn up in 2019 and includes the measures summarized in the table below.

Table 6. Details of the Action Programme

| Measure | General details in Action Programme (*) |
|---|---|
| Period of prohibition of fertiliser application | • Specific periods of limited use of N inputs are applied in different NVZ (Table of Chapter D of AP Annex) |
| Restrictions for application on sloped soils | • Not when slope >8% if liquid fertilizers (exception in case of drip irrigation or injection). Recomanded apply solid fertilizers that must be incorpored into the soil at the time of applicaiton; in areas with a slope exceeding 10%, a plant cover, even of non-cultivated species, must be applied during the rainy period and until the soil is prepared for the next sowing. Where possible, autumn legumes must be cultivated (Chapter A of AP). |
| Restrictions for application on soaked, frozen, or snow-covered soils | • Not on frozen or snow-covered surfaces, and on water-saturated soils with poor drainage or flooded (Chapter A of AP). |
| Restrictions for application near watercourses (buffer strips) | • Mineral: |
| | >= 2 m in flat surfaces |
| | >= 50 m from springs /wells/boreholes |
| | • Processed livestock waste: |
| | >= 10 m from all water bodies in the case of solid waste |
| | >= 20 m in the case of liquid waste |
| Effluent storage works | • Chapter A of AP |
| Capacity of manure storage | • Chapter A of AP |
| Rational fertilisation (e.g., splitting fertilisation, limitations) | • Application of nitrogenous fertilisers and livestock waste (Chapter A of AP). |
| | • Maximum N-total applied during the growing period |
| | • Good irrigation practices (Chapter A of AP). |
| Crop rotation, permanent crop enhancement | • Dry crop rotation applied to at least 30% of the irrigated area (Chapter A of AP). |
| Vegetation cover in rainy periods, winter | • The rational use of fertilisers on winter vegetables and flowers, as well as on crops cultivated under cover, is permitted, in so far as no poultry farm waste or livestock liquid waste is applied (Chapter A of AP). |
| Fertilisation plans, spreading records | • It is recommended to apply fertilisers using fertiliser spreading devices |
| | - granular spreaders for solids; or |
| | - fertiliser spreading devices equipped with special liquid sprinklers/injectors, penetrating at a depth of 12-15 cm into the ground |
| Other measures | • See Chapter A of AP, in particualr related to irrigation measures |
| | • Other measures (emission controls and the code of good practice) are also adopted under the river basin management plans |
| Date for application limit of 170 kg N/ha/year: | • Not specified |

(*) Action Programmes (JMD No 38552/265, Government Gazette, Series II, No 1496, 03.05.2019)

In particular the AP contains the following measures for reducing pollution caused by nitrates in NVZ areas: limiting the amount of nitrogenous fertilizers; determining the method and time of application of the necessary fertilizer units per crop; establishing a prohibition period for spreading certain types of fertilizer; adapting cultivation practices; managing agricultural and livestock waste and defining the capacity of manure storage tanks; establishing the obligations of producers; and the control and sanction monitoring mechanism. Specific rules for irrigation were also introduced.

Other measures (emission controls and the code of good practice) are also adopted under the river basin management plans. Specific voluntary measures and actions have also been adopted in the 1st Management plan to control diffuse pollution from agricultural sources. However, the information related to complaint farmers are not reported as well as of cost-effectiveness analyses.

# Controls

The mandatory provisions of the Code of Good Agricultural Practices have been incorporated into the cross-compliance document for the 2014-2020 Programming Period. No information was given concerning the controls and controls resulting in non-compliance.

# Designation of NVZ

Greece has not changed the areas designated as Nitrate Vulnerable Zones since the last reporting period. The total designated area represents a total surface of 42 274.5 $km^2$.

# Forecast of Water Quality

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

# Summary

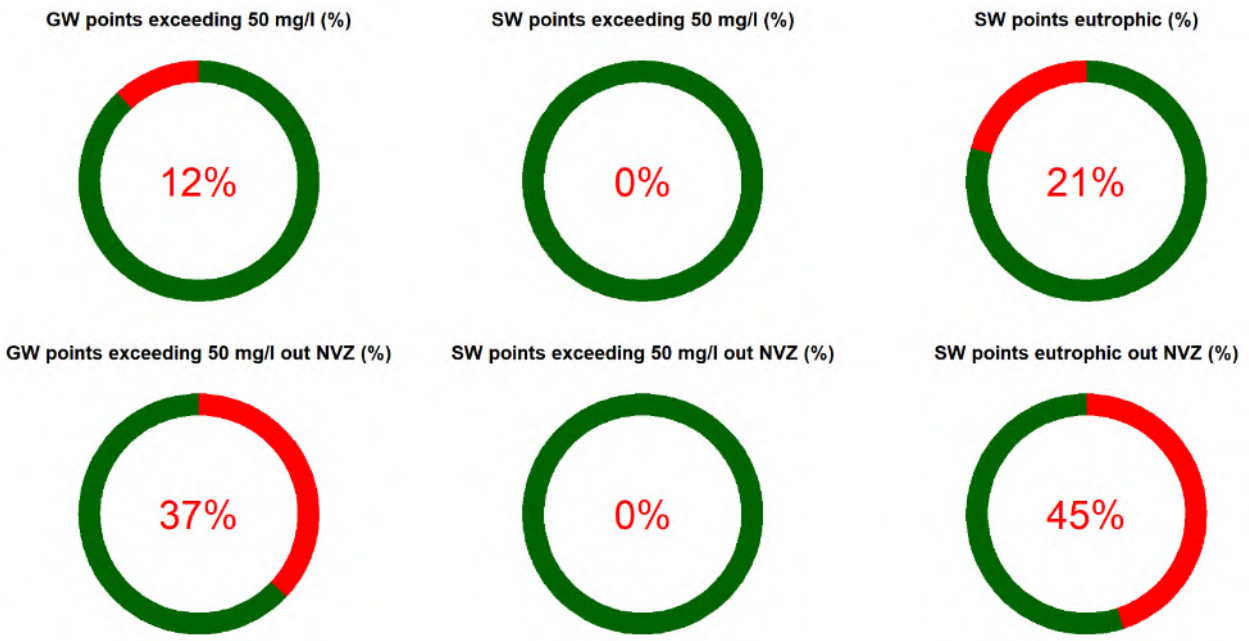



Figure 16. The summary plot for the period 2016-2019

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

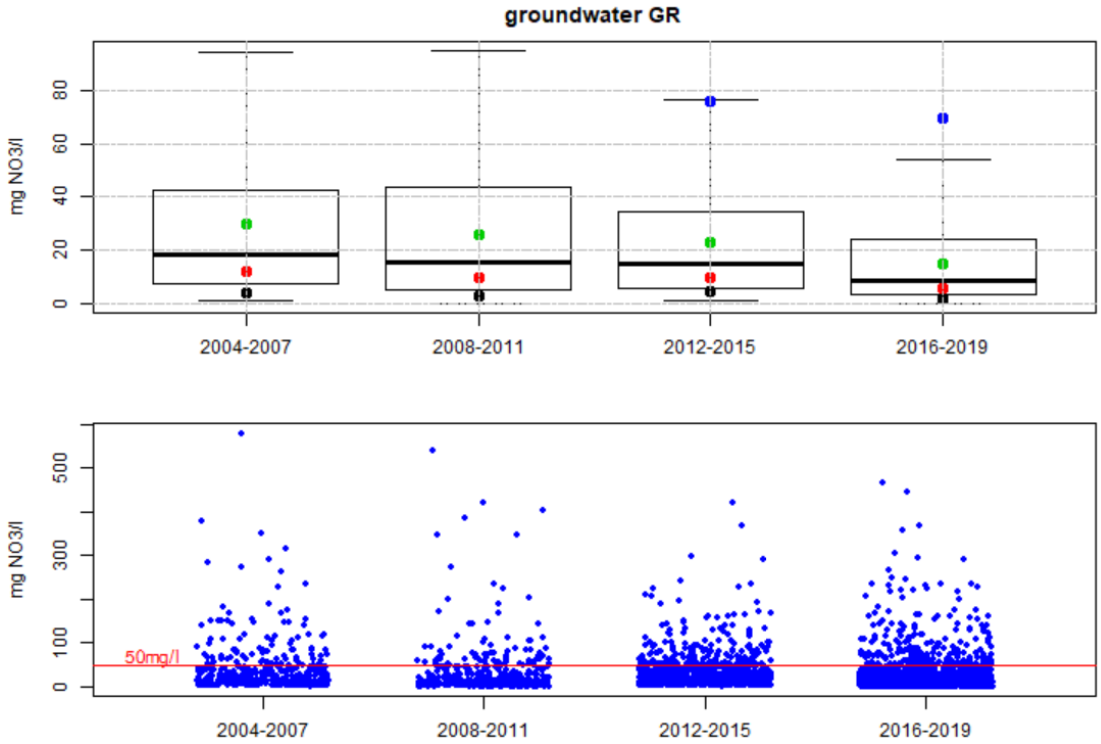



Figure 17. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period, for groundwater stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

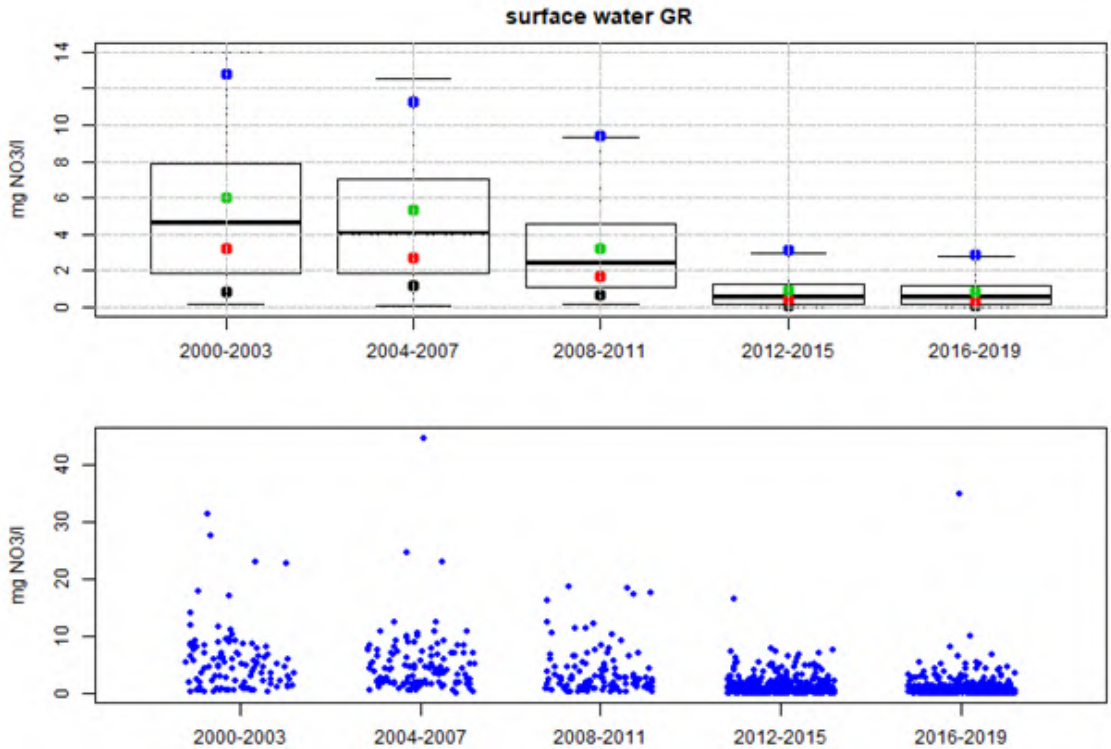



Figure 18. Time series of box whisker plots along with the distribution of the average NO3 annual concentrations for each reporting period, for surface water stations. The blue, red, green and black dots represent the mean of the fourth third, second and first quartiles, respectively.

# Conclusions and recommendations

Greece has a low livestock density and the surplus of nitrogen is about the EU average, while there is almost no surplus of phosphorus.

There is a well-elaborated network of monitoring stations. The current reporting period reports data only for year 2018-2019, missing 2016-2017. There are a number of hotspots, with a nitrate concentration > 50 mg/l. A high number of surface waters are eutrophic. Trends are missing both for groundwater and surface waters as in the previous reporting period.

A high number of groundwater monitoring stations with nitrate concentrations above 50 mg/l and of surface waters found to be eutrophic are located outside the NVZ.

A revised action programme was published in 2019.

The Commission recommends Greece verify the designation of NVZ, considering that not all the ground waters with nitrate concentrations above 50 mg/l and surface waters found to be eutrophic are included in the NVZ's. It also recommends extending the monitoring data to include the four years of the reporting period and need report the trends.