National Center for the Environment
and Sustainable Development (NCESD)

Greece State of the Environment Report

Summary /2018

ISBN: 978-960-99033-3-2

NATIONAL CENTER OF ENVIRONMENT
& SUSTAINABLE DEVELOPMENT (NCESD) 2018

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We thank all thematic units of the **Ministry of Environment and Energy** that worked with NCESD for the completion of the report as well as Mr. Andrea Bonetti for providing photographic material.

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Edition
National Center of Environment and Sustainable Development (NCESD) July 2018
http://ekpaa.ypeka.gr/index.php/soer-2018

Design
Souldesign Studio

Introduction

The National Center for the Environment and Sustainable Development Center (NCESD) presents the 2018 State of the Environment Report (SoER 2018), with a view to the protection of the environment and the benefits of sustainable development.

This report is the 4th State of the Environment Report of Greece, and stands as an integrated summary of current developments and challenges registered in the main environment fields. It is the first report since 2013, when the latest State of the Environment Report for the period 2008-2011 was published. The SoER 2018 includes the latest, detailed information for the state of the environment in Greece in the fields of climate change, air quality, noise, nature, water, waste and horizontal environmental issues, thus providing to all interested stakeholders a useful database.

SoER 2018 is published at a critical point of time, as Greece is at a crossroads. Greece, after many years of recession, begins to shape a prosperity and progress strategy towards an effective exit from the multi-faceted economic, social and environmental crisis, aimed at creating a sustainable and resilient society against external and environmental threats. A crucial stage in this process will be the recognition of the environment and the Greek natural capital as a key element of the country's identity and a central developmental resource. As such, environmental protection is a necessary precondition for a new, sustainable model of production and consumption, laying the foundations for social prosperity, productive employment, fair development and preservation of natural wealth. Now is the time for strategic decisions, so that the country takes advantage of its unparalleled natural and human wealth, without being bound by choices and activities which may jeopardize our unique natural environment and the well-being of our children.

At the same time, the global community stands before crucial decisions that will determine the course of mankind for the decades to come. Moving towards a low carbon-emission system, circular economy and rich biodiversity, is an increasingly recognized priority by social partners everywhere in the planet. The scientific community has already tabled proposals for measures which should be directly implemented, with a sense of responsibility and urgency, in order to ensure a sustainable future for both present and future generations.

These new policies can provide an opportunity for a global sustainable development as described in the 17 SDGs. These goals are a global heritage and a useful tool for a green and just transition linking key social goals, such as poverty eradication and fair employment with environmental protection objectives, tackling climate change and the transition to new production and consumption models.

At the same time, these same goals are also at the core of social priorities, for which an objective and long-term monitoring, through appropriate indicators, is needed. In this context, the NCESD presents today the SoER 2018, which was prepared in cooperation with universities, the Ministry of the Environment and Energy, research centers and consultants.

The National Center for the Environment and Sustainable

Development Center (NCESD) was established in 2000 with the aim to contribute to the integration of the environmental dimension into broader development policy, sub-areas and strategic planning, providing an appropriate know-how and objective information. After its administrative and financial autonomy in 2015, NCESD has now been actively engaged in supporting the Greek State in framing and implementing effective environmental and sustainable policies, by focusing its actions on the following:

⇢ Supporting the Ministry of Environment and Energy with respect to country's obligations to the European Commission and the European Environment Agency.

⇢ Implementing environmental projects and policies.

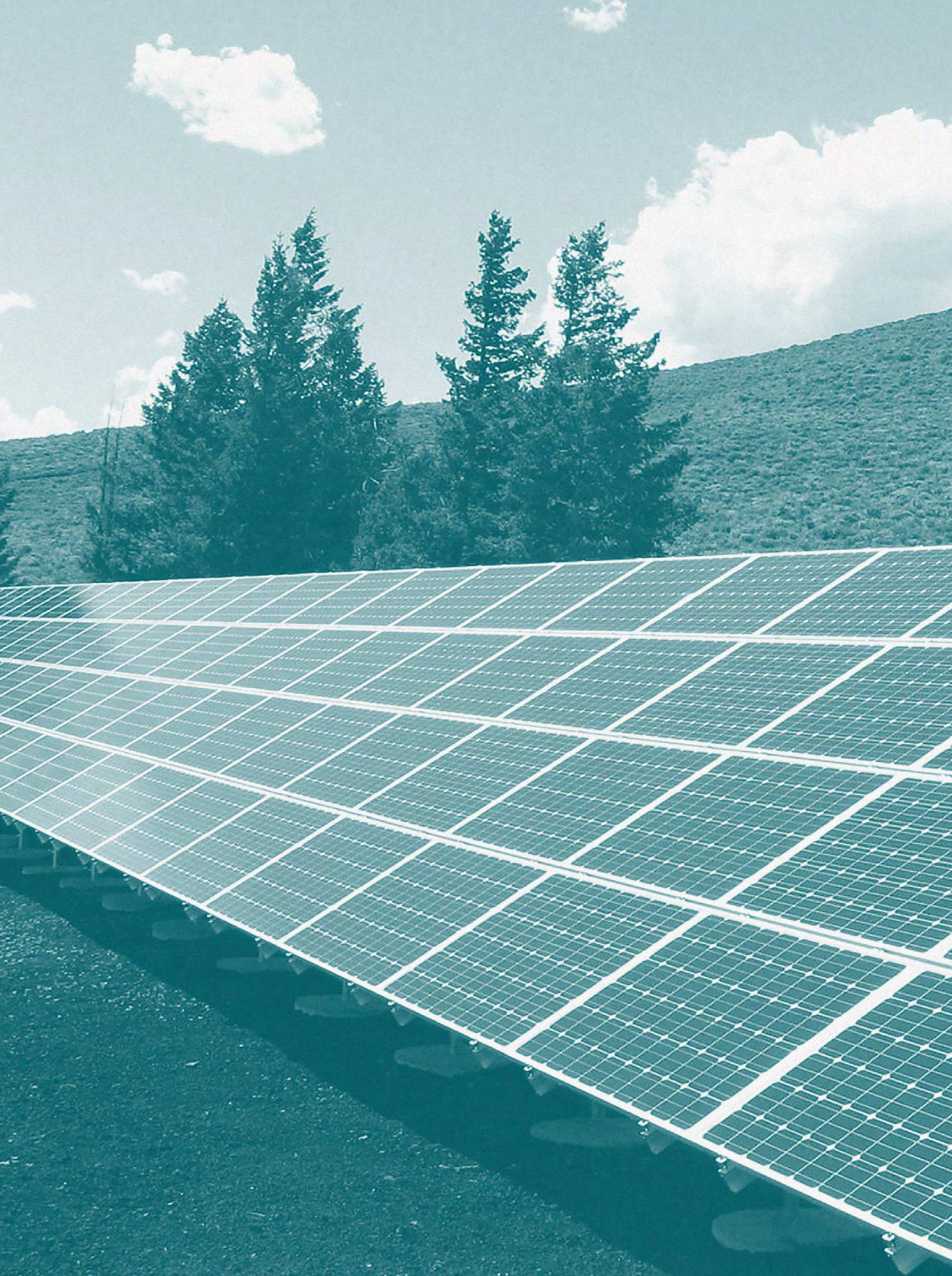
⇢ Taking action for dissemination of environmental policy, cooperation with all stakeholders and raising public awareness regarding to environmental and sustainability issues.

We are committed to continue the dissemination of environmental information to citizens through the annual SoER and a number of other projects and initiatives, aiming at establishing better access to environmental information, promoting environmental awareness and citizen's involvement. Our core aim is to ensure a fair and sustainable future, taking into consideration that the initiatives we take today are of major significance.

Through the annual release of the State of the Environment Report, we aim to provide credible and consistent information, so that all relevant stakeholders can have access to sufficient and reliable data that will enable their action in protecting and improving our natural environment and wellbeing. Ultimately, our contribution aims to provide resilient pathways on how to exit the current multifaceted social, economic and environmental crisis through environmental protection and sustainable development.

Zoi Vrontisi
President of the Management Board of NCESD

Athens, July 2018



1

Climate Change

Climate change is happening and undoubtedly comprises the most serious global environmental issue, with severe consequences for ecosystems and most aspects of human life and activity, which are expected to worsen in the years to come. Recognizing the role of increased emissions of greenhouse gases (GHGs) from anthropogenic activities in the observed temperature rise, the international climate action for their control in order to mitigate climate change, has intensified during the last two decades.

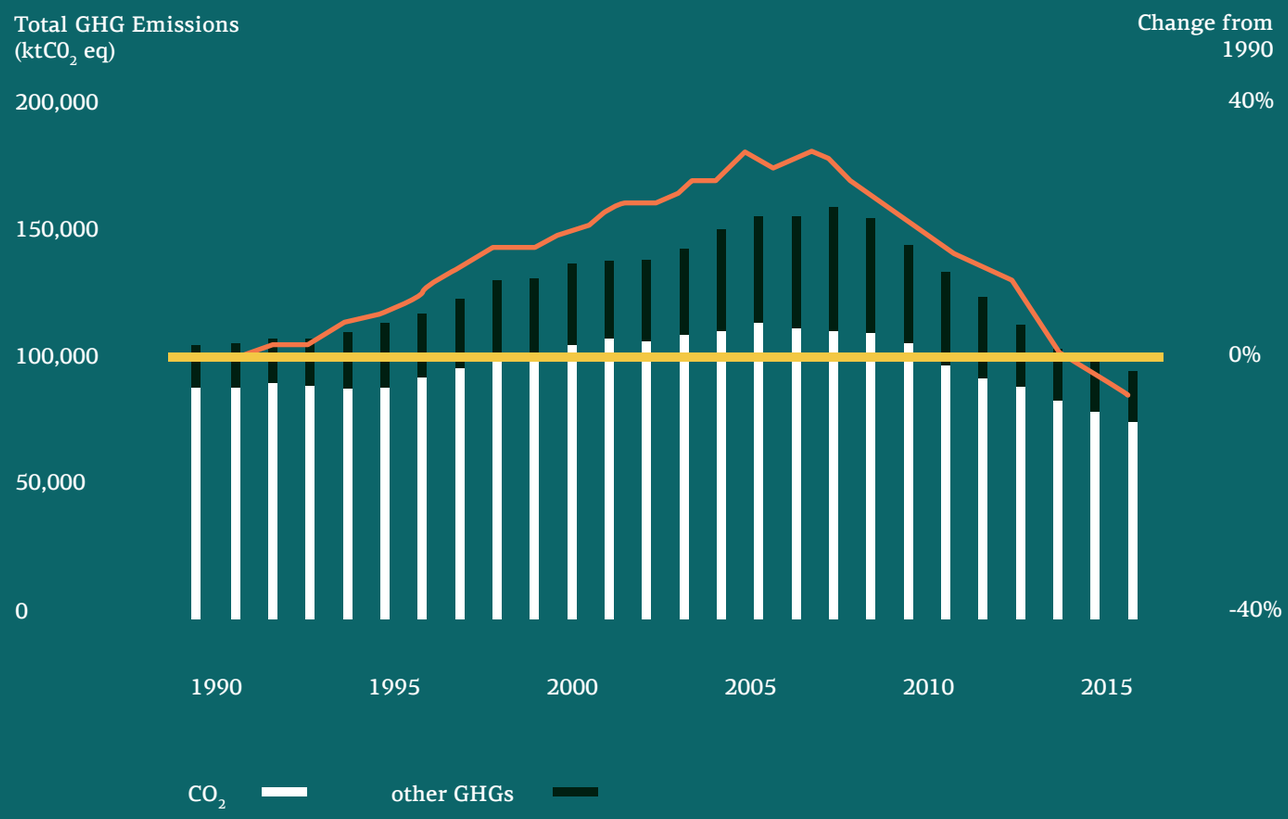
Even if mitigation efforts succeed, given the long lifetimes of GHGs, some change in the climatic conditions is inevitable and as a result additional action towards adaptation to climate change is required. Adaptation includes the assessment of foreseen climate change impacts and pertinent actions - at local and international levels - to prevent them or limit their severity. The Mediterranean area is rather vulnerable to climate change, being already sensitive to high temperatures and droughts, which are anticipated to further aggravate in the future.
Besides the "average" levels of climatic variables, an increase in the frequency and intensity of extreme events is expected to impact health, ecosystems and key sectors of the economy, such as agricultural production and tourism. In this framework, it is important to monitor and assess GHG emissions, changes of climatic parameters and related extreme events. Reporting and analysis of measures aiming at climate change mitigation and adaptation is equally important.

1. Greenhouse Gas Emissions and Mitigation Measures

This report provides information regarding GHG emissions reported by Greece under the United Nations Framework Convention on Climate Change (UNFCCC). Emission data, total and by GHG, are analyzed for trends and regarding the contribution of various activity sectors. The changes of their intensity with respect to main demographic and macroeconomic indicators is also presented. During 2015, which is the latest year of reporting, the national total of GHG emissions was 95.7 Mt of CO_2eq, reduced by 7.1% since 1990. Calculations do not take into account the sector of land-use, land-use change and forestry (LULUCF), which has a favorable impact on the removal - emission net balance. If LULUCF were included, the reduction of GHG emissions, with respect to the base year would rise to 8.3%. Greece has fulfilled the target regarding the first period (2008-2012) of commitment to the Kyoto Protocol and is on track to achieve the EU target for reduction of emissions deriving from sectors not covered by the emissions trading system.

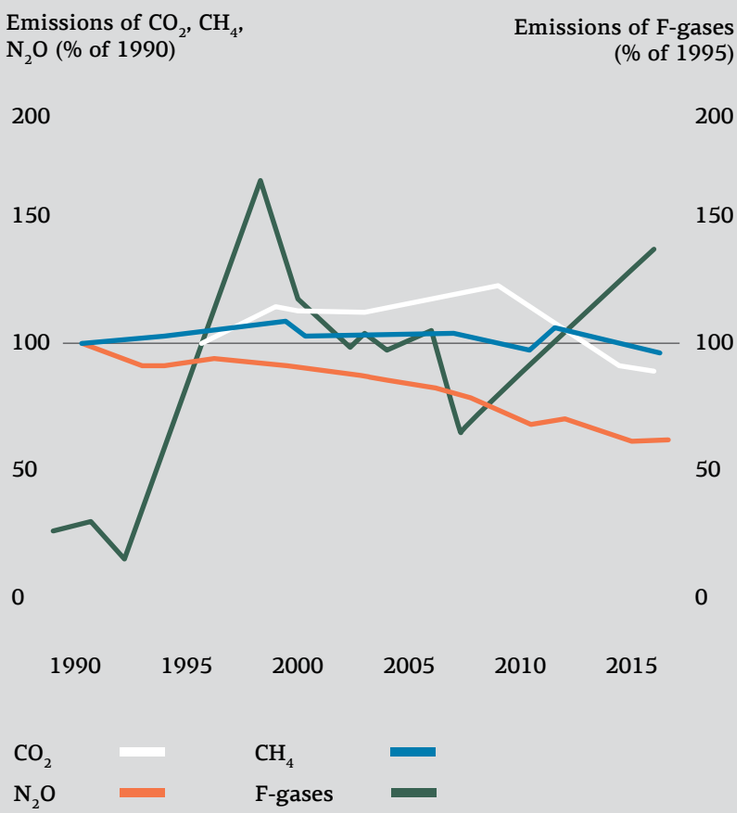
Graph 1.1. displays the change of equivalent CO_2 emissions during 1990-2015. CO_2 emissions comprise the largest part (78.3% in 2015). It appears that in Greece, GHG emissions are not fully decoupled from economic growth - as it is the case in the EU - since up to 2007 an upward trend is observed, with emissions largely exceeding those of the base year, while in the following years (2008-2015), a significant drop (27.3%) is recorded.

Graph 1.1.
GHG emissions in Greece (without LULUCF), as equivalent CO_2 (CO_2 eq) emissions and % change from 1990



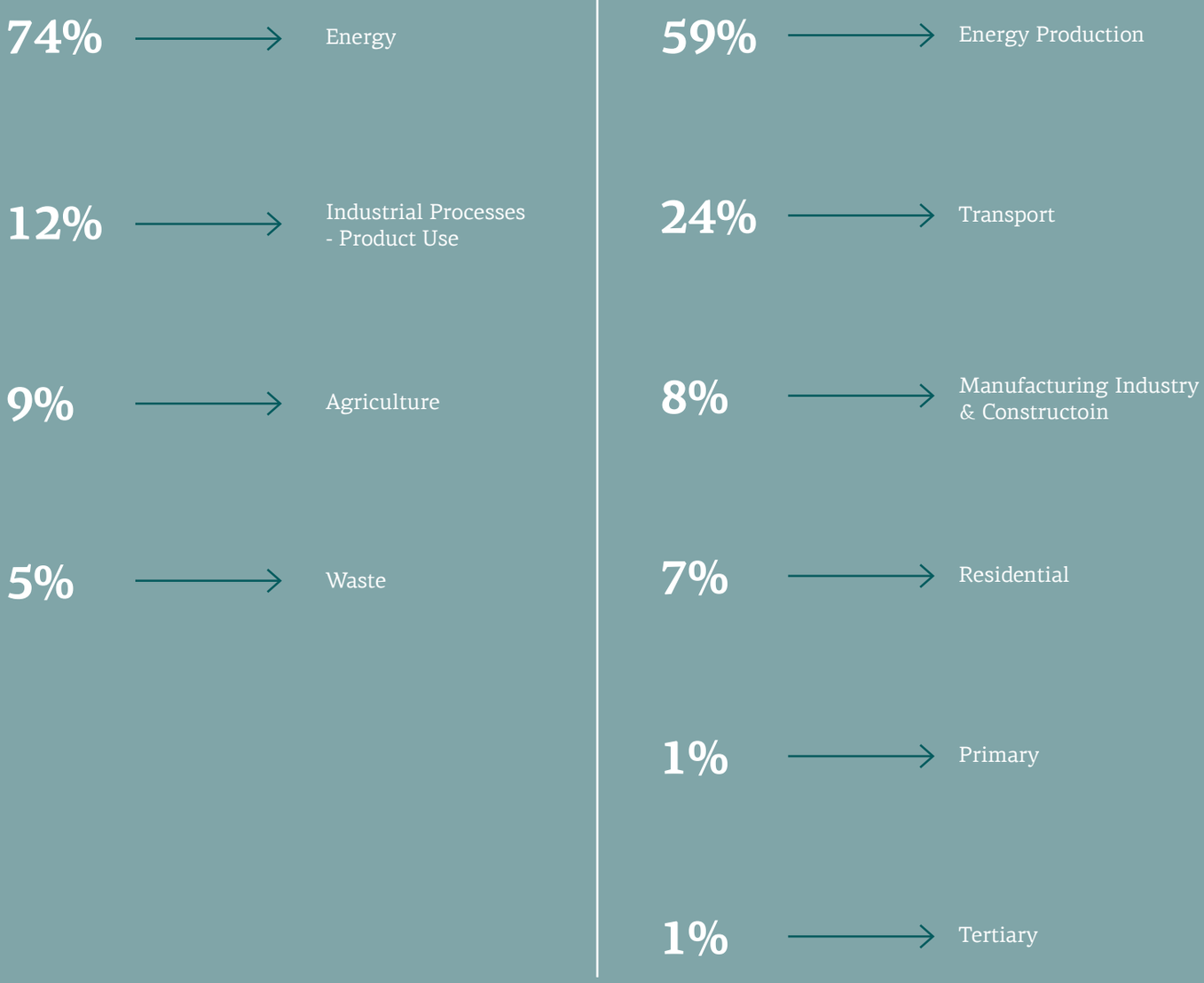
The effect that the reduction of CO_2 emissions (10.1% since 1990) bears on the total GHG reduction is moderated by the comparatively smaller (6.3%) reduction of CH_4 emissions (10.7% of total emissions in 2015), as well as the increase (42.7% since 1995) of emissions of fluorinated gases (F-gases), which now constitute a 6.3% of the total. Hydrofluorocarbons (HFCs) is the subgroup with the largest contribution among F-gases. Nitrous oxide (N_2O) emissions have decreased by 39.3% since 1990 and account for 4.7% of the total in 2015. Emission trends by greenhouse gas are presented in Graph 1.2.

Graph 1.2.
Emission trends in Greece (without LULUCF) by GHG

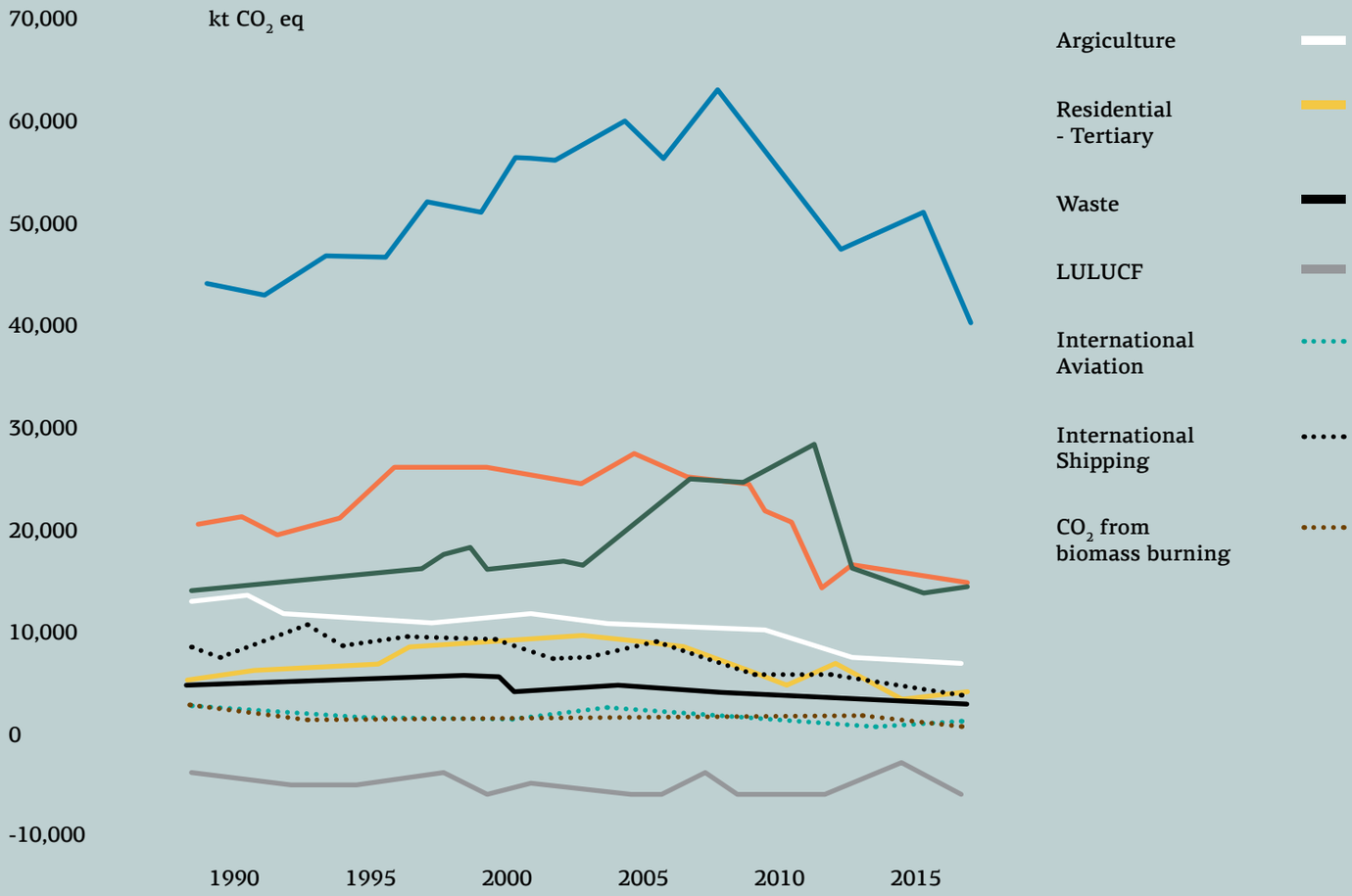


The largest part of GHG emissions derives from the energy sector (74.2% το 2015, without LU-LUCF). Emissions from energy in 2015 were 7.6% lower than those of 1990 and at their lowest level ever since. The increase observed up to 2000 was followed by a stabilization period through 2007. From 2007 to 2015, the reduction of energy emissions has reached 34.3%. The drop observed for total GHG emissions from the energy sector during 2007-2015 is also recorded for the majority of specific energy sectors, with emissions from energy production diminishing by 31.3% and from transport by 26.3%. In comparison with the base year (1990), transport emissions have increased by 17.8%, while energy production emissions have been reduced by only 5.4%. The contributions of main and energy-specific sectors, to total (without LULUCF) GHG emissions and GHG emissions from energy, respectively, are summarized in Graph 1.3.

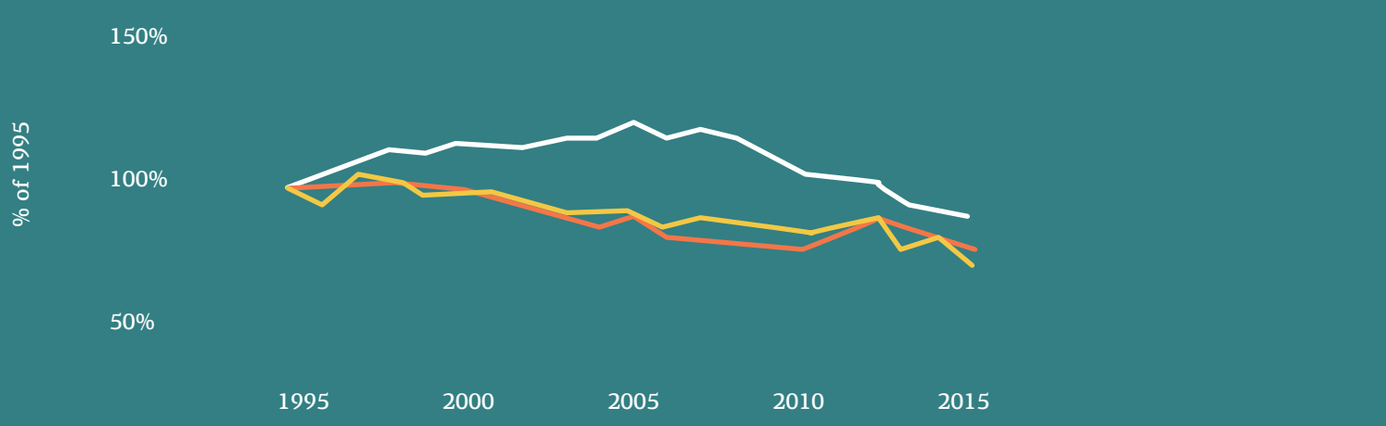
Graph 1.3.
Share of sectors in total (a) and energy-specific (b) GHG emissions for 2015



Graph 1.4.
GHG emissions by sector. Dotted lines represent sectors whose emissions do not count towards the national GHG totals (memorandum items). Respective emissions from energy use are included in industrial and agricultural totals.



Graph 1.5
Change of GHG emissions per capita, of GHG emissions intensity per GDP unit (constant prices of 2010) and of GHG emissions intensity per unit of generated electricity



The industrial processes and product use (IPPU) sector produced 12.4% of 2015 emissions (without LULUCF). Even if emissions have increased by 6.0% since 1990, when compared to the first years of the previous decade, a large reduction is observed, especially for emissions from chemical and mineral industries. Emissions from the agricultural sector cover the 8.7% of the total (without LULUCF) in 2015, having decreased by 17.9% in comparison with the base year. The reduction is mainly attributed to the moderation of N_2O emissions, mainly related to decreased fertilizer use. The waste and waste management sector accounts for 4.7% of total GHG emissions (without LULUCF) in 2015. Emissions from the sector have decreased by 7.8% since 1990, as a result of reducing emissions from waste water treatment and controlling the increase of methane emissions from solid waste disposal. The LULUCF sector has been a net GHG sink in Greece, constantly over the period 1990-2015. Since 1990, the sink capacity of LULUCF has increased by 44.2%, mainly due to increased net removals from forest land, even though the cropland category is becoming a net emission source in the last years. Emission trends of specific sectors during 1990-2015 are displayed in Graph 1.4.

GHG emissions per capita (without LULUCF), since 2013 have fell below 10 tons of CO_2eq per year. The index value for 2015 (8.9 ton) is 12% lower than in 1990 and comparable to the European average (8.5 ton). During the period of 1995-2008, the GDP increase of 57% was accompanied by a 20.7% increase of GHG emissions and as a result the intensity of emissions by GDP unit decreased by 23%. In the following period (2009-2015), the intensity has remained relatively stable, as the reduction of GHG emissions by 23.1% is combined with - and partially attributed to - the economic recession, evidenced by the 23% loss of GDP (in constant 2010 prices) in the same period. Regarding the intensity from electricity and heat production, a reduction is observed even before the onset of the recession, emphasizing the gradual shift of the electricity production sector to low emission fuels and efficient production technologies. Results are displayed in Graph 1.5.

Within the scope of national commitments toward UNFCC, the Kyoto Protocol and EU emission reduction targets, a wide range of measures has been adopted and implemented. Special consideration has been given to the energy sector with the modernization of conventional power plants and promotion of renewable energy sources for electricity production, as well as to the residential-tertiary sectors with measures for the improvement of the energy efficiency of buildings. According to projections from the 7th National Communication under the UNFCCC, by the Greek Ministry of Environment and Energy (2018), the total potential reduction of GHG emissions by 2020 as a result of adopted and implemented sectoral policies at the national level is expected to reach 34.8 Mt of CO_2eq.

2. Climate change impacts and adaptation

Notwithstanding the climate change mitigation action at the international and national stages, and the observed reductions of emissions, in the path of the following decades important changes are expected for key climatic factors and regarding the frequency and intensity of extreme weather events.

According to the calculations of anthropogenic impacts on climate, under the two extreme climate change scenarios (B2 and A2), which are analyzed in this study, it is expected that by the end of the 21st century rainfall will be reduced between 5% and about 19%, at a national level. Moreover, air temperature will rise between 3.0 °C and 4.5 °C, respectively. The projections of the balanced scenario A1B regarding the changes in precipitation and mean air temperature, between periods 2071-2100 and 1961-1990 in the Greek region are displayed in Picture 1.1.

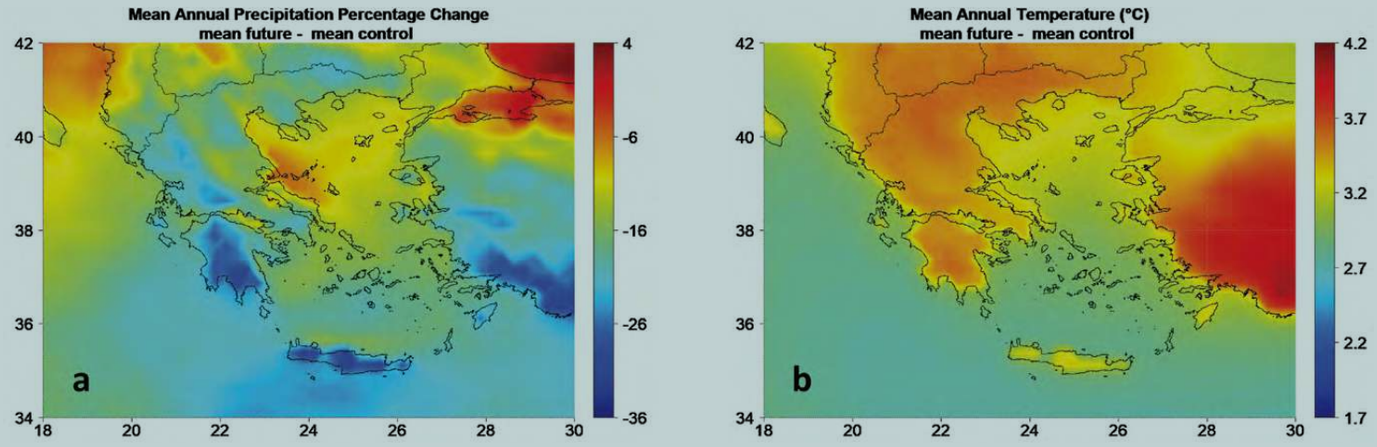
In general, simulations predict important shifts in numerous climatic parameters, including relative humidity, cloud cover, incoming shortwave radiation and wind speed. It is of importance for the utilization of RES that incident solar radiation is expected to increase (by 2.3-4.5 W m^{-2}) nationwide, along with the increase of wind speeds (by about 10%), until the end of the century.

The severity of climate change impacts is probably more related to shifts in the frequency of extreme weather events than to changes in the “mean climate”. The study presents simulation results for expected variations in the frequency and intensity of events related to extreme temperatures and rainfall/droughts, according to the A1B scenario.

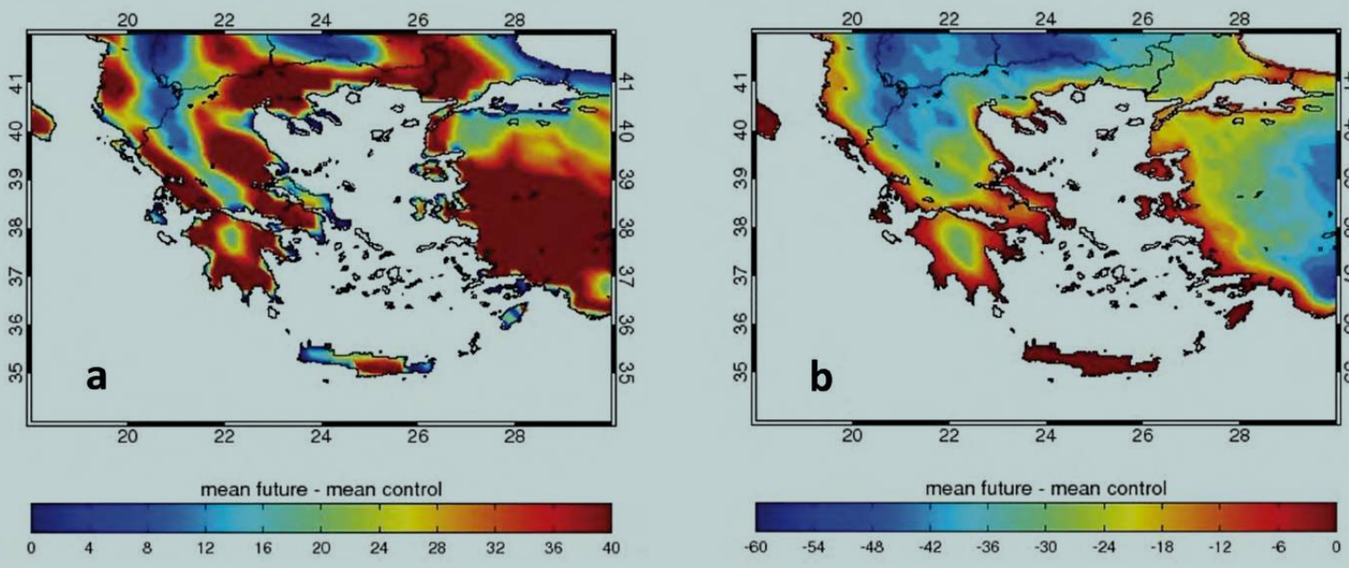
The mean maximum summer temperature is expected to rise by 5 °C, by 2071-2100. Significant countrywide changes are foreseen in the number of heat events - days with maximum temperature >35 °C - which are a cause of thermal discomfort for the population, especially in urban areas (Picture 1.2a.). It has been estimated that the coolest summers in 2070 - 2100 will be as warm as the warmest summers of the past (for example, in Athens, the 1987 summer will be considered relatively mild in the future).

Furthermore, all regions of Greece are expected to experience higher minimum winter temperatures, by approximately 3.5 °C, in 2071-2100, with the increase being larger in the mountainous areas. A decrease in the number of night frosts is expected (Picture 1.2b.), with implications for sensitive crop productivity. The increase of electricity demand for cooling in summer is an important side effect of the expected temperature increases. Especially at low-altitude continental areas of Greece an excessive demand is predicted for an additional 40 days per year, in the period 2071-2100 (increments will be less intense in the islands and in mountainous areas). The reduction of heating energy demand during winter will be a positive effect. Because of the later-in-autumn and earlier-in-spring occurrence of first and last frosts, respectively, the growing season is expected to be elongated.

Picture 1.1.
Percentage change of mean annual precipitation (b) and change of mean air temperature (°C) (b), in 2071-2100, relative to 1961-1990 (scenario A1B)

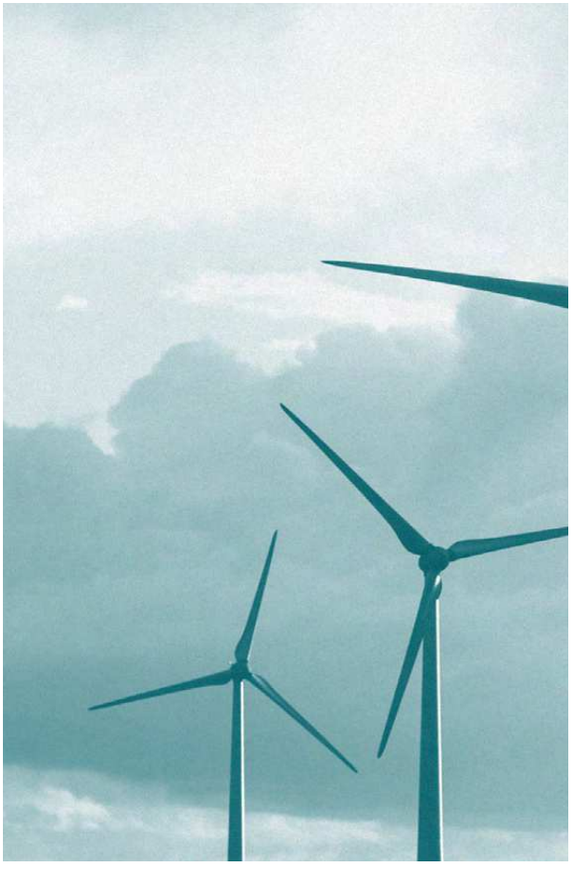


Picture 1.2.
Change in the number of days with maximum temperature >35 °C (a) and change in the number of night frosts (b) in 2071-2100, relative to 1961-1990 (scenario A1B)

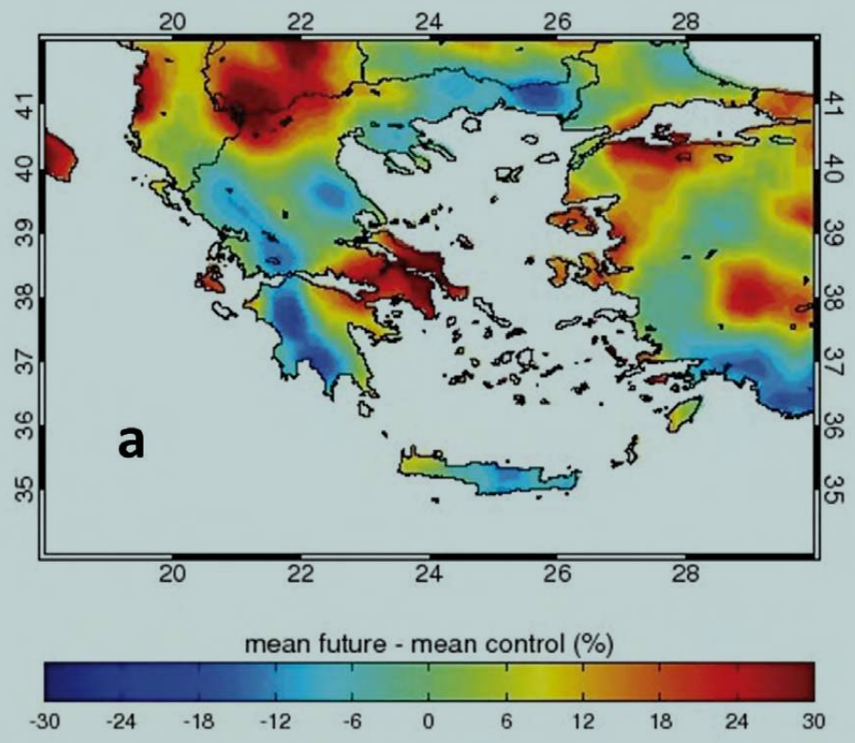


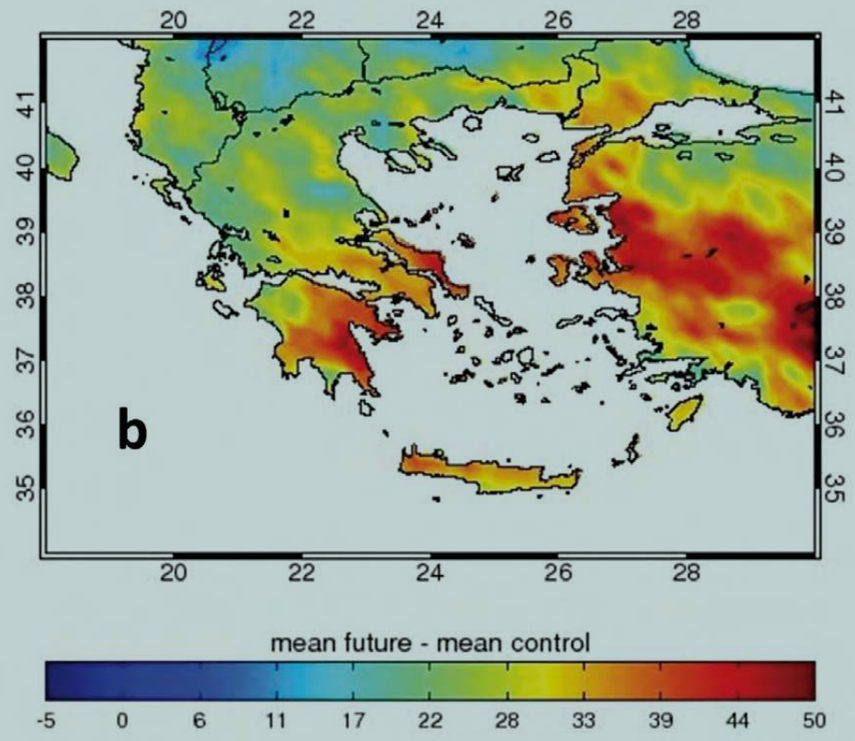
Changes are also expected regarding extreme rainfall values. In Eastern Greece and Northwestern Macedonia, the maximum amount of precipitated water in up to three days is expected to increase by up to 30%, while in Western Greece to diminish by up to 20% (Picture 1.3a.). The increasing trends combined with the concurrent decrease in total annual precipitation indicate that more frequent and more intense rainfall events will occur in short periods, with a higher risk for flash floods. On the contrary, the largest increases in the duration of dry periods are expected in Eastern Continental Greece and Northern Crete where 20 and 40 additional dry days are foreseen by 2021-2050 and 2071-2100 (Picture 1.3b.), respectively. The change of climatic conditions will extend the number of days with very increased fire risk by 40 by 2071-2100 in the whole of Eastern Greece, while smaller increases are predicted for Western Greece.

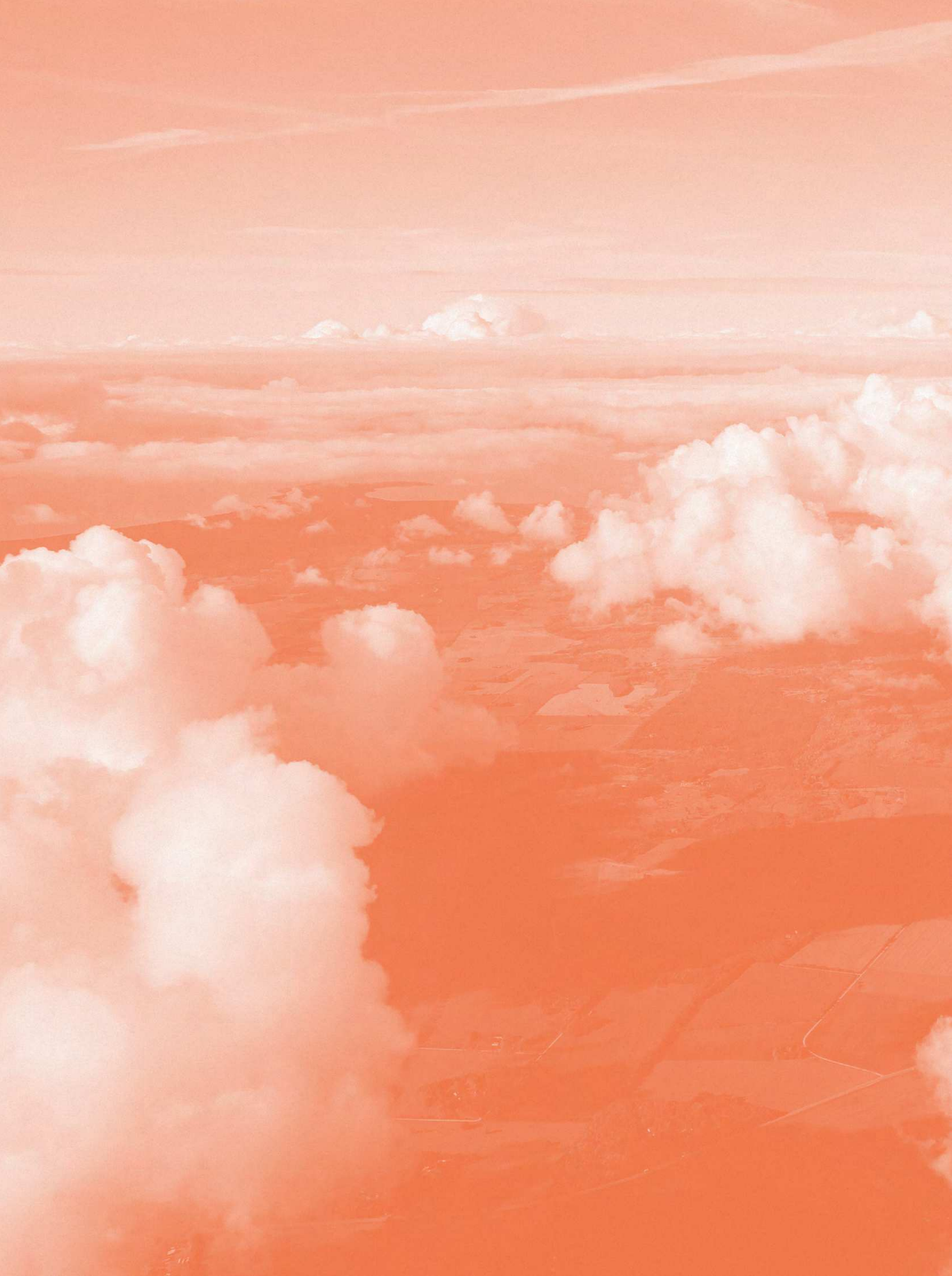
The effects of these changes do not only affect the natural environment, where in the case of forests and biodiversity the ramifications will be severe, but also the economic activity, with tourism being an exemplary case where important adjustments are foreseen. The total cost of climate change for the Greek economy is significant and includes direct sectoral impact costs, indirect costs and costs deriving from between-sector impacts. The Climate Change Impacts Study Committee of the Bank of Greece, in its study on the Environmental, Economic and Social Climate Change Impacts (2011) has estimated costs for no-action, mitigation action and adaptation action scenarios.
The results of the committee's assessment indicate that:
⇢ For the no-action scenario, cumulative costs up to 2100 for the Greek economy, expressed as base year GDP reduction, will reach 701 billion € (2008 constant prices).
⇢ For the mitigation action scenario, cumulative costs will include the costs of measures for GHG emissions reduction (142 billion €) and the costs of the residual climate change (294 billion €). Thus, the total costs will be by 265 billion € lower than those of the no-action scenario.
⇢ For the adaptation action scenario, the costs from non-addressed impacts of climate change are estimated at 510 billion €. Taking into account the costs of adaptation measures (67 billion €), total savings of 124 billion €, with respect to the no action scenario, are estimated.



Picture 1.3.
Percentage change in annual maximum consecutive 3-day preciptation (a) and changes in the maximum duration of dry spells (b) in 2071-2100, relative to 1961-1990 (scenario A1B)







2

Air Quality

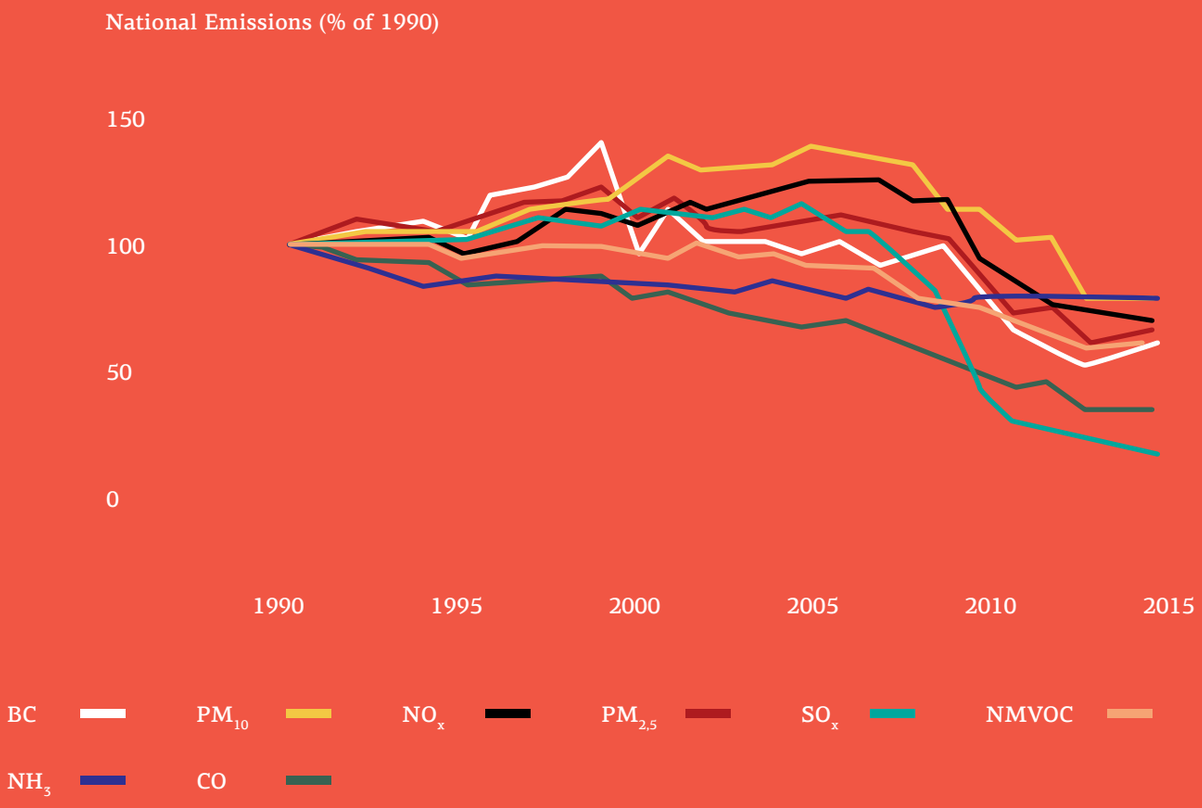
Air pollution is a complex environmental and social issue at the European and international levels. It poses a high risk to human health as it is related to cardiorespiratory disease and cancer. At the same time, it impacts the economy, adding to the health expenditure and reducing productivity. Air pollution also has important effects to the natural environment affecting ecosystems, soil and water quality and vegetation. Moreover, it interacts with the climate, since several main pollutants behave as climate forcers.

The European Union has specified as a long-term target the achievement of ambient air quality levels that don't have important adverse effects for human health and the environment. To reach this objective, European legislation follows a two-pronged approach, with the promulgation and implementation of air quality standards, and with the control and reduction of anthropogenic emissions. In the case of Greece, high levels of pollutants are a perennial cause of concern. Their management and mitigation are priorities for the protection of public health, not discounting their considerable importance for the environment. Greece is a characteristic example where the need of systematic observation of both primary emissions and actual air quality indicators is emphasized, since the distinct geographical and climatological conditions of the region convolute the processes that the atmospheric mixture undergoes along the path from the point sources to the receptors. An understanding of the state and also the tendencies which affect ambient air quality in the country, is an important first step towards addressing the issue. The present study reviews the current conditions and the trends of primary emissions from sources and of ambient pollutant concentration levels in large urban centers in Greece.

1. Emissions of air pollutants

Systematic inventorying of main pollutant emissions in Greece is conducted according to the provisions of the Geneva Convention on Long Range Transboundary Air Pollution and of the European Union's legislation on National Emission Ceilings. The available data, which cover the period between 1990-2015 and now incorporate a wide range of gaseous and particle pollutants, can highlight trends in anthropogenic contributions to air pollution and indicate the efficacy of implemented strategies and measures for control of emissions. The inter-annual variability of emissions for main pollutants, with respect to the base year (1990), is shown in Graph 2.1. Reductions in the range of 20-80% are observed for all pollutants in 2015. A detailed account of emission levels, their trends and the contribution of various activity sectors is provided in this report, focusing on pollutants for which reduction targets are stipulated in the (EU) 2284/2016 directive, which sets the year 2005 as the reference year for required reductions.

Graph 2.1.
National emission trends between 1990-2015



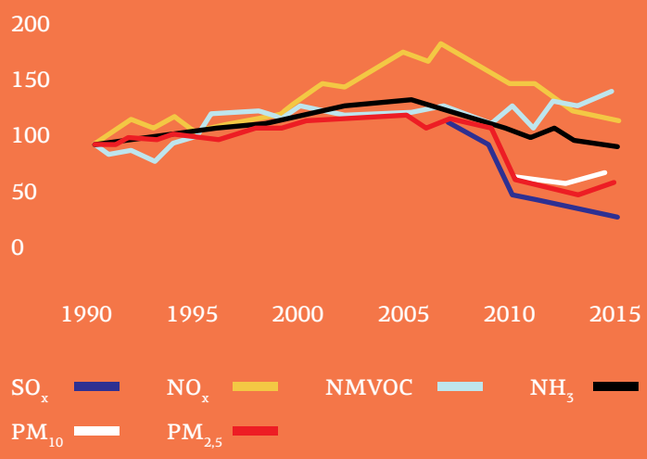
In Greece, 2015 emissions of sulfur oxides (SO_x as SO_2) are reduced by 80% and 83% in comparison to 1990 and 2005, respectively. Since the energy sector produces almost 80% of SO_x emissions, observed reductions mainly reflect the modernization of conventional older power plants and the operation of new units using natural gas. European fuel legislation, during the last decades, has imposed successive reductions in the sulfur content of petrol and diesel, leading to important cuts of SO_x emissions from the road transport sector. While 2015 emissions of nitrogen oxides (NO_x as NO_2) have also diminished (31% and 43% since 1990 and 2005, respectively), the grade of reduction is not comparable to that of sulfur oxides, while its major part mainly occurred during the beginning of the recession period. The main factor for observed reductions is the transport sector, whose emissions, as well as those of the residential-commercial sector, have shrank by 40%, during 2009-2015. Comparable reductions (37% and 33% for 2015 since 1990 and 2005, respectively) have been also recorded for emissions of non-methane volatile organic compounds (NMVOCs). These are related to emission controls in new-technology vehicles (Euro emission standards) as well as to the reduction of emissions from solvent use - the sector with the highest contribution in total emissions.

Emissions of ammonia (NH_3) originate mainly from agricultural activity and their decline has been of lesser magnitude (22% and 7% for 2015, since 1990 and 2005, respectively). These reductions are mainly attributed to the decreased use of synthetic fertilizers and to the spread of organic farming practices.

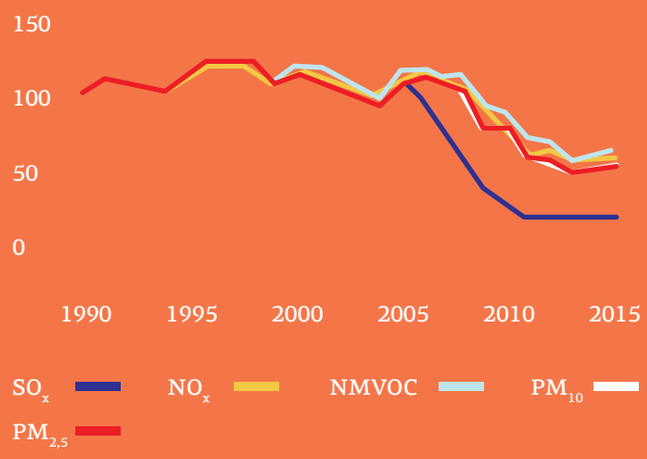
The energy sector appears to have a critical contribution to emissions for the majority of pollutants; through energy production, its use in industry, fuel use for transport and use in the residential and commercial sector. Changes of emissions from energy related sectors are presented in Graph 2.2.

Graph 2.2.
Changes of emissions (% of 1990) from energy related source sectors, between 1990-2015

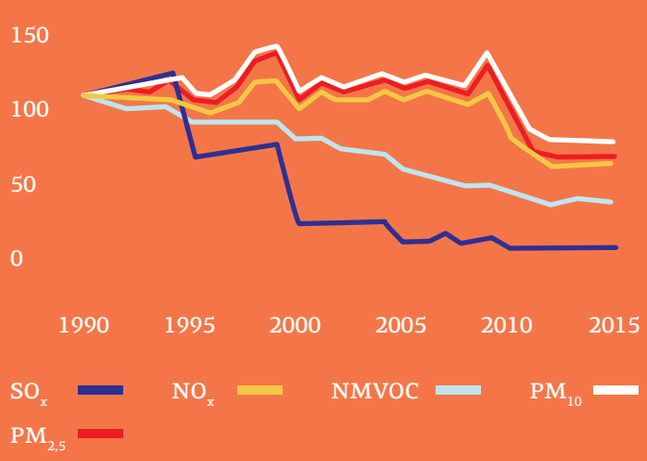
Energy Production & Dstribution



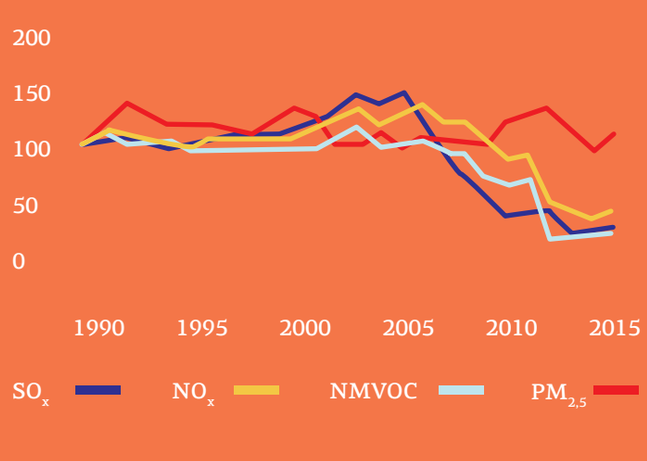
Energy Use in Industry



Transport



Commercial - Residential



A characteristic deactivation of the transport sector - especially road transport - as a source of any significance for SO_x emission is obvious, as a result of legislation on the sulfur content of fuels. The European legislation on vehicular emission control is also leading to the gradual decline of NMVOC emissions.

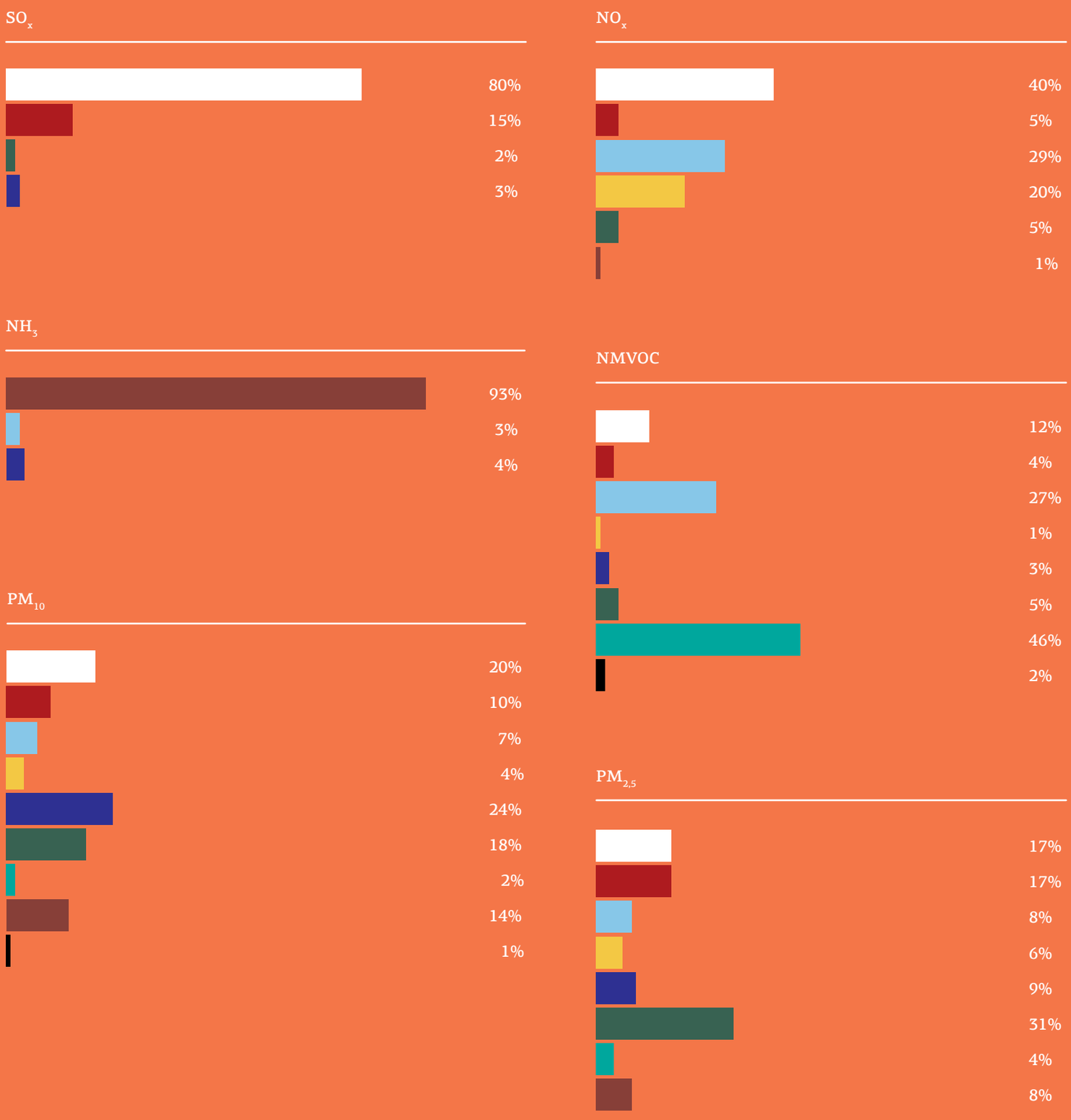
The important reductions which were recorded in most cases during the last decade, regardless of the implementation of appropriate policies and measures, are expected to be influenced to a certain degree by the general decrease in energy demand, related to the recession (for example in the secondary, tertiary and residential sectors). In 2015, the main exceptions to the general reduction of emissions since 1990, are NO_x and NMVOC emissions from the energy production sectors and ambient particles from commercial and household uses.

The contribution of the main activity sectors (energy production and distribution, energy use in industry, road and non-road transport, industrial processes, commercial and residential uses, solvent and product use, agriculture and waste) to the national emission total for 2015 is displayed in Graph 2.3.

The energy production sector is still the highest contributor to SO_x and NO_x. Since NO_x emissions from energy have remained comparable to 1990 levels, while those from transport have decreased significantly, the relative contribution of the sector (40%) is higher than in 1990. This is also the case for its contribution to SO_x emissions (80%), whose decline from the energy production sector, although significant, occurred at a lower rate, in comparison with the energy use in industry sector. The transport sector records the higher contribution to NO_x (49% combined), NMVOC (28%, almost exclusively from road transport) and PM (11-14%) emissions. Its share in NH_3 emissions, although small is measureable (3%), due to emissions from catalytic converters. The monitoring of variations and relative contributions of NO_x emissions from the sector is of particular importance, given the observed discrepancies between actual on-road vehicular emissions and those determined in laboratory tests assessing compliance with the EU regulations. The industry-related sectors (energy use in industry and industrial processes) appear to have a substantial contribution to particle emissions (26-34% combined, for $PM_{2.5}$ and PM_{10}, respectively). Particle emissions receive also a noteworthy contribution from the commercial - residential sector (18-31%, for PM_{10} και $PM_{2.5}$, respectively).

Emissions from agriculture and solvent and product use contribute the most to emissions of NH_3 and NMVOC, respectively. NMVOC emissions from solvents in 2015, even though they don't differ much from those in 1990, are largely reduced since the middle of the last decade due to legislative action towards the limitation of the volatile organic compound content in organic solvents and the control of emissions from their use.

Graph 2.3.
Contribution of main source sectors
to national emissions in 2015



Overall, regarding the national emission reduction targets, set by the directive (EU) 2284/2016 on national emission ceilings, it is expected that for SO_x, NO_x and NH_3 compliance with the required reductions will be achieved at the first stage (2020-), while for NMVOCs additional cuts will be necessary. Primary $PM_{2.5}$ emissions are on track to meeting the target, however they have to be closely monitored, given the slight uptick (2.7%) that has been observed between 2013-2015.

It is also important to assess the aggregate effects of pollutant groups, involved in physicochemical processes that are linked to serious environmental issues. Typical examples are the acidification of water and soils and the atmospheric formation of secondary pollutants. Sulfur and nitrogen oxides, along with ammonia, are the main pollutants related to ground and water acidification, an environmental issue that has caused great concern in the past. The reduction of SO_x emissions has led to the decline of the total acidification potential (57% for the period 1990-2015). The effectiveness of international action for combatting acidification is rather visible at the European level, where the issue, nowadays is much less of a concern than in the past, as opposed to the issue of eutrophication, a major ecological problem especially in the Mediterranean area.

Gaseous SO_x, NO_x and NH_3 are precursors of sulfate, nitrate and ammonium particles. These secondary particles constitute a large portion of PM mass (especially in the fine fraction). Therefore, controlling the precursor emissions can help lowering ambient particulate levels. In fact, the decline of emissions of primary PM_{10} since 1990 has been less pronounced (20%), in comparison with the decrease (51%) of the secondary particle emission potential.

Nitrogen oxides and NMVOCs are the main pollutants - especially within the urban environment - which participate in the secondary ozone formation cycle. As a result, cuts in their production - mainly from combustion sources - have led to corresponding reductions of the total tropospheric ozone formation potential (38% since 1990).

2. Ambient Air Quality

In Greece and especially in urban areas inhabitants are exposed to a composite mixture of air pollutants, which have numerous and diverse emission sources. During the last decade, a gradual amelioration of air quality has been recorded, mainly as the result of primary pollutant emission reductions. Notwithstanding the observed decrease of pollutant releases - a combined effect of European legislative action and the recession - exceedances of limit values set for the protection of public health are still being observed.

Air quality is routinely recorded at monitoring stations which operate under the oversight of the Ministry for Energy and the Environment (MEEN) and the regional authorities of the country. Systematic monitoring at the national level was initiated in 2001 with the operation of the National Network for Air Pollution Monitoring (NNAPM), which included stations in major urban agglomerations, continuously recording pollutant concentrations according to the provisions of the European legislation (directives 2008/50/EC and 2004/107/EC). Even though the results from recorded pollution levels during the first period of the network's operation were rather concerning, a gradual decline has been observed since. In 2016 (most recent reporting year), exceedances of the European air quality standard continue to occur for ozone, PM_{10} and NO_2.

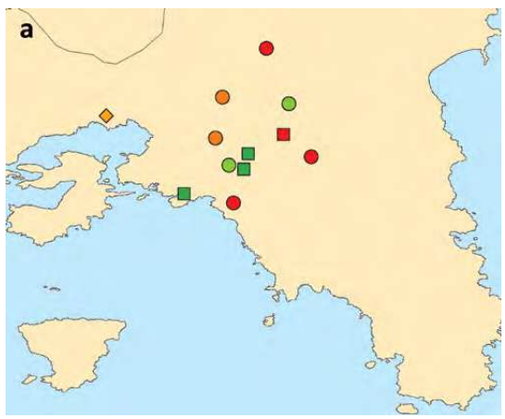
2.1 Ozone

In contrast to the rest of the pollutants which are of exclusive or principal primary character, the long-term improvement in O_3 levels has been less pronounced. This is mainly due to regionally prevailing climatological conditions which favor the appearance of intense high-concentration episodes. The EU standard for O_3 sets a target value of 120 μg m^{-3} for the protection of public health, as the maximum daily 8-h mean concentration not to be exceeded more than 25 times in a year.

Graph 2.4. displays the variation of the median value, among background stations in Greece, of the 93.2 percentile of maximum daily 8-h mean concentration values, corresponding to the 26th highest value in an annual time-series. It can be seen that the majority of stations exceed the target value, throughout the period 2001-2016. In 2016, the standard was violated in 6 of the 10 background stations of the network.

Graph 2.4.
Median, interquartile range and min-max values for the 93.2 percentile of maximum daily 8-h mean O_3 concentration values, recorded at background stations of the NNAPM

In Athens the mean values of the percentile among urban and suburban background stations is higher than the target value for the entire period 2001-2016. In background stations of Thessaloniki, violations of the standard have also been recorded throughout the years, although more variable and less intense than in Athens. Meteorological conditions in Northern Greece are less favorable for photochemical production of O_3, in comparison with Athens, where intense insolation, higher temperatures and topographic characteristics of the basin increase the frequency of high concentration events. Results for the percentile indicator in Athens and Thessaloniki in 2016 are shown in Picture 2.1.

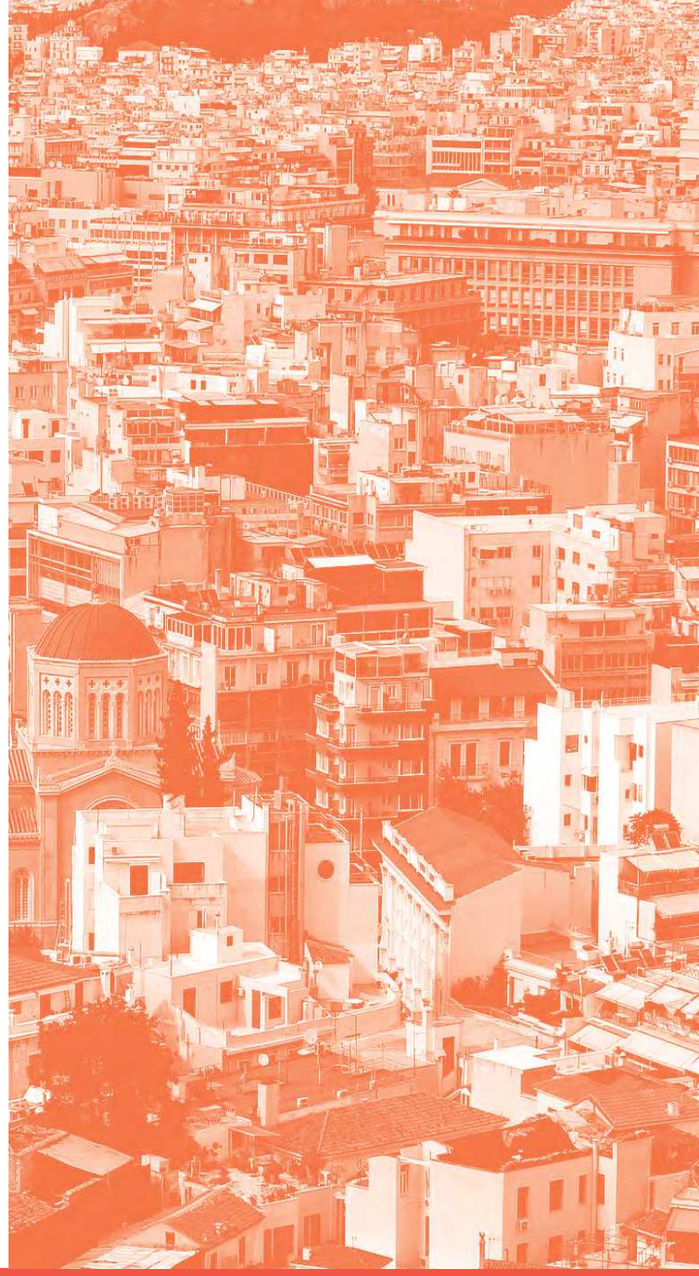


Picture 2.1.
93.2 percentile of maximum daily 8-h mean O_3 concentration values in 2016, in Athens (a) and Thessaloniki (b)
(circles: background stations, squares: traffic stations, diamonds: industrial stations)

<110 110-120

120-130 >130

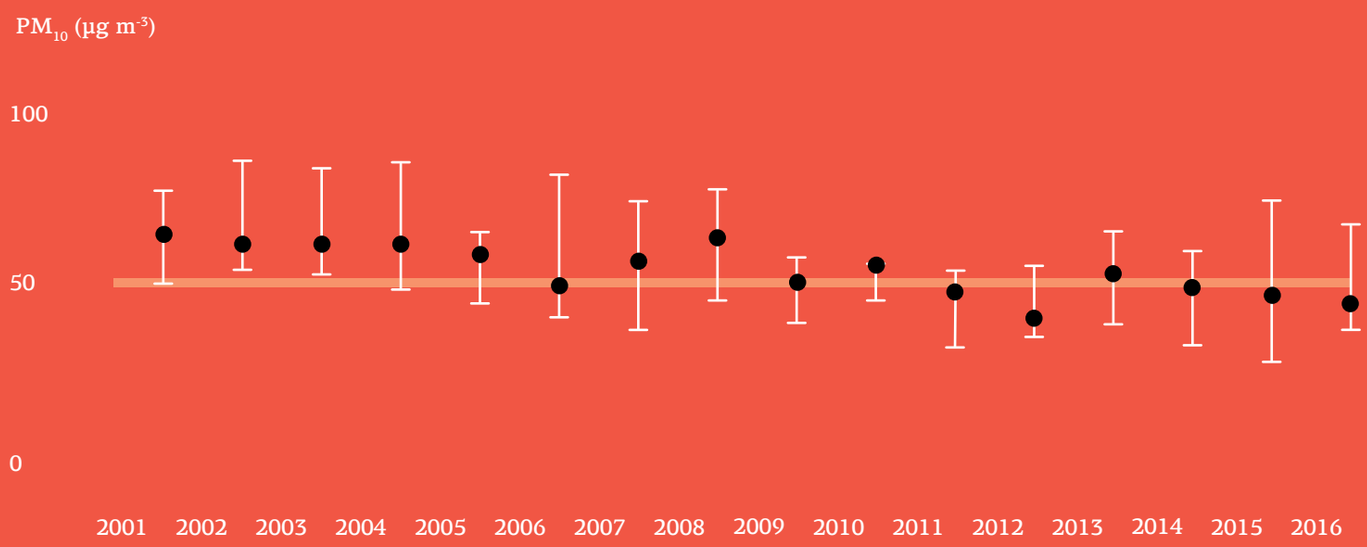
A slow decline of O_3 levels can be deduced, which for Athens and Thessaloniki, in terms of background station average of the percentile indicator, is estimated at 14.5-15.1% between 2001-2015. In the same time period, the decrease of the O_3 formation potential from gaseous precursors is significantly higher (40%). This discrepancy is attributed to the type of the target value, which is designed to track short-term increases of O_3 concentrations, since these are linked to the most adverse health effects. Due to its secondary character, peak ozone levels are rather variable and depend on fluctuations of precursor emissions and on meteorological conditions which in Greece promote the occurrence of episodes, especially during the warm months.



2.2 Particulate matter

Regarding mean annual PM_{10} levels, the improvement over the years is obvious. While 75% of the network's stations breached the annual limit value (40 μg m^{-3}) in 2001, in 2016 such exceedances are observed at only two out of 19 PM_{10} recording stations. However, the daily standard (50 μg m^{-3}, not to be exceeded more than 35 times in a year) was exceeded in 10 out the 19 stations with adequate data coverage. Graph 2.5. presents the variation of the median value, among background stations in Greece, of the 90.4 percentile of daily mean PM_{10} concentrations, corresponding to the 36th highest daily mean in an annual time-series.

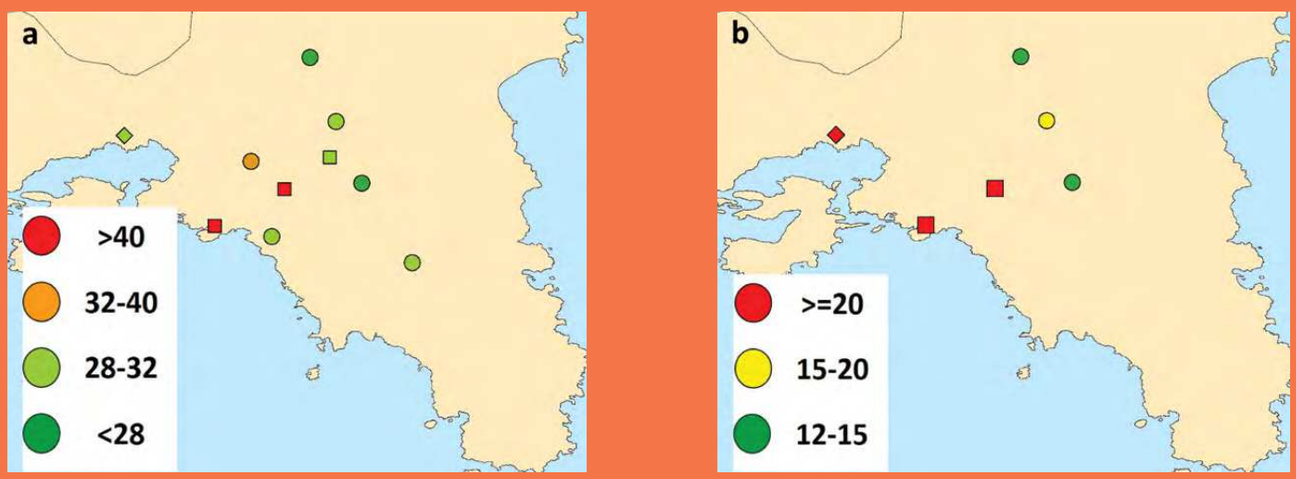
Graph 2.5.
Median and min-max values for the 90.4 percentile of daily mean PM_{10} values, recorded at background stations of the NNAPM



The observed decline of PM_{10} levels is to a certain degree relevant to the decline of respective emissions at a national level, which for the 2001-2015 period reached 54% for primary particles and secondary particle precursors, combined. It is noted, that the number of exceedances is influenced also by particles of natural origin, such as Saharan dust particles and sea salt, which are taken into account in the assessment of the country's compliance with the provisions of European legislation.

An improvement is observed also in the case of $PM_{2.5}$ fine particles. Since 2010, no exceedances of the annual limit value (25 μg m^{-3}) have been recorded. However, all reported mean annual concentrations were higher than 10 μg m^{-3}, which is the guideline value set by the World Health Organization. Special concern should be given to the impact of emissions from extensive biomass burning for residential heating in observed concentrations of PM and their constituents, such as black carbon (BC) which displays rather high levels during the winter period. Results for the annual mean concentrations of PM_{10} and $PM_{2.5}$ at a spatial scale in Athens are provided in Picture 2.2.

Picture 2.2.
Annual mean concentrations of (a) PM_{10} and (b) $PM_{2.5}$ in Athens, in 2016 (circles: background stations, squares: traffic stations, diamonds: industrial stations)

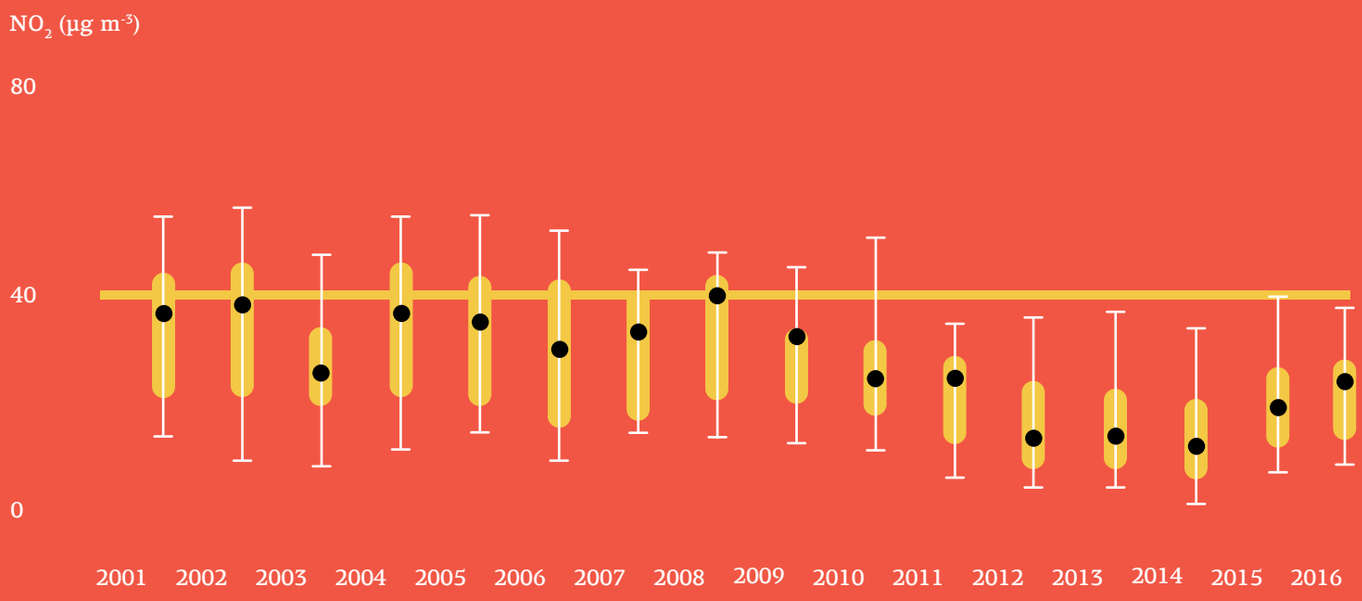


Although PM emissions from road transport on a national level have decreased, the roadside enhancement (difference between traffic and background stations) of mean annual particle concentrations in Athens is large and in 2016 exceeded on average 10 μg m^{-3} for PM_{10}, while the mean annual traffic-background difference in $PM_{2.5}$ reached 6 μg m^{-3}. It is obvious that along with direct fine particle emissions from combustion in vehicles, road traffic also produces coarse particles ($PM_{10-2.5}$) from mechanical and tire wear and from road dust resuspension.

2.3 Nitrogen dioxide

Annual average NO_2 levels display a noteworthy downward trend, which bears resemblance to the declining progress of NO_x primary emissions, especially during the recession period. Graph 2.6. shows the variation of the median value, among background stations in Greece, of the annual mean concentration of NO_2. Notably, following 2010, there have been no exceedances of the annual limit value at background stations, while in 2016, out of all (21) stations, the standard was only breached at 3 traffic locations in Athens.

Graph 2.6.
Median, interquartile range and min-max values for annual mean NO_2 concentration values, recorded at background stations of the NNAPM



The overall reduction of NO_2 levels appears to track the respective reduction of primary NO_x levels, which between 2001-2015 was 40%. A characteristically large decline of levels is observed between 2008-2015, when NO_x emissions from road transport decreased by over 50%.

Results for the annual mean concentration NO_2 at a spatial scale in Athens and Thessaloniki are depicted in Picture 2.3. The observed mean roadside enhancement of concentrations (traffic vs. background stations) in the greater area of Athens is 24 μg m^{-3} in 2016 and has been on the rise since 2014.

2.4 Other Pollutants

Levels of remaining pollutants regulated by European legislation do not pose a reason for concern. Regarding carbon monoxide (CO), during the whole 2001-2016 period, there has been only one exceedance of the 8-h limit value. In the same period, the daily limit value (125 μg m^{-3}) for sulfur dioxide has never been exceeded in NNAPM stations, while only 3 exceedances of the 1-h limit value have been reported. During the examined period, SO_2 levels have decreased drastically, in line with reduced national SO_x emissions of 82% between 2001-2015.

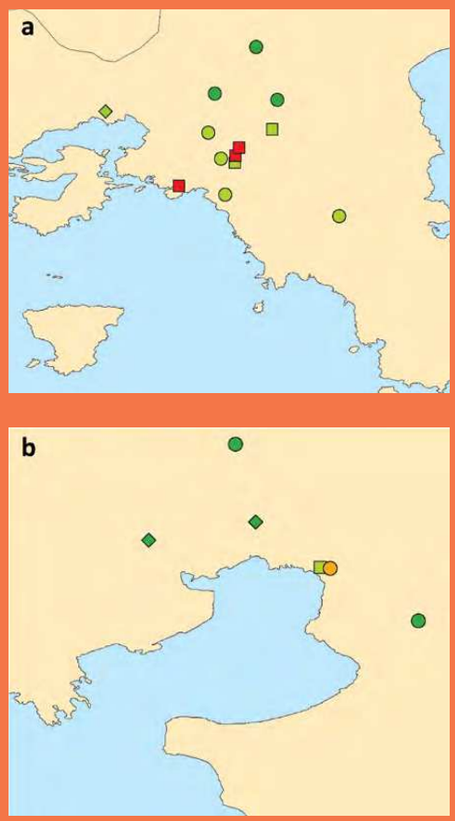
Exceedances of the mean annual limit value for benzene (5 μg m^{-3}) have been reported only at the traffic station of Patission Str. in the center of Athens. Benzene concentrations, since the upgrade of the NNAPM in 2015, are recorded at 3 additional stations in Athens, while measurement equipment has been installed in four other cities. In 2016, for stations in Athens, mean annual concentrations were lower than the limit value, with the sole exception of the Patission station.

Indicative measurements of benzo[a]pyrene (BaP) which have been conducted during 2014-2015 at stations around the country, are suggesting that exceedances of the annual target value of 1ng m^{-3} are probable. Thus, systematic measurement of BaP is necessary to assess the attainment of the target value for the protection of human health.

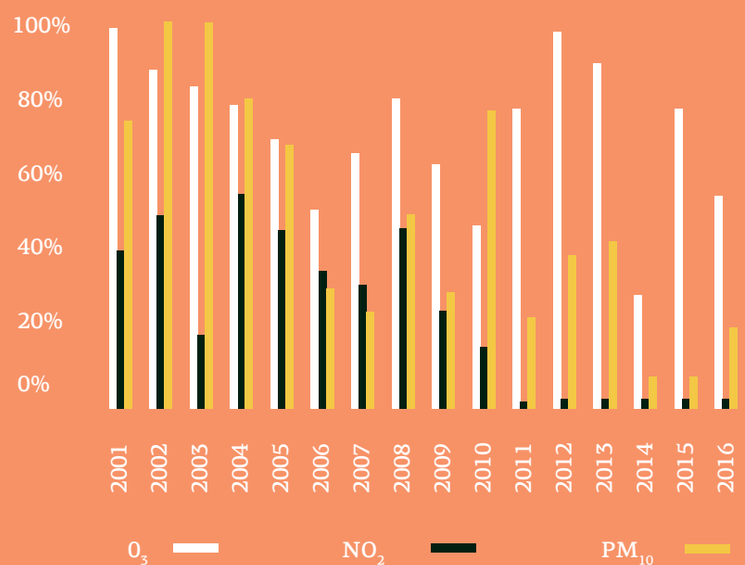
2.5 Population exposure to air pollutants

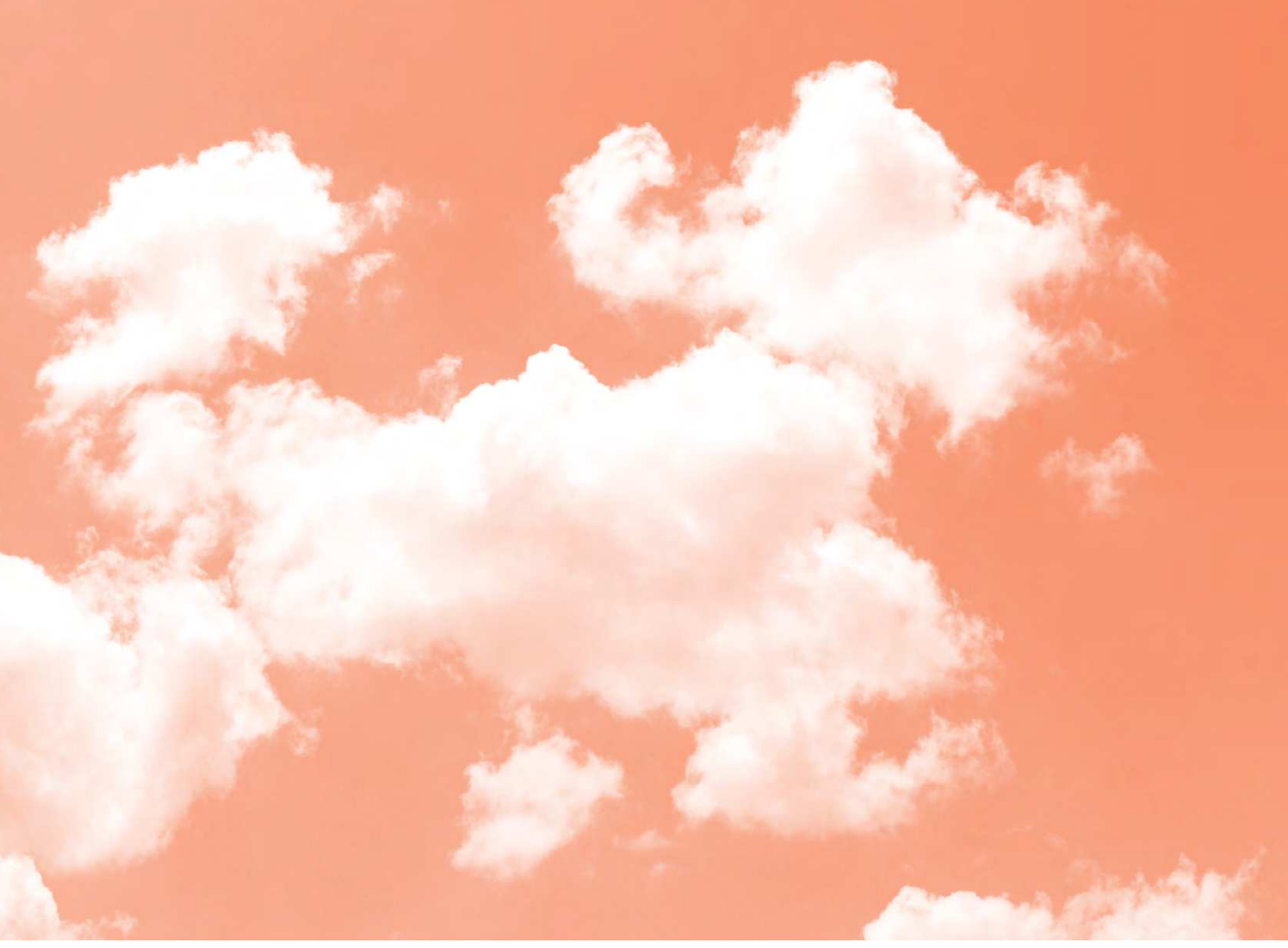
Following the methodology proposed by the European Environment Agency (indicator EEA CSI 004), and utilizing data on monitoring station characteristics, on the recorded exceedances of limit values and on demographic factors, the fractions of the urban population exposed to levels above the EU reference values were estimated. The inter-annual variation of fractions of urban population exposed to levels exceeding the air quality standard, for O_3, PM_{10}, NO_2 is presented in Graph 2.7.

Picture 2.3.
Annual mean of NO_2 concentrations in 2016, in Athens (a) and Thessaloniki (b) (circles: background stations, squares: traffic stations, diamonds: industrial stations)



Graph 2.7.
Fraction of the urban population exposed to concentrations above the European air quality standard (directive 2008/50/EC)





Specifically, for 2016, according to the estimations:

55% of the urban population is exposed to O_3 levels above the EU target value for the protection of health.

2% of the urban population is exposed to NO_2 annual mean concentrations exceeding the EU limit value.

21% of the urban population is exposed during the year to more than allowed exceedances of the EU limit value for daily mean PM_{10} concentrations.

2% of the population in Athens is exposed to annual mean benzene concentrations exceeding the EU limit value.

The urban population is not exposed to $PM_{2.5}$ annual mean concentrations exceeding the EU limit value.

The urban population is not exposed to SO_2 daily mean concentrations exceeding the EU limit value.

There are some inherent limitations in the estimations provided by this indicator, which in the case of Greece are magnified due to the small number of background stations in cities other than Athens. The large upgrade that the monitoring network has undergone in 2015 and the increase of spatial coverage in cities where existing monitoring capabilities are out of service or outdated are expected to provide valuable and spatial representative data for population exposure assessment.

3

Environmental Noise

Adverse health effects of noise are numerous and diverse, ranging from a mere annoyance or discomfort to permanent damage, including hearing loss, cognitive impairment, mental disorders and cardiovascular effects.

The aim of Directive 2002/49/EC (Environmental Noise Directive - END) is to define a common approach intended to avoid, prevent or reduce, on a prioritised basis, the harmful effects, including annoyance, due to exposure to environmental noise.

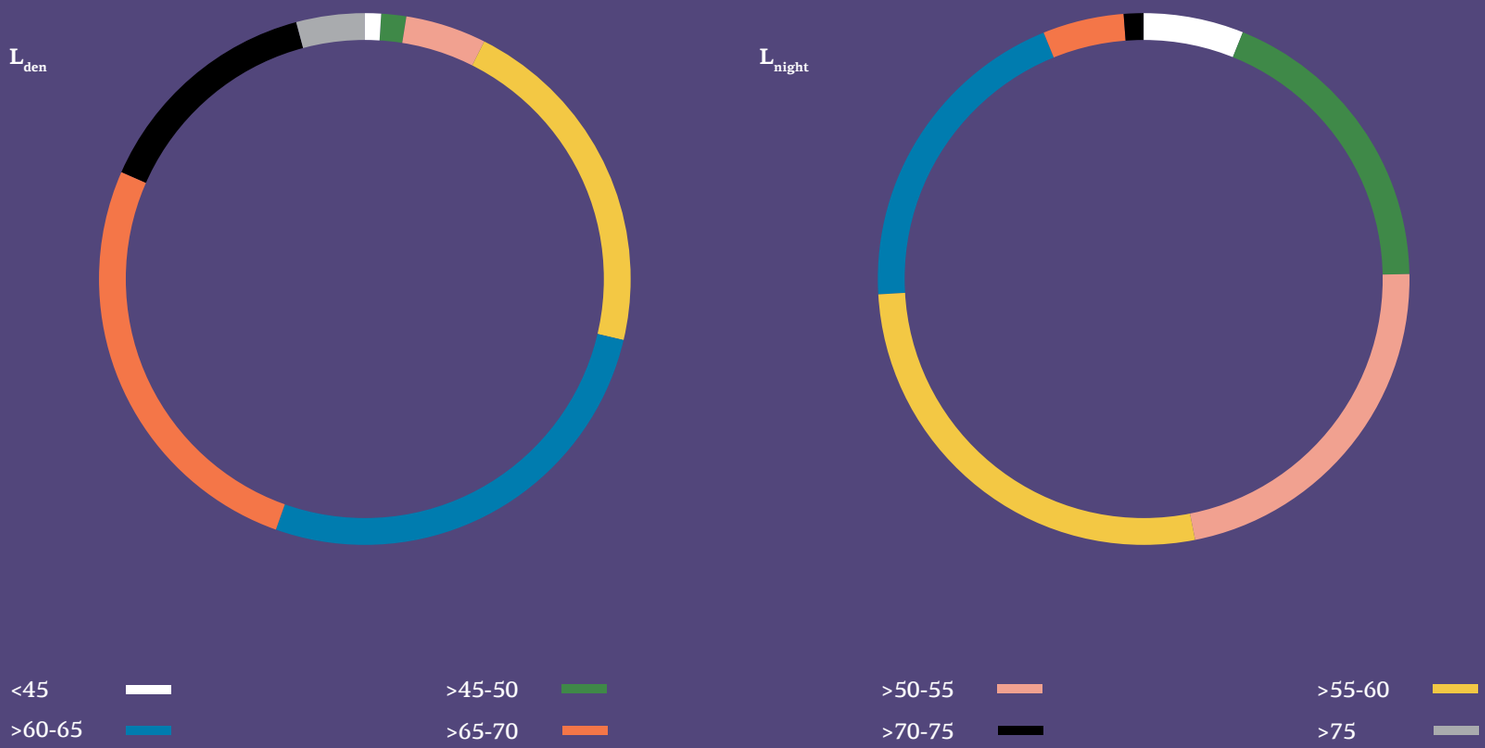
In Greece, the END is transposed by the Common Ministerial Decision (CMD) 13586/724/2006, while CMD 211773/2012 sets the time periods to be used for noise mapping (day time: 07:00 to 19:00, evening time: 19:00 to 23:00, night time: 23:00 to 07:00) and thresholds for the environmental noise from the operation of transportation projects: L_{den} = 70 dB(A) and L_{night} = 60 dB(A). It is noted than the 7th European Environmental Action Plan and generally all recent documents of the EU and the European Environmental Agency, consider as high noise levels the values of L_{den} = 55 dB and L_{night} = 50 dB. However, in the absence of a downward trend in urban population exposure to high noise levels, the objective of reducing noise pollution below the aforementioned thresholds by 2020 is not foreseen.

Moreover, the proposed guidelines of the World Health Organization (WHO) are even more stringent aiming at the highest possible level of human health protection. For example, based on studies, during nighttime, outdoor noise levels even lower than L_{night} = 40dB may cause sleep disturbances like body movements and awakenings, while cardiovascular effects are likely for levels over 55dB. These effects can contribute to increased premature mortality. WHO has published a guideline of L_{night} 40dB aiming at the protection of public health, including sensitive subgroups such as the children, the chronically ill and the elderly. A limit value of L_{night} 55dB is suggested as an intermediate target for countries where the night guideline can't be achieved in the short term.

The present report summarizes the results of all Strategic Noise Mapping (S.N.M.) studies and Noise Action Plans (N.A.P.) up to now, in the framework of the END, for Greek Agglomerations, major roads and the "Eleftherios Venizelos" Athens International Airport. A synthetic evaluation of mapping data is presented and summary descriptions of indicative action plan proposals for each agglomeration are provided as an annex.

Strategic Noise Mapping and Noise Action Plans have been completed in most of the Greek Agglomerations with population > 100,000 (an exception being the Western and Eastern part of the Athens Agglomeration), for the reporting year 2013 (in the general case; studies span from 2012 to 2015). The results of Strategic Noise Mapping for 16 Greek Agglomerations (counting 3 separate studies for Athens: Southern, Northern and Centre), totalling a population of approx. 3.14 million people, which are presented in Graph 3.1, show that the majority of the population is exposed to road noise levels above the thresholds L_{den} = 55 dB(A) (92% of the population, 2,893,099 people) and L_{night} = 50 dB(A) (75% of the population, 2,353,598 people). Of these, 574,429 people (18%) are exposed to L_{den} > 70 dB(A) and 812,376 people (26%) are exposed to L_{night} > 60 dB(A). Less than 5% of the population resides in zones with L_{night} < 40 dB(A).

Graph 3.1.
Distribution of exposed people to noise bands (dB), for L_{den} and L_{night}, in 16 Greek agglomerations, based on S.N.M.



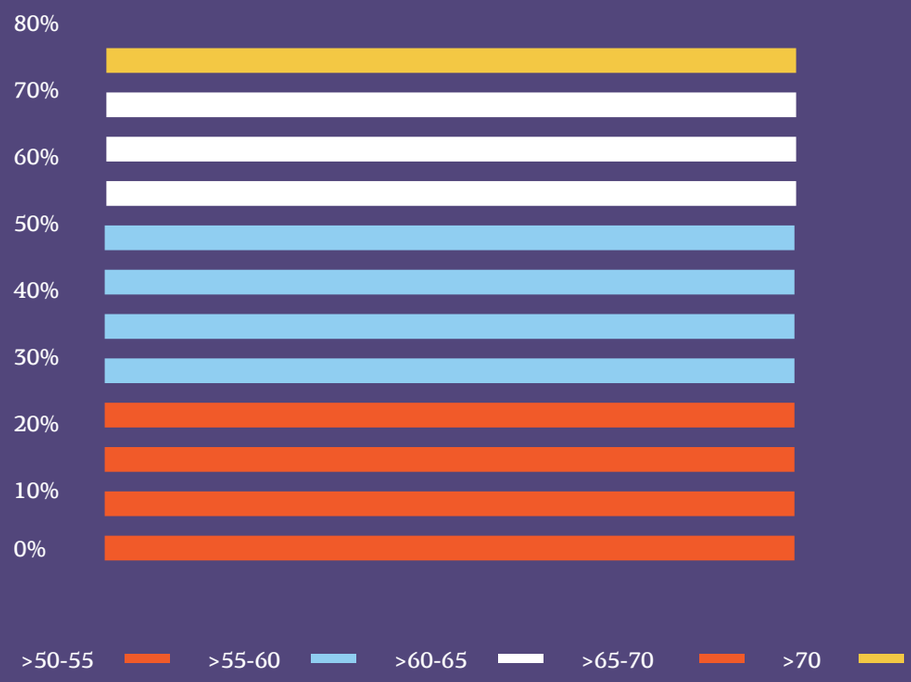
Graph 3.2.
Percentage of total population in agglomerations exposed to noise bands (db), based on Strategic Noise Mapping and after Noise Action Plans

Based on the estimates of the studies, the implementation of the Noise Action Plans should result in a 3% reduction of the population in noise zones above national thresholds (15% and 23% of the population will be exposed to L_{den} > 70 dB and L_{night} > 60 dB, respectively). The results are summarized in Graph 3.2.

Aggregate data on noise exposure levels for agglomerations are presented in Graph 3.3. It is noted that the main noise source in all agglomerations is road noise. This is mainly due to the lack of a widespread rail network within cities and a limited number of industrial units. It is noted that industrial noise also includes noise from the harbors. However, even in the case of the three largest ports in the country (Piraeus, Thessaloniki, Patras), the estimates of the studies coincide with the fact that they do not cause population exposure to noise levels above the existing limits and that even the exposure of residents to noise levels above the limits of the 7th EU Action Plan ($L_{den} \geq 55$ dB, $L_{night} \geq 50$ dB) due to the harbor are practically negligible at the level of the agglomeration (0.2% - 0.3% of the population). The distribution of the total population exposed to night-time noise levels of L_{night} >50bB is provided in Graph 3.4.

Graph 3.3.
Percentage of population exposed to noise bands (dB) of L_{den} and L_{night}, by agglomeration (S.N.M.)

Graph 3.4.
Fractions of urban populations exposed to noise bands (dB) of L_{night} > 50dB



The operation of the Egnatia Odos major road (motorway) does not cause significant exposure to high noise levels. In the framework of the 2015 strategic noise mapping study, 24h noise measurements were carried out over three years (2013, 2014 and 2015) in various locations covering the entire length of the road, as well as along two sections of Vertical Axes; no exceedance of the national threshold values was observed, for the L_{den} and L_{night} indicators. Furthermore, according to the revised Action Plan, in 2015, only 4,292 people (26% of the 16,228 people, considered to be living within the influence zone of 200 meters on either side of the road) resided in L_{den} > 55 dB (A) zones, while only 1,247 people lived in L_{night} > 50 dB (A) zones (8% of the estimated population within the influence zone). This is mainly due to the absence of significant residential settlements within the influence zone. The operation of Attiki Odos major road, due to its passage in some parts through densely populated areas, despite the noise protection measures, causes population exposure to noise levels above the current national limits. However, according to the estimates of the 2010 Action Plan, the implementation of the 1st Action Plan led to a more than twofold decrease of the number of inhabitants in L_{den} > 70 dB and L_{night} > 60 dB zones (from 16% to 7% and 19% to 9%, respectively) and, based on the planned measures, the estimates were that in 2011, residents in L_{den} > 70 dB and L_{night} > 60 dB areas would have been reduced to 1,606 and 2,230 people, respectively (estimated total number of affected residents 25,257, based on the NSS 2001 data, then available). According to unpublished data from the competent Directorate of the Ministry of Environment and Energy, the monitoring program of Attiki Odos continues and is being implemented, submitted and updated on an annual basis and, depending on its findings, new noise barriers are put in place, to protect adjacent homes or other sensitive uses. To date, more than 125,000 m^2 of noise barriers have already been built since the start of the operation of Attiki Odos. However, according to the 2nd Action Plan of 2011, only 1-in-8 residents within the influence zone was expected to live in zones of L_{den} ≤ 55 dB (3,404 people, 12.4% of the estimated total of 25,257 people with population figures of 2001) and only 1-in-3 in zones of L_{night} ≤ 50 dB (8,469 people, 33.5% of the estimated total in 2001). There are not yet publicly announced Strategic Noise Maps and Action Plans for the National Road Network, although noise studies for specific road sections have been carried out as part of the study, implementation and environmental licensing of major concession projects. Also, sections of the National Road Network and/or National Railways (there are no major railways falling under END in the country) have been taken into consideration in the Strategic Noise Mapping studies of agglomerations that they cross. It should be noted that almost all of the National Road Network was under (re)construction up to 2017 in the frame of major concession projects, so there are currently insufficient data on the "normal" traffic loads. Thus the sections of the National Road Network that fall under the provisions of END are still to be determined.

The operation of the Airport of Athens "Eleftherios Venizelos" does not result in the population exposure to levels above the national thresholds, while, according to the last approved Action Plan (2011), out of 64,364 inhabitants in the area, 10,925 (17%) were exposed to L_{den} > 55 dB (A) and 1.435 (2,2%) were exposed to L_{night} > 50 dB (A). According to the 2017 revision of the Action Plan (under evaluation, made public in the context of public consultation), although air traffic has increased and in 2016 had returned to the 2006 levels, the situation has not deteriorated, due to improved procedures. It was estimated that the national threshold values of L_{den} and L_{night} are only exceeded within the boundaries of the airport, while only 21% (16,641 people) and 3% (2.566 people) of the permanent population (79,487 inhabitants) lived in zones of L_{den} > 55 dB (A) and L_{night} > 50 dB (A), respectively.

4

Water Management

1. Directive 2000/60/EC “Establishing a framework for community action in the Field of water policy”

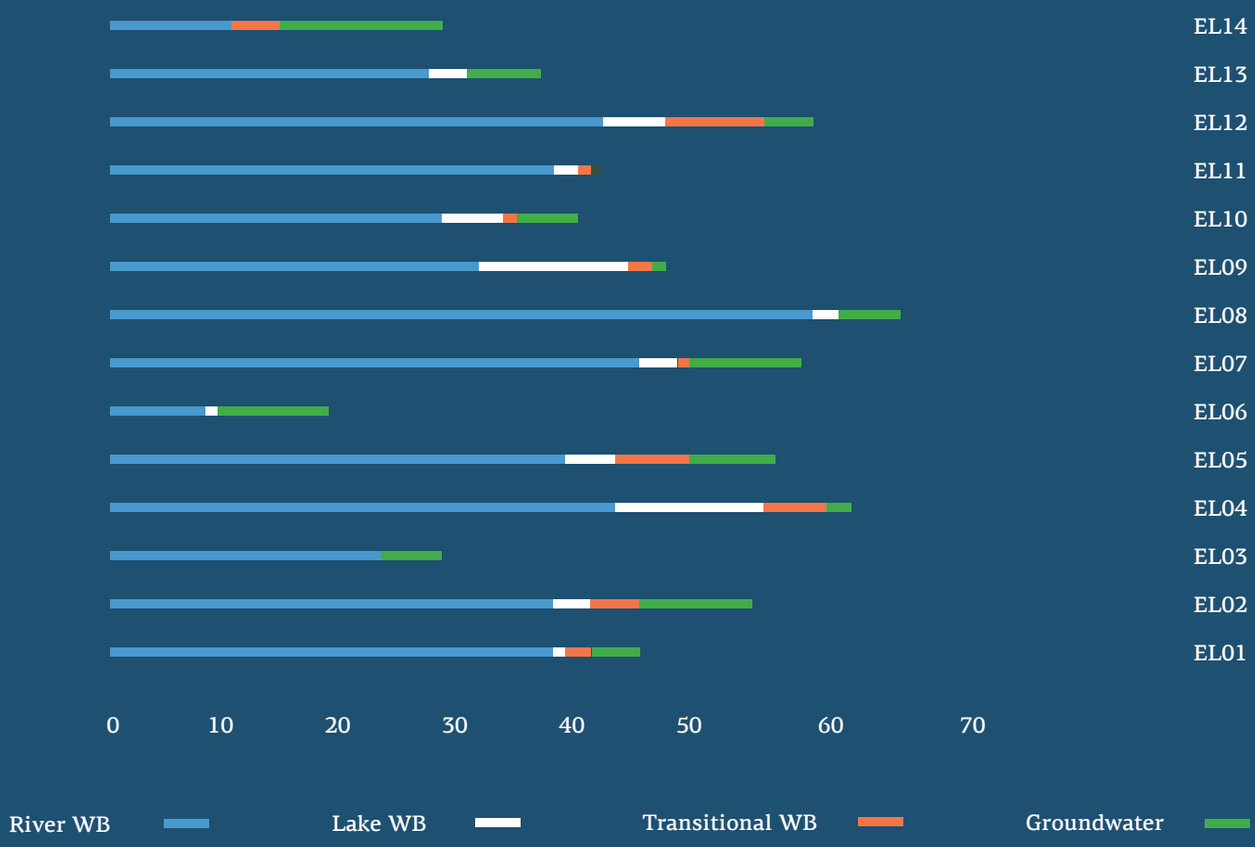
1.1 Monitoring program for the qualitative and quantitative status of the surface and groung waters - National Monitoring Network

The National Monitoring Network comprises 449 survaillence and monitoring stations in rivers, 53 stations in lakes, 34 in transitional waters, 80 stations in coastal waters and 1,392 stations in groundwaters (i.e. the total number of stations is 2,008, from which 616 refer to surface waters and 1,392 to groundwaters).

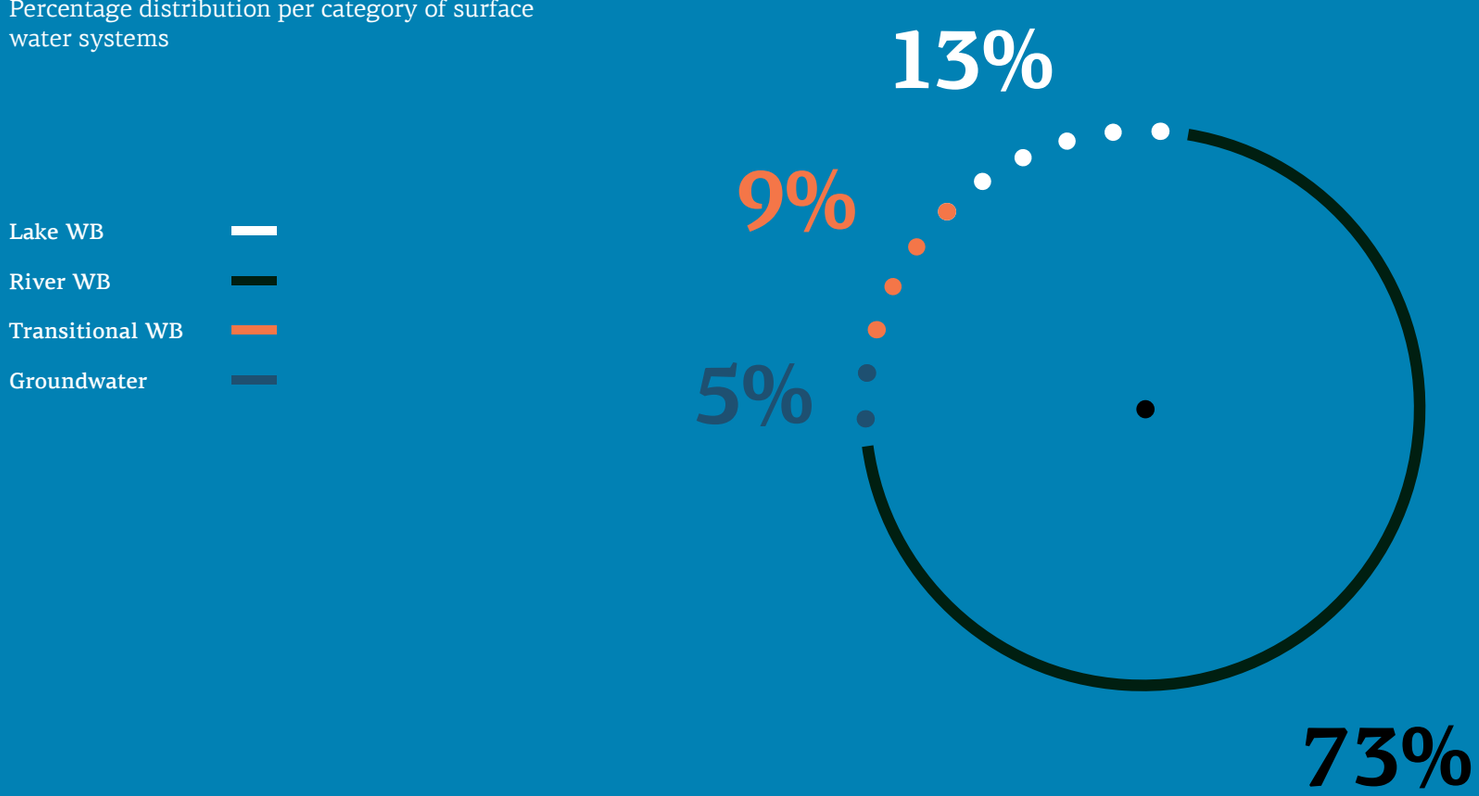
1.2 Monitoring of surface waters

Within the framework of the National programme ‘Monitoring of the water quality (ecological – chemical) of river, lake, coastal and transitional waters of Greece for the implementation of Article 8 of the Water Framework Directive 2000/60/EC’ samplings and analyses of physico-chemical, hydromorfological and biological quality elements have been carried out at the stations of the National Monitoring Network and the relevant reports for all River Basin Districts of the country have been submitted. Data were used from a total of 616 monitoring, of which 449 refer to river water bodies, 53 in lake waters, 43 in transitional waters and 80 in coastal waters. Stations collected results on the ecological and chemical status throughout the monitoring period, that is 2013-2015.

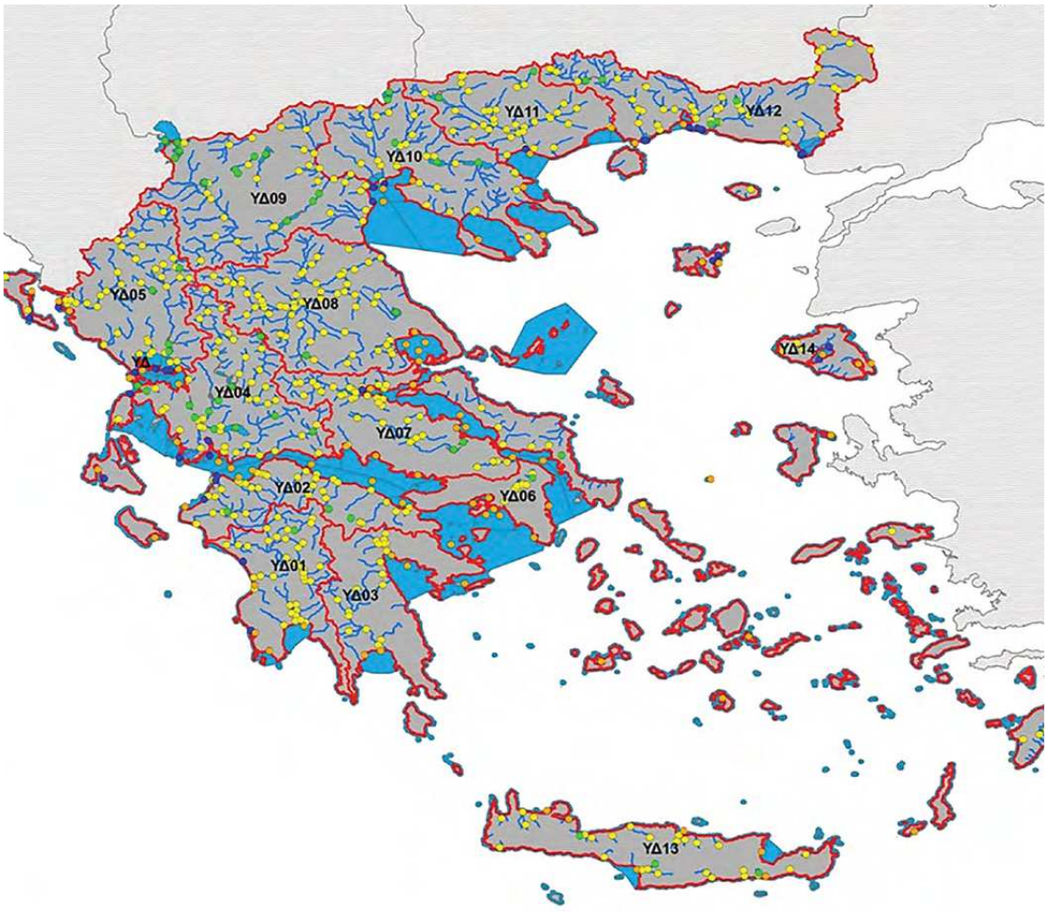
Graph 4.1a.
Distribution of monitoring stations of surface waters per River Basin District



Graph 4.1b.
Percentage distribution per category of surface water systems



Picture 4.1.
Monitoring Network stations
of Surface waters



Coastal

Lake

River

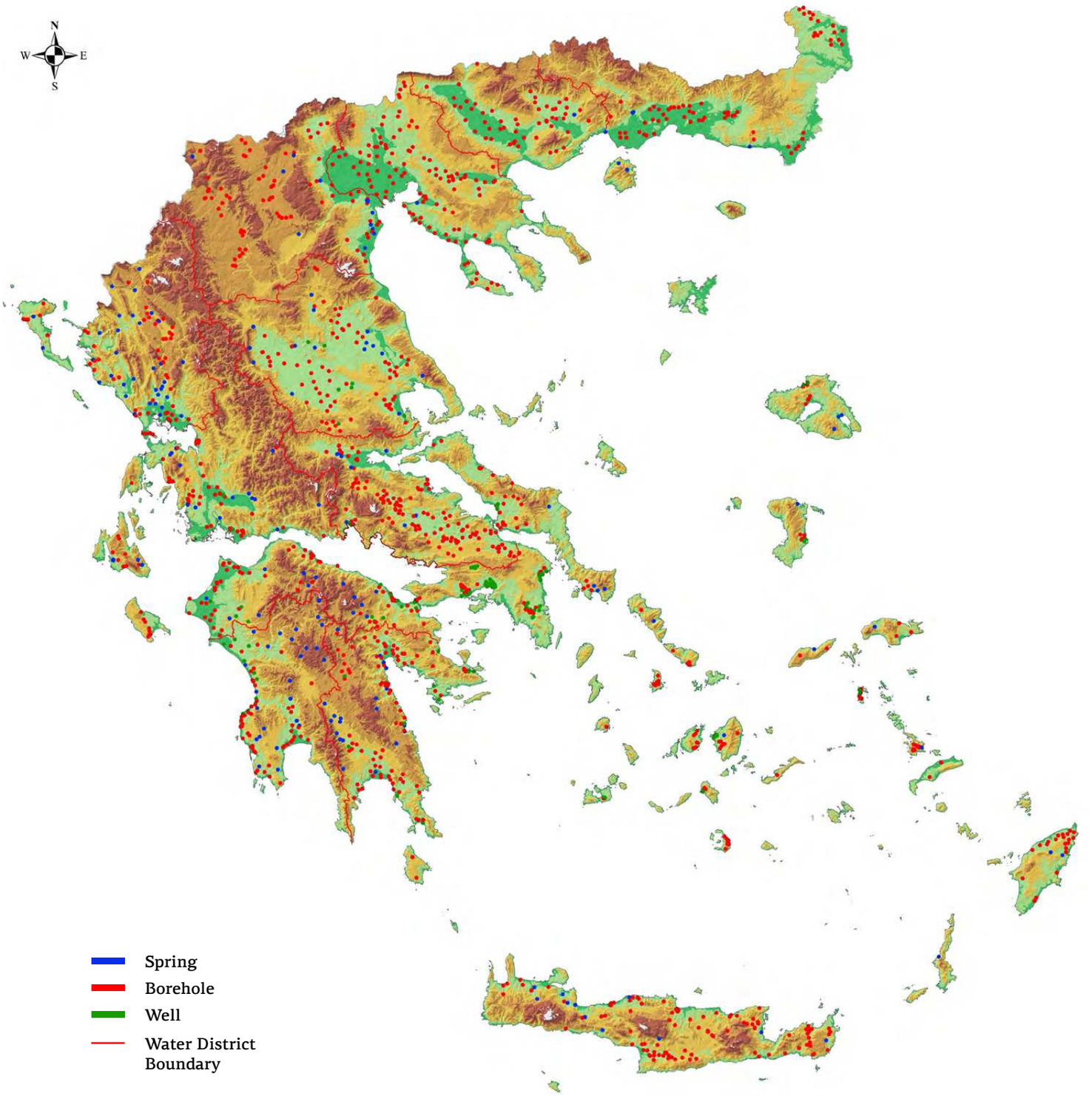
Transitional

1.3 Monitoring of Groundwaters

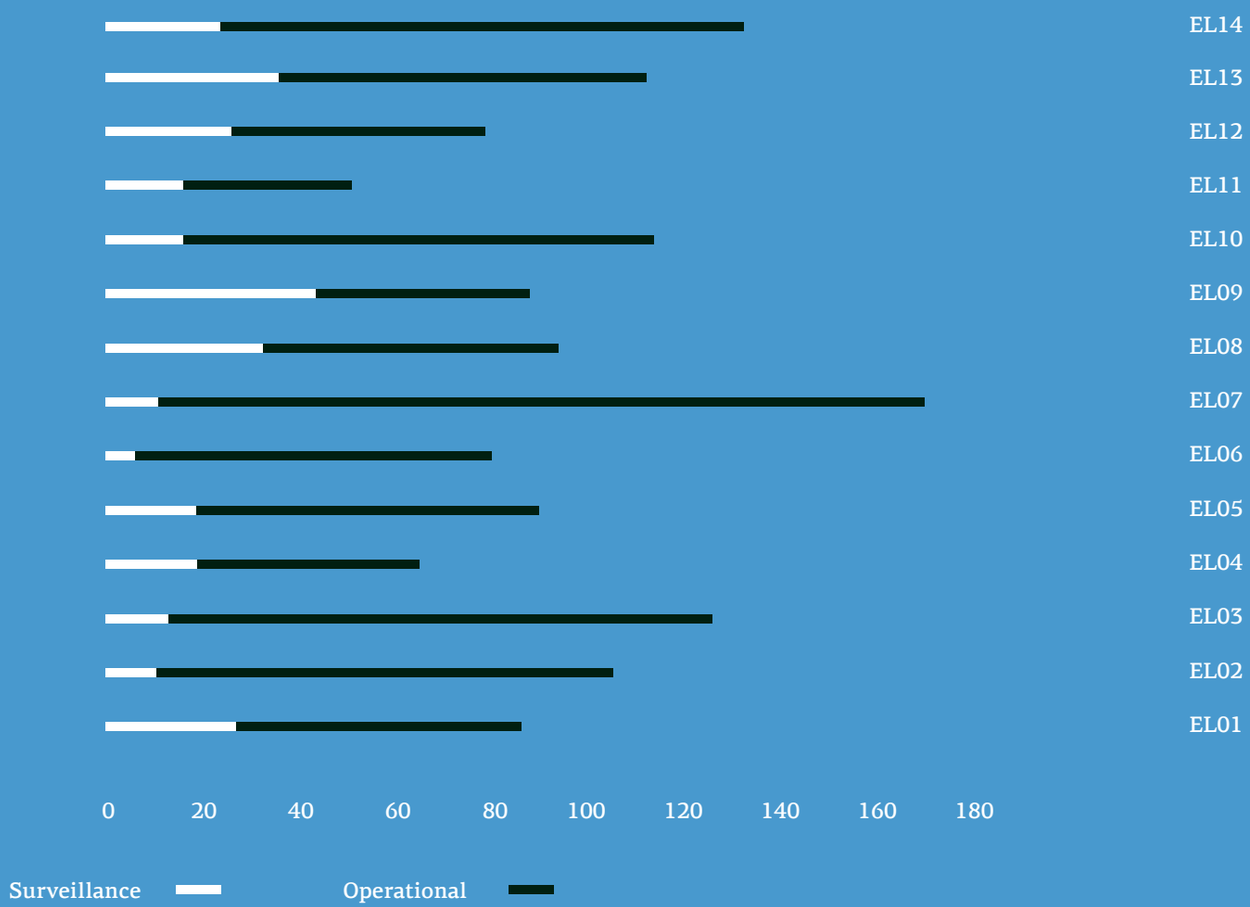
The programme is in accordance with the EU policy in the field of water management, and is aimed at the operation of a 'National Network' for monitoring the quality and quantity of the 591 most important groundwater bodies of the country (233 karstic, 216 granular, 102 fracture and 40 mixed) as detailed in the 1st Update of River Basin Management Plans (RBMPs).

The aggregated Figures show that, with respect to the quantitative status, 81-83% of the monitoring points is classified in good status, the 15-17% in bad status and roughly the 2-3% remains in an unknown condition, due to lack of measurements and insufficient data. With respect to the qualitative (chemical) status, 58-60% is in good status, 30% is in bad status (mainly due to high nitrate concentrations, attributed to intensive agricultural activity and often unreasonable use of nitrogenous fertilizers and/or high chlorine concentrations, attributed to seawater intrusion caused by the overexploitation of water drillings, mainly in coastal and insular regions), roughly 7–10% in bad status due to natural causes, mainly because of natural seawater intrusion (direct hydraulic communication with the sea) and presence of heavy metals (As, Hg, Cr, Pb, Ni etc.), due to geogenic conditions (geological rocks, geothermical – volcanic activity, presence of gypsum etc.) and 2-3% remains in an unknown status due to lack of measurements and sufficient data. In those cases that there is an exceedance of ammonium ions and nitrite, the cause is mainly attributed to septic tanks, absorbent cesspits and livestock activities due to lack of sewerage networks. The monitoring of quantitative and qualitative parameters for a sufficient time series will allow answers to be given on the fluctuation tendencies of all those components that can affect the future condition of ground waters.

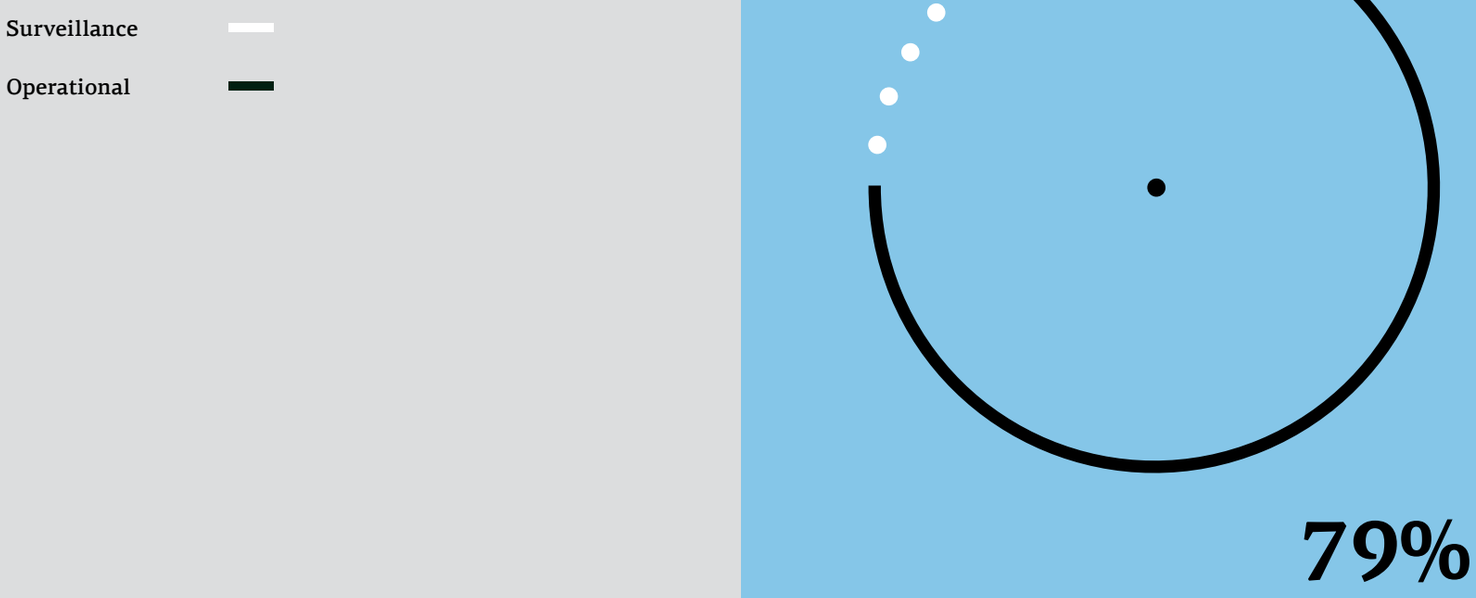
Picture 4.2.
Monitoring Network stations of ground waters



Graph 4.2a.
Distribution of monitoring stations for groundwaters per River Basin District and per monitoring type (surveillance, operational)

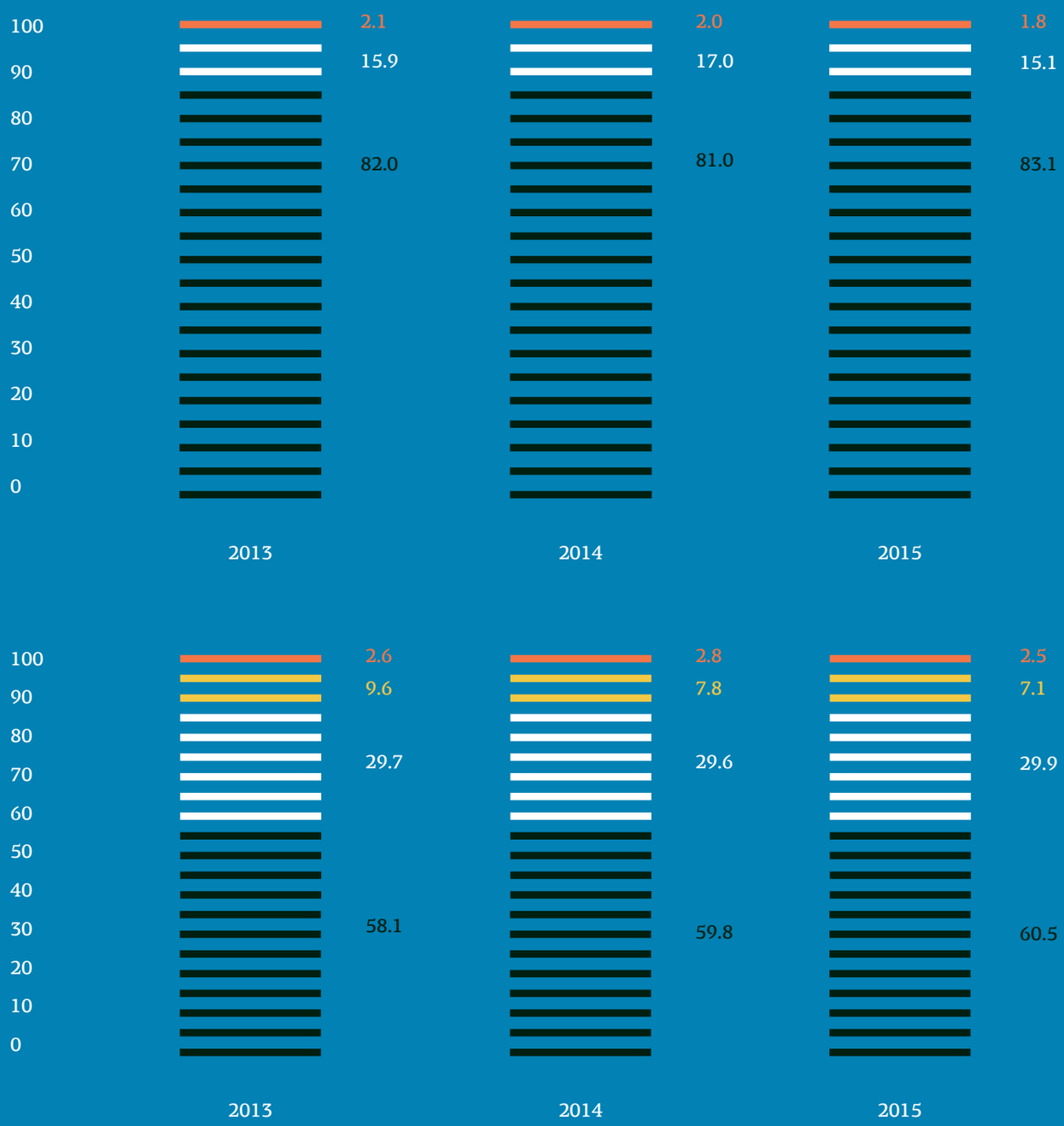


Graph 4.2b.
Percentage distribution per monitoring



Finally, aggregated Figures are provided, in which the quantitative and qualitative (chemical) evolution of ground waters are depicted over time based on the classification and characterization of the monitoring points throughout the years 2013-2015.

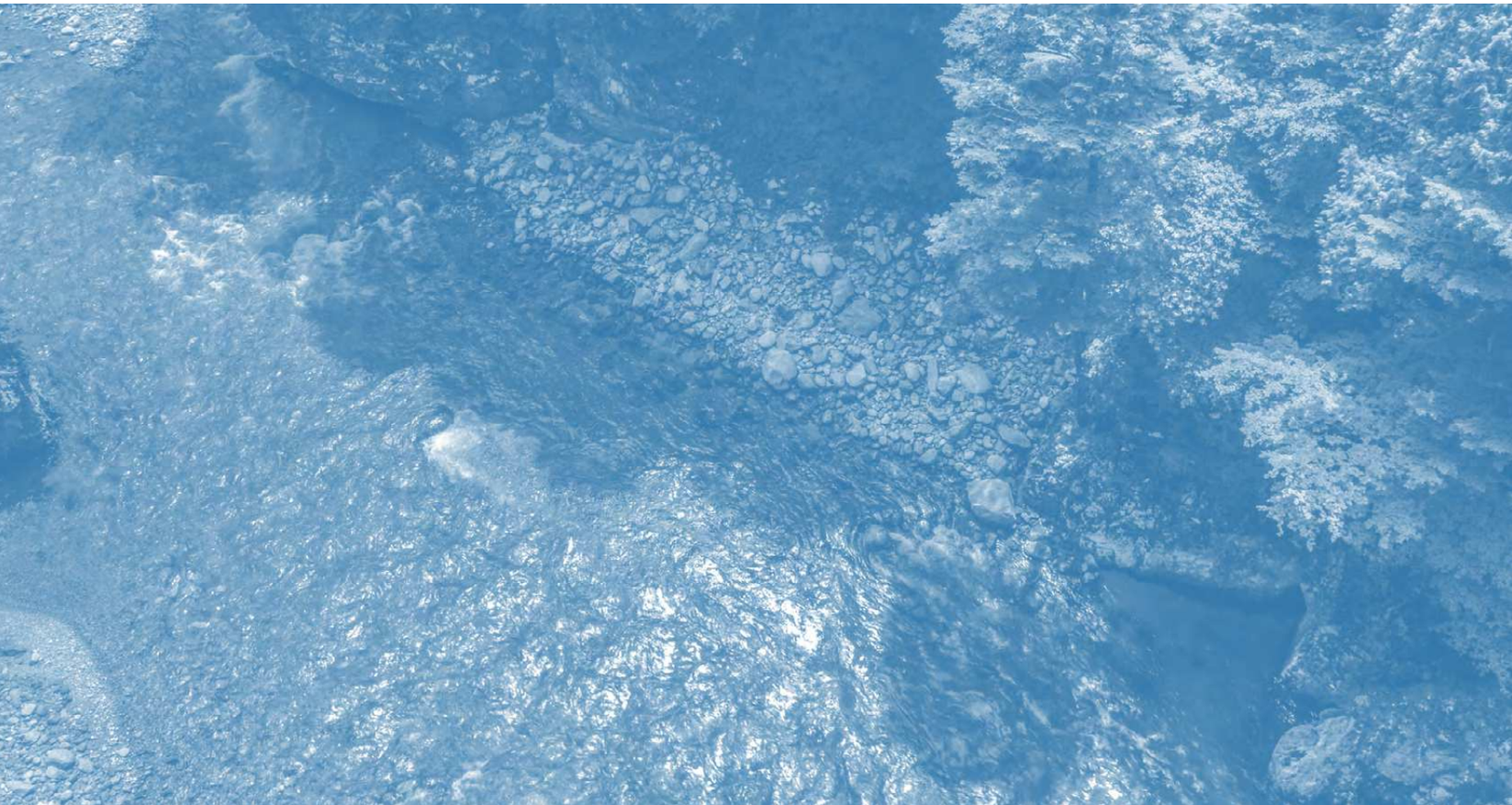
Graph 4.3.
Agreggated Characterization Chart and classification of the water monitoring points of ground waters for their quantitative (up) and qualitative (chemical) condition (down) per year



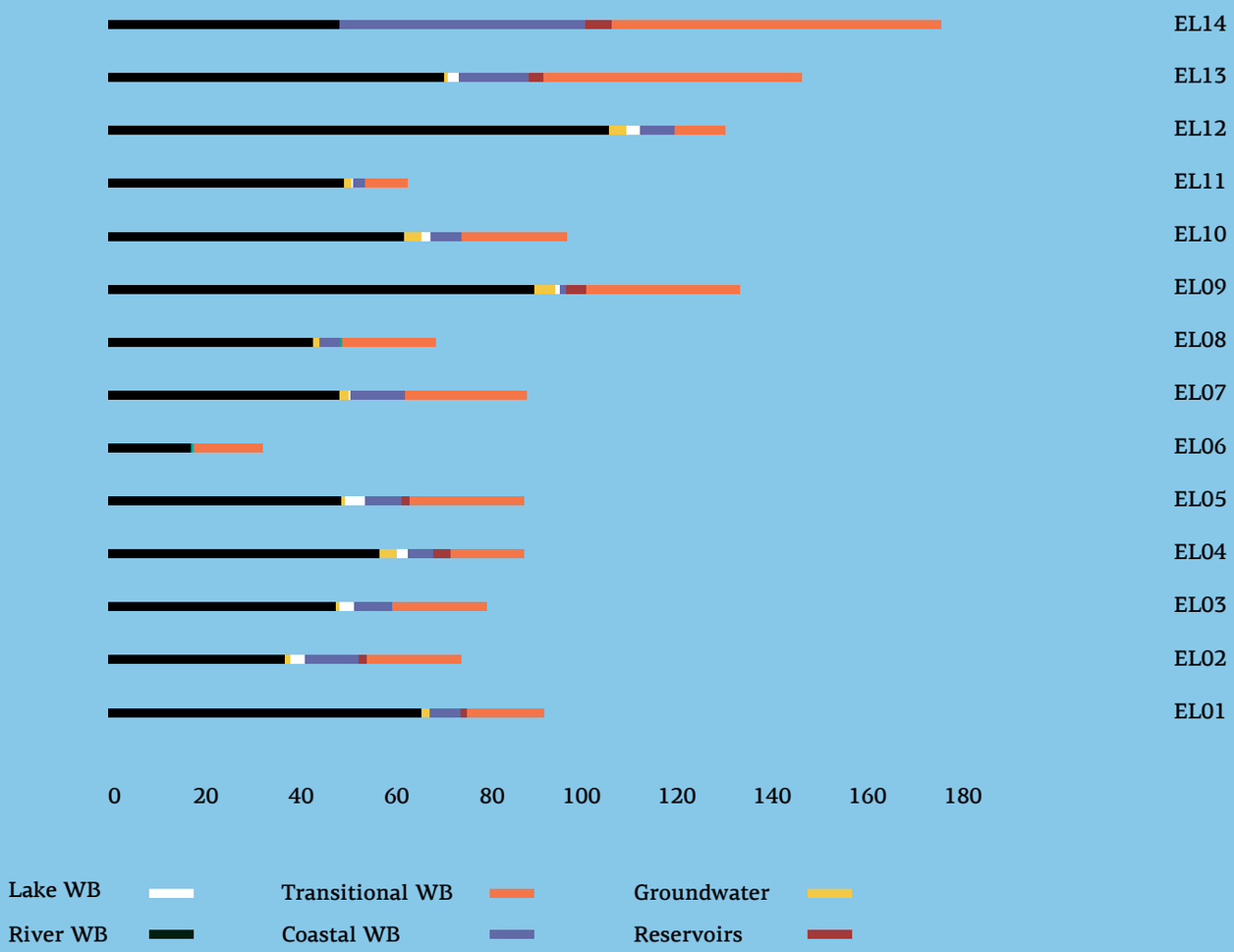
1.4 River Basin Management Plans (RBMPs) per River Basin District

The 1st Update of Water River Basin Management Plans (WRBMP) for the total of 14 River Basin Districts of the country was completed in 2017 with the approval of the National Water Committee in accordance with the provisions of Article 13 of the Directive 2000/60/EC. The data that are presented next result from the implementation of methodologies and approaches that were applied during the 1st Update of Water River Basin Management Plans and the appropriate connection of pressures with programs of measures have been made, with the purpose of reaching good surface and ground water status. In particular, among other things, the summary of the important pressures and impacts that human activities have on water bodies, the monitoring network and the results of monitoring, which show the ecological, chemical and quantitative condition of water bodies are included.

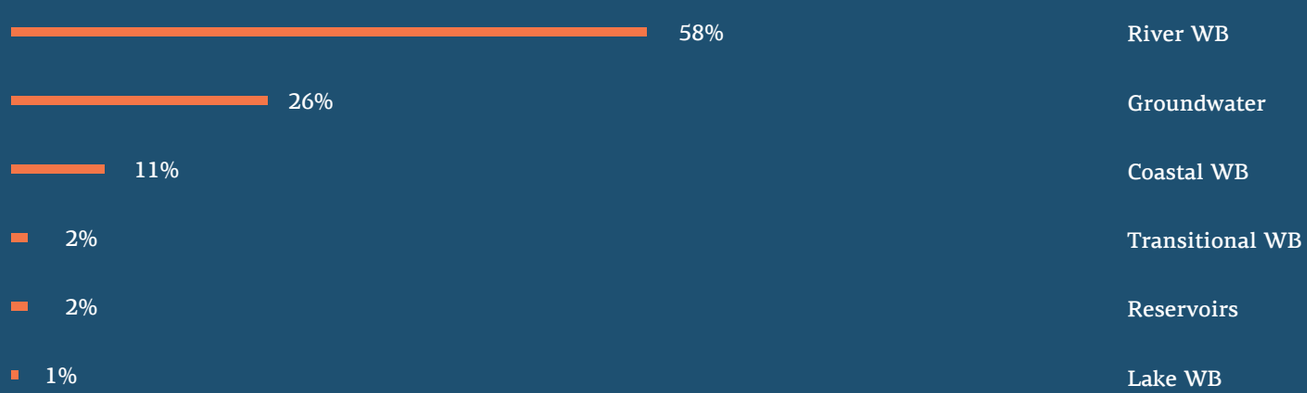
The overall condition of a surface water body is based on four categories of measurable factors. These are biological, physicochemical, hydromorfological as well as particular or synthetic pollutants or special pollutants. Regarding the heavily modified and artificial water bodies (HMWB/AWB), these are evaluated based on the variables of the most similar natural body category and the consept of good ecological dynamic is used instead of the consept of good ecological status.



Graph 4.4a.
Distribution of water bodies per river basin district



Graph 4.4b.
Percentage distribution of the total of water bodies

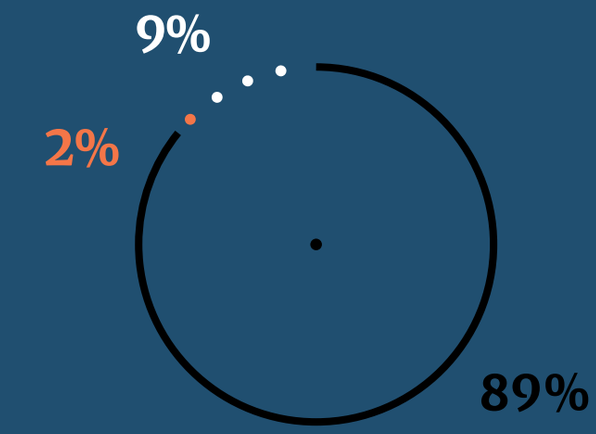


Graph 4.5. Percentage distribution of river water bodies of the country

0%	Unknown
1%	Bad
5%	Poor
21%	Moderate
72%	Good
1%	High

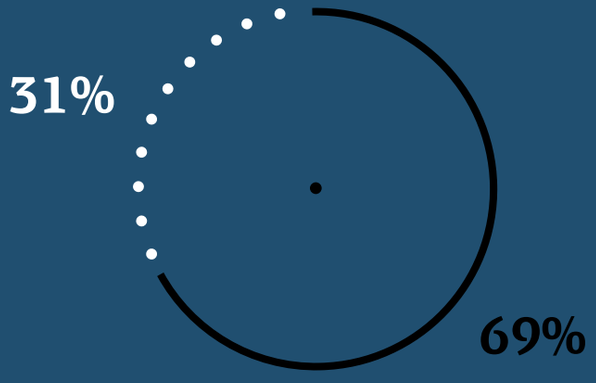
Good
Unknown

Failing to achieve good



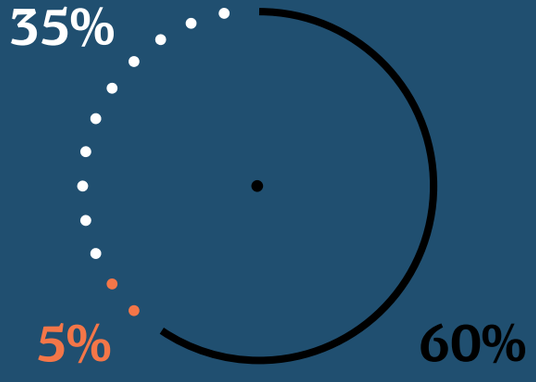
Graph 4.6. Percentage distribution of lake waters of the country

14%	Unknown
13%	Bad
18%	Poor
32%	Moderate
23%	Good
0%	High



Graph 4.7. Percentage distribution of transitional waters of the country

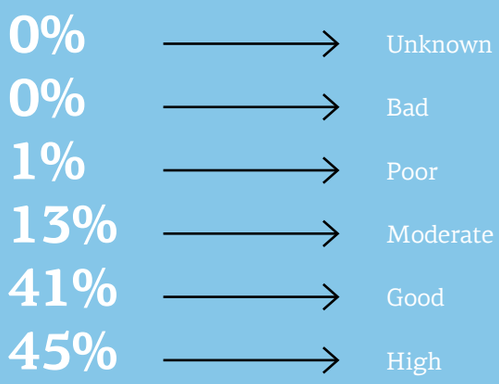
53%	Unknown
3%	Bad
22%	Poor
17%	Moderate
5%	Good
0%	High

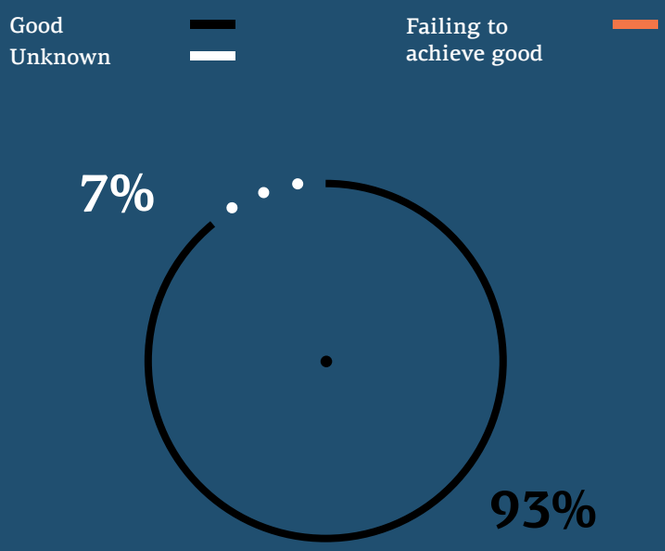


ecological status

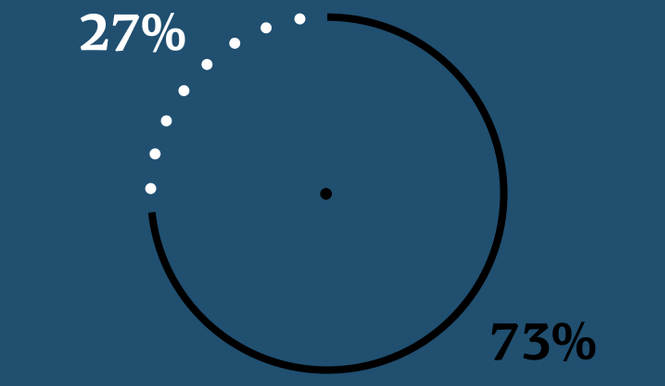
chemical status

Graph 4.8. Percentage distribution of coastal waters of the country

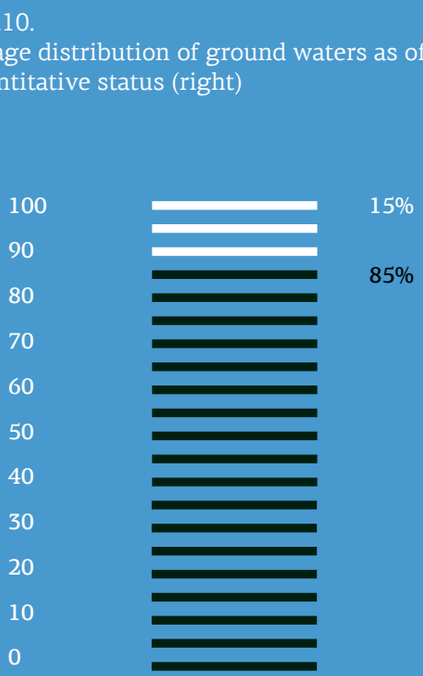


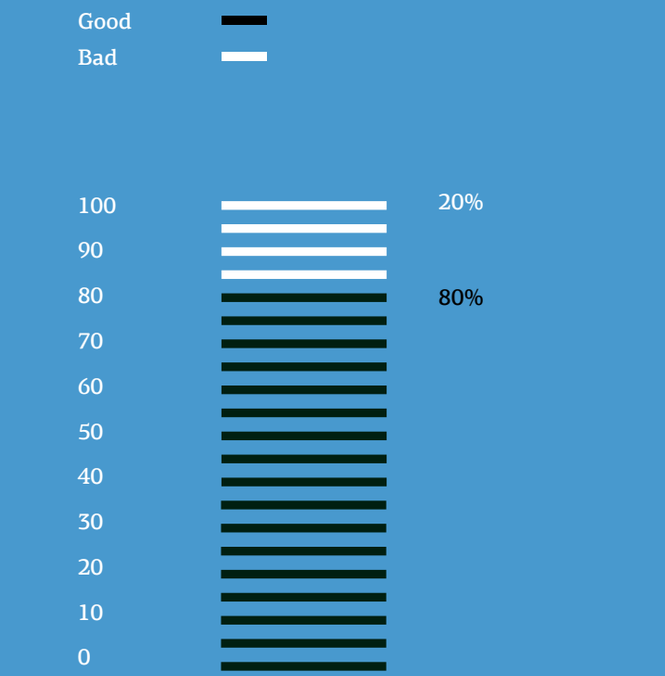


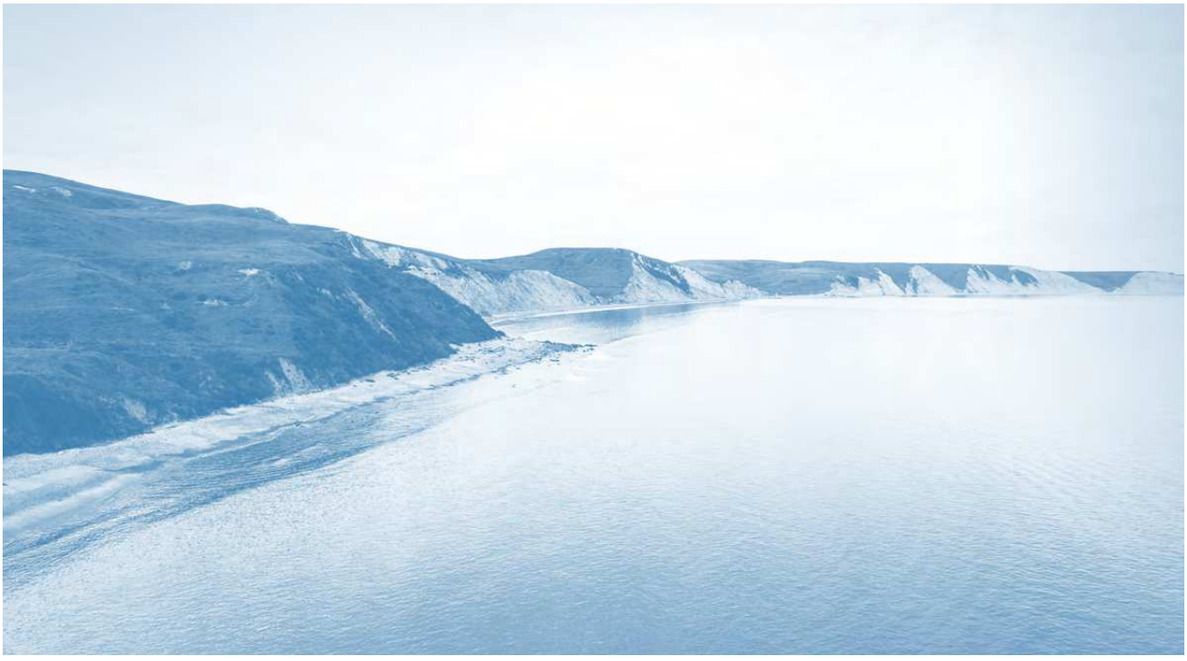
Graph 4.9. Percentage distribution of HMWB/AWB waters of the country



Graph 4.10.
Percentage distribution of ground waters as of the qualitative (left) and quantitative status (right)







Graph 4.5./ Regarding River Water Bodies the majority shows good ecological status with only a small percentage showing incomplete, bad and/or unknown condition. Respectively, a high percentage of 89% shows good chemical status, while only 2% shows a chemical status lower than good and a percentage of 9% shows an unknown condition due to lack of data and measurement deficiencies.

Graph 4.6./ Concerning Lake water bodies none of the lake areas show high ecological status, with the greatest percentage showing moderate ecological status. On the contrary, regarding the chemical status, the majority of these water bodies shows good chemical condition (69%), a zero percentage shows a status lower than good and a 31% shows an unknown status due to lack of data and measurement deficiencies.

Graph 4.7./ Regarding Transitional Water Bodiess, the majority shows an unknown ecological status (53%) and the rest shows incomplete condition due to lack of data. On the contrary 60% shows good chemical status and 35% shows unknown chemical status.

Graph 4.8./ Regarding Coastal Water Bodies the vast majority belongs to high and good ecological status with percentages of 45% and 41% respectively (86% in total). Also, the good chemical status is significantly superior to other classifications with a percentage of 93%, while 7% remains unknown due to measurement deficiencies.

Graph 4.9./ Regarding HMWB/AWB Water Bodies good and superior ecological status show the highest percentage (55%), with the unknown condition coming next (28%). As for the chemical status, the majority of these water bodies show good chemical status (73%), while a 27% shows an unkown status due to lack of data and measurement deficiencies.

Graph 4.10./ Finally, in Groundwater Bodies, good quality (chemical) status significantly exceeds in percentage (85%) and bad status comes next (15%). Regarding the quantitative status, the majority of these water bodies show good status (80%), while bad status accounts for 20%.

To summarize, from the above Figures, it seems that the majority of water bodies belong to the category of rivers and ground waters, with coastal waters coming next, while lake, transitional and HMWB/AWB water bodies are the minority. From an ecological status point of view, coastal water bodies are mainly in high or good status, rivers in good to moderate status, while lake and transitional waters are mostly in moderate and/or unknown status, due to lack of data and lack of monitoring stations. From a chemical status point of view all the categories of surface water bodies are mainly in good status and only a small percentage remains in an unkown and/or lower than good status. Finally, concerning groundwater bodies, the vast majority is in good qualitative (85%) and quantitative (80%) status. Quantitative degradation of groundwaters is mainly, on the one hand, a result of the mitrates pollution because of the intensive farming and the irrational use of fertilizers and pesticides, and on the other hand a result of the salt water intrusion (exceedaces of chorides) as a consequence of overexpoitation and over drilling of coastal ground water bodies.

Picture 4.3.
Spatial distribution of qualitative (chemical) and quantitative status of ground water systems of the country


QUANTITY STATUS OF
GROUNDWATER BODIES (GWB)
N
W
E
S
LEGEND
Quantity status of Groundwater Bodies (GWB)
Bad (98 GWB)
Good (498 GWB)
1:4,000,000
0 25 50 100 150
Km

2. Directive 2007/60/EC “on the assessment and managment of flood risks”

2.1 Preliminary Flood Risk Assessment

The first stage of the implementation of the Directive 2007/60/EC is the preparation of the Preliminary Flood Risk Assessment for each river basin and the designation of areas with significant probability of flooding (Areas of Potential Significant Flood Risk). The results of the Preliminary Flood Risk Assessment are available at the sites www.ypeka.gr, http://maps.ypeka.gr and floods.ypeka.gr and the database of the European Committee (European Environment Information and Observation Network) http://cdr.eionet.europa.eu/gr/eu/floods (Reportnet).

Table 4.1.
Total Surface of Areas of Potential Significant Flood Risk in the River Basin Districts of the country according to the Preliminary Flood Risk Assessment

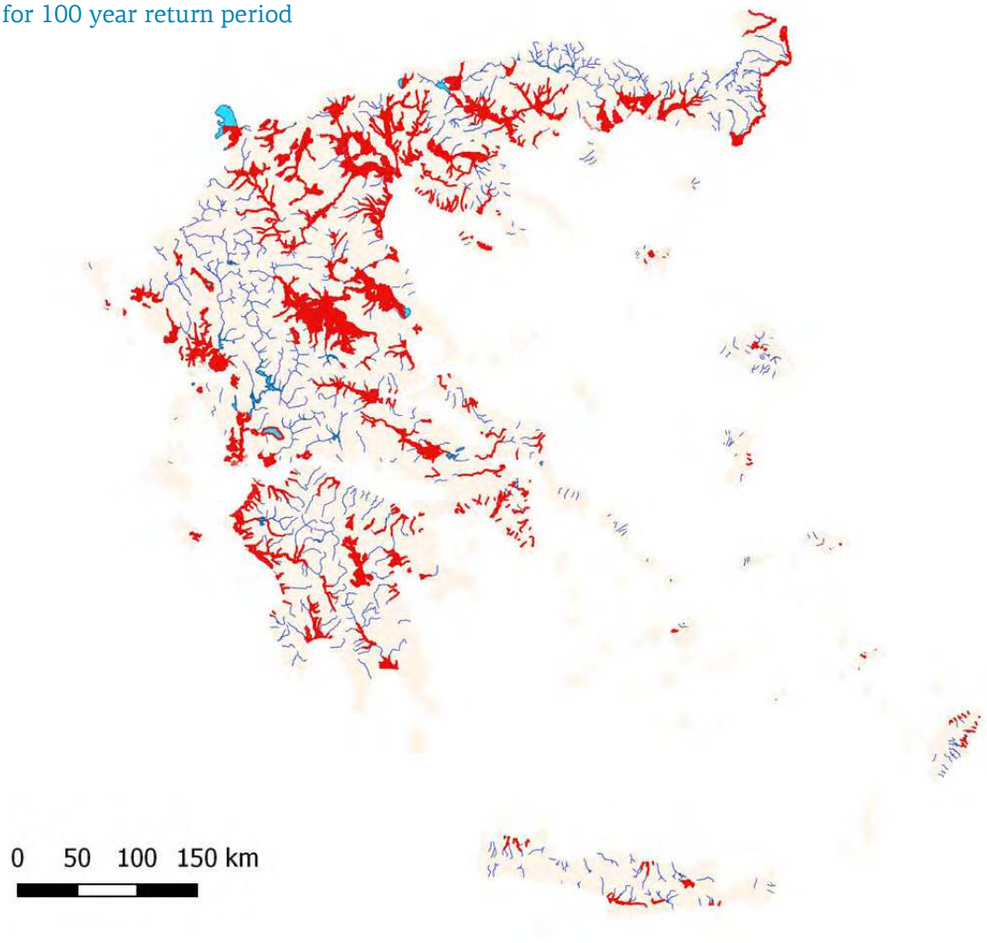
River Basin District	N	Area RBD in km²	Area PSFRZ in km²	Surface percentage of PSFRZ in the WD
Western Peloponnese	(EL01)	7,235	637	8.8%
Northern Peloponnese	(EL02)	7,397	1,227	16.6%
Eastern Peloponnese	(EL03)	8,442	606	7.2%
Western Mainland Greece	(EL04)	10,498	874	8.3%
Epirus	(EL05)	9,980	1,003	10.1%
Attica	(EL06)	3,187	673	21.1%
Eastern Mainland Greece	(EL07)	12,279	1,938	15.8%
Thessaly	(EL08)	13,140	4,172	31.8%
Western Macedonia	(EL09)	13,616	3,098	22.8%
Central Macedonia	(EL10)	10,165	3,735	36.7%
Eastern Macedonia	(EL11)	7,319	2,817	38.5%
Thrace*	(EL12)	11,240	1,927	17.1%
Crete	(EL13)	8,345	220	2.6%
Aegean Islands	(EL14)	9,105	391	4.3%
Surface Percentage of HFRZ in the country				**17.7%**

* For EL12 “Thace” in the framework of the study of Evros the Preliminary Assessment was updated for the basin of Evros and the areas of ‘Potentially Significant Flood Risk Zone’ (PSFRZ) were modified.

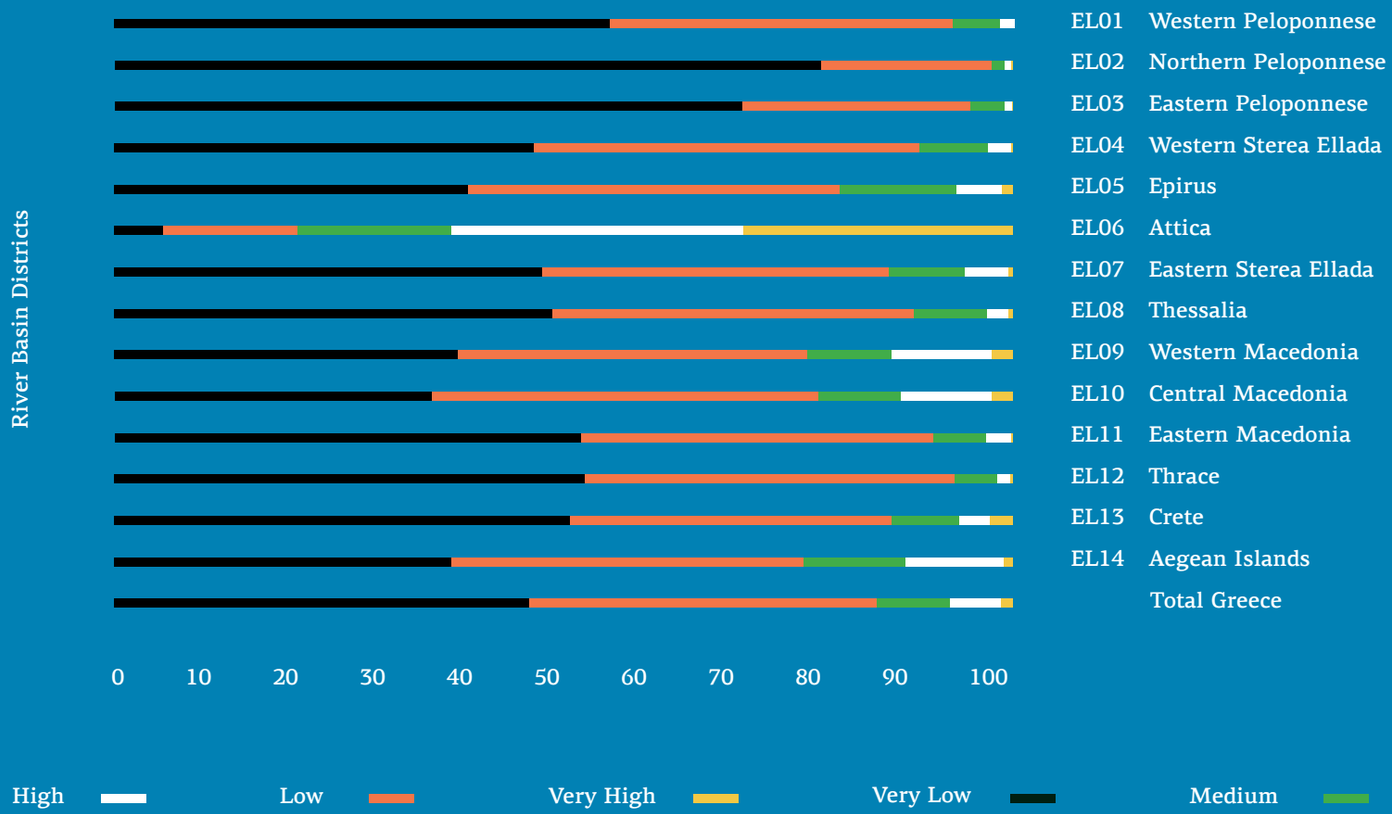
2.2 Flood Hazard Maps and Flood Risk Maps

The second stage of the implementation of the Directive 2007/60/ECconcerns the preparing of the Flood Hazard Maps and the Flood Risk Maps inside the Areas of Potential Significant Flood Risk, as they emerged from the Preliminary Flood Risk Assessment and in which the negative consequences of floods (for human health, the environment, cultural heritage and economic activity) are depicted. The above mentioned maps were prepared for watercourses, lakes and coastal areas that are within the the Areas of Potential Significant Flood Risk and are available at the relative website of the Ministry of Environment and Energy floods.ypeka.gr and at the database of the European Committee (European Environment Information and Observation Network) http://cdr.eionet.europa.eu/gr/eu/fhrm/ (Reportnet). In the context of the flood risk management plans, a special methodology for flood risk assessement was developed and applied in all River Basin Districts. The aim is the evaluation of flood risk within the flooded areas as they came out from the hydraulic analysis performed for different return periods (T50, T100 και T1000), taking into consideration the flood hazard (depths, flow rate) and the vulnerability (based on potential impacts) of uses and activities in the flooded areas.

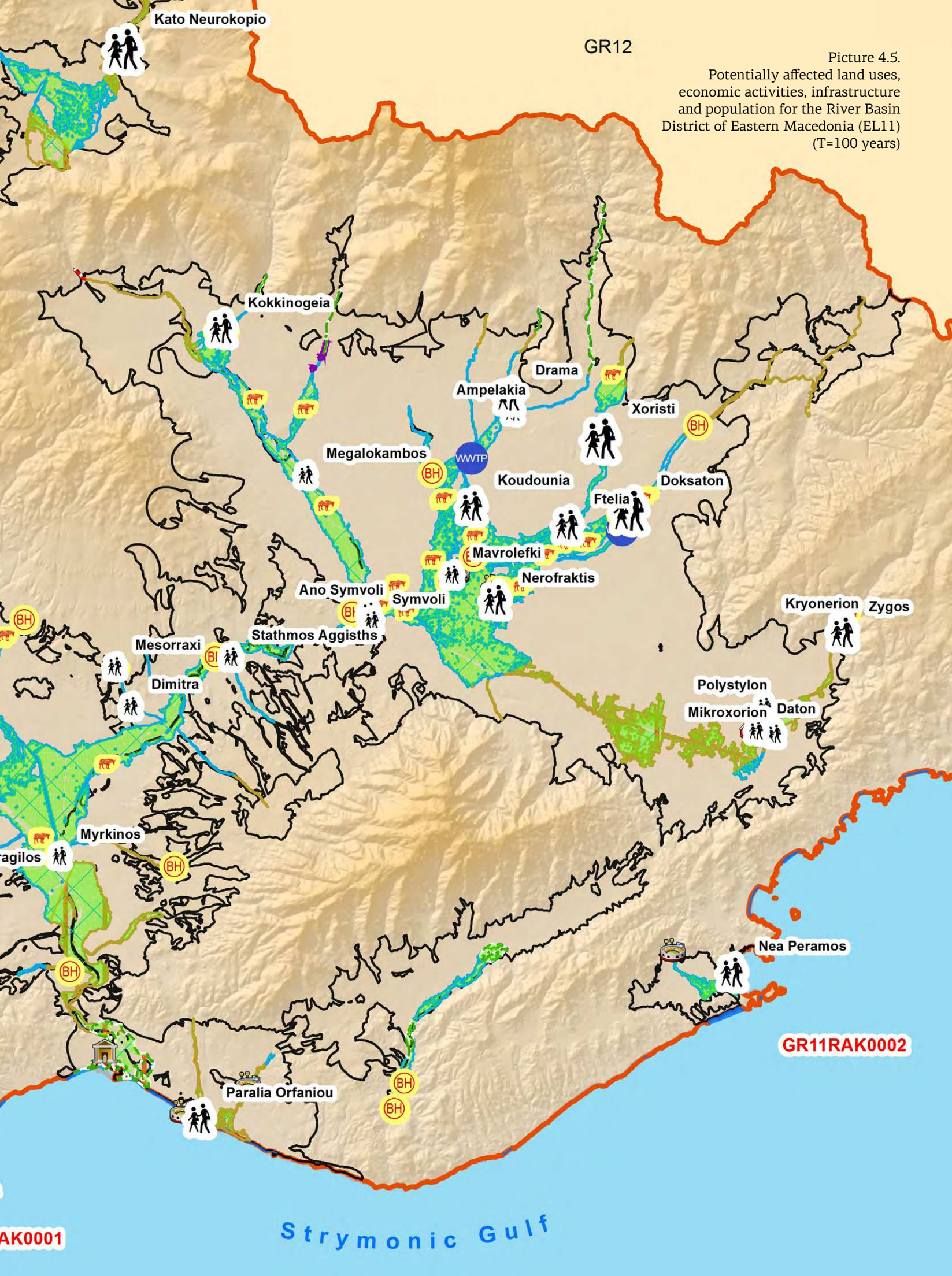
Picture 4.4.
Flooded areas for 100 year return period



Graph 4.11.
Degree of flood risk evaluation in flooded areas in River Basin Districts for Return Period T100




GR11RAK0004
GR11RAK0005
GR11RAK0003
Megaloxorio
Strumonoxorio
Gonimo
Koimisis
L. Kerkini
Simon
Xrusoxorafa
Hrakleia
Baltron
Dasoxorion
Kala Dendra
Lefkon
Serrai
Mitrousion
Kato Mitrousion
Xryson
Neoxorion
Srymonikon
Barikon
Skoytari
Koumaria
Adelfikon
Valtotopion
Pettonia
Kato Kamila
Koyvoyklia
Agia Eleni
Terpni
Maurothalassa
Nea Vrasna
Υπόμνημα/Legend
ΧΡΗΣΕΙΣ ΓΗΣ - ΟΙΚΟΝΟΜΙΚΕΣ ΔΡΑΣΤΗΡΙΟΤΗΤΕΣ
(εντός ζώνης κατάκλυσης)
ΥΓΕΙΟΝΟΜΙΚΕΣ ΜΟΝΑΔΕΣ/HEALTH UNITS
ΝΟΣΟΚΟΜΕΙΑ/ HOSPITALS
ΚΛΙΝΙΚΕΣ-ΚΕΝΤΡΑ ΥΓΕΙΑΣ / CLINICS- HEALTH CENTERS
ΕΚΠΑΙΔΕΥΣΗ/EDUCATION
ΧΩΡΟΙ ΑΘΛΗΤΙΣΜΟΥ/ SPORTS FACILITIES
ΧΩΡΟΙ ΠΟΛΙΤΙΣΤΙΚΗΣ ΚΛΗΡΟΝΟΜΙΑΣ/ CULTURAL SITES
ΔΟΜΕΣ ΠΟΛΙΤΙΚΗΣ ΠΡΟΣΤΑΣΙΑΣ/ CIVIL PROTECTION FACILITIES
ΚΤΗΝΟΤΡΟΦΙΚΕΣ ΜΟΝΑΔΕΣ/ LIVESTOCK HOLDINGS
ΥΠΟΣΤΑΘΜΟΙ ΔΕΗ/ PPC POWER SUBSTATIONS
ΥΔΡΕΥΤΙΚΕΣ ΓΕΩΤΡΗΣΕΙΣ / WATER SUPPLY BOREHOLES
ΠΡΩΗΝ ΧΩΡΟΙ ΑΝΕΞΕΛΕΓΚΤΗΣ ΔΙΑΘΕΣΗΣ ΑΠΟΒΛΗΤΩΝ / EX UNCONTROLLED DUMPING SITES
ΑΠΟΚΑΤΕΣΤΗΜΕΝΟΣ / RESTORED
ΒΙΟΜΗΧΑΝΙΕΣ / INDUSTRIES
ΒΙΟΜΗΧΑΝΙΑ ΤΡΟΦΙΜΩΝ/ FOOD INDUSTRY
ΧΥΤΑ / LANDFILL
ΣΕ ΛΕΙΤΟΥΡΓΙΑ / IN OPERATION
ΒΙΟΠΑ/INDUSTRIAL PARKS
ΒΙΠΕ/INDUSTRIAL AREAS
ΑΝΑΠΤΥΓΜΕΝΕΣ ΤΟΥΡΙΣΤΙΚΑ ΠΕΡΙΟΧΕΣ / DEVELOPED TOURIST AREAS
ΑΝΑΠΤΥΣΣΟΜΕΝΕΣ ΤΟΥΡΙΣΤΙΚΑ ΠΕΡΙΟΧΕΣ /DEVELOPING TOURIST AREAS
ΡΥΖΟΚΑΛΛΙΕΡΓΕΙΕΣ/ RICE CROPS
ΘΕΡΜΟΚΗΠΙΑ/ GREENHOUSE
ΛΟΙΠΕΣ ΚΑΛΛΙΕΡΓΕΙΕΣ/ OTHER CROPS
ΠΕΡΙΟΧΗ ΑΕΡΟΔΡΟΜΙΟΥ/ AIRPORT AREA
ΠΛΗΜΜΥΡΙΚΗ ΖΩΝΗ T=100 ΕΤΗ / FLOOD ZONE T=100 YEAR
ΕΓΚΑΤΑΣΤΑΣΕΙΣ ΕΠΕΞΕΡΓΑΣΙΑΣ ΛΥΜΑΤΩΝ/
WASTEWATER TREATMENT PLANTS
<10.000 ι.π.
10.000 - 100.000 ι.π.
>100.000 ι.π.
ΕΝΔΕΙΚΤΙΚΟΣ ΘΙΓΟΜΕΝΟΣ ΠΛΗΘΥΣΜΟΣ
/ INDICATIVE POTENTIALLY AFFECTED
POPULATION
<500
500 - 2000
>2000
ΠΡΟΣΤΑΤΕΥΟΜΕΝΕΣ ΠΕΡΙΟΧΕΣ ΤΗΣ ΟΔΗΓΙΑΣ 2000/60/ΕΚ
PROTECTED AREAS OF 2000/60/EC DIRECTIVE
ΕΙΔΙΚΕΣ ΖΩΝΕΣ ΔΙΑΤΗΡΗΣΗΣ /SPECIAL CONSERVATION AREAS
ΖΩΝΕΣ ΕΙΔΙΚΗΣ ΠΡΟΣΤΑΣΙΑΣ /SPECIAL PROTECTION AREAS
ΥΔΑΤΙΚΑ ΣΥΣΤΗΜΑΤΑ ΠΟΥ ΕΧΟΥΝ ΧΑΡΑΚΤΗΡΙΣΘΕΙ ΩΣ ΥΔΑΤΑ ΑΝΑΨΥΧΗΣ/ WATER BODIES DESIGNATED AS RECREATIONAL WATERS



Picture 4.5.
Potentially affected land uses, economic activities, infrastructure and population for the River Basin District of Eastern Macedonia (EL11) (T=100 years)

During the third stage of the implementation of the Directive 2007/60/EC the preparation of Flood Risk Management Plans takes place for the Areas of Potential Significant Flood Risk. Taking into consideration the provisions of the Directive 2007/60/EC and the relevant guidelines, the following General Targets were determined at a national level during the 1st cycle of implementation of the Directive 2007/60/EC:

- ⇢ Moderation of the exposure to flood
- ⇢ Reduction of the possibility of flood
- ⇢ Enhancement of preparedness for flood response
- ⇢ Improvement of restoration mechanisms for the affected areas

he above mentioned General Targets are of strategic nature and their purpose is to establish a common perception and policy for matters related to the mitigation of flood risks. For the achievement of the General Targets, there is a Programme of Measures in the Flood Risk Management Plans for each River Basin District that covers all management aspects.

The Programme of Measures in the 1st cycle of the implementation of the Directive 2007/60/EC 26 includes Measures, which are divided as following according to their priority axis:

7 prevention measures
Target: Moderation of the exposure to flood

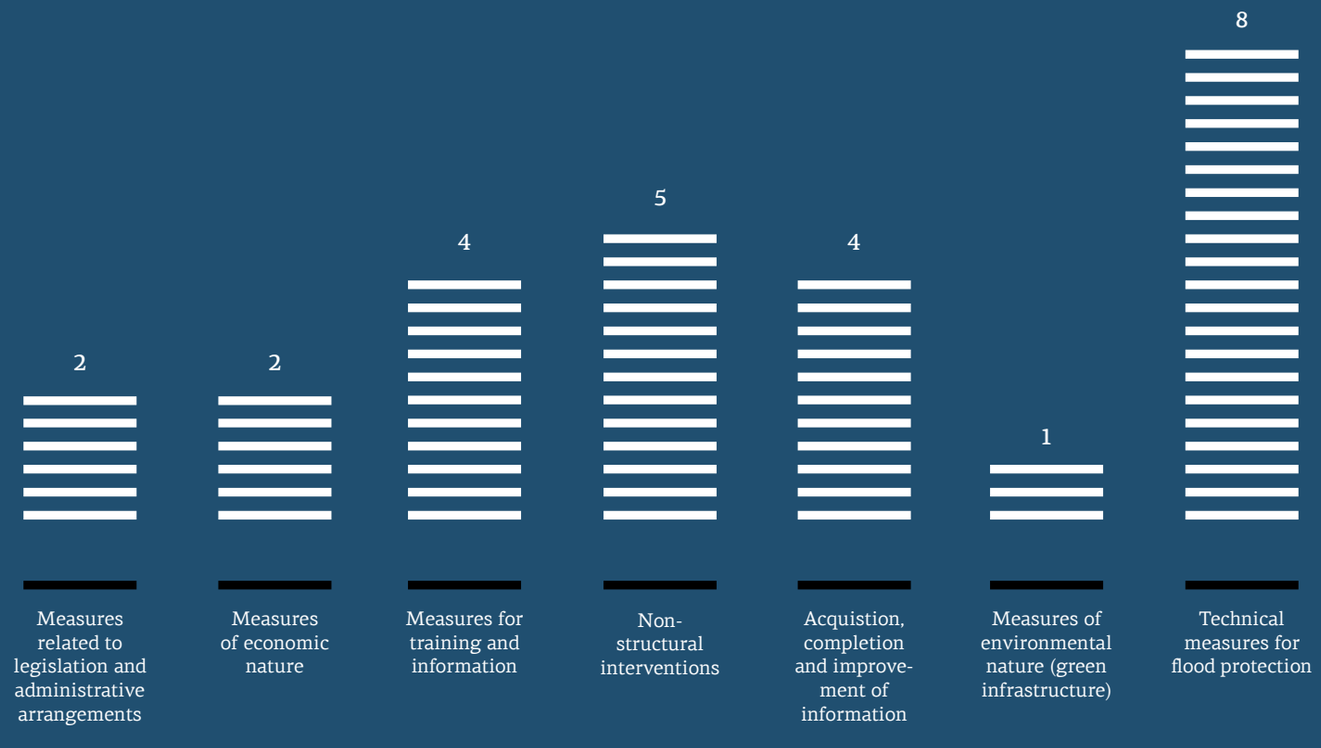
10 protection measures
Target: Reduction of the possibility of flood

6 preparedness measures
Target: Enhancement of preparedness for flood response

3 restorations measures
Target: Improvment of restoration mechanisms for the affected areas

These measures were evaluated uniformly for all River Basin Districts through the methodology of assessing their cost effectiveness, where each measure is assessed by its effectiveness on reducing flood damage (benefit) with the lower cost. For the implementation of the Programme of Measures, an action plan is set up, where all the procedures that must take place are defined in detail as well as the timeline and the implementing bodies.

Graph 4.12
Number of measures per kind of measure as defined in the Flood Risk Managements Plans of the River Basin Districts of the country



3. Directive 91/271/EEC “concerning urban waste-water treatment”

3.1 Implementation of the Directive 91/271/EEC

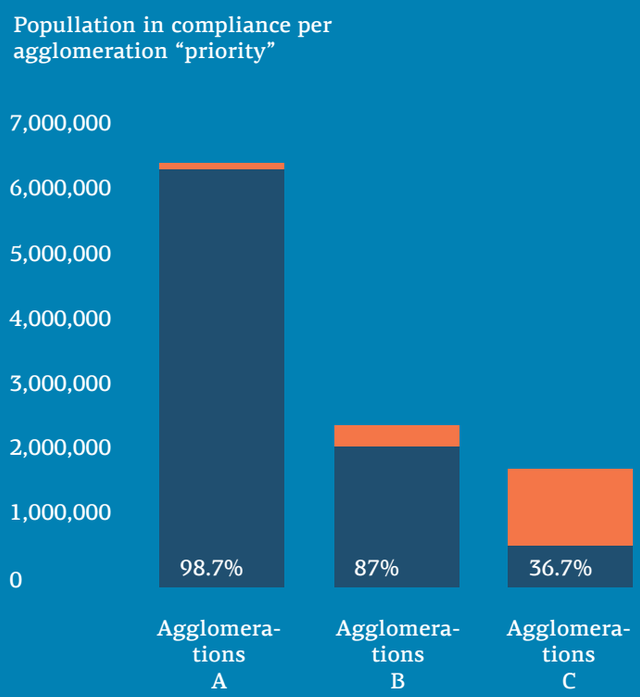
With regard to the country’s compliance with the requirements of Directive 91/271/EC, it is noted that, following the priority given, over the past decades, to the construction of wastewater collection and treatment facilities in medium and large urban centers, (agglomerations of Priority A and B) the compliance rate for these settlements today is around 95%. The compliance rate to the Directive’s obligations regarding collection and treatment infrastructure for smaller agglomerations (priority C agglomerations) is lower. According to the data submitted to the EU, in the context of the National Reports for the year 2016, by Special Secretariat for Water, 455 agglomerations were reported under Directive 91/271 / EEC with a total population equivalent of 11,803,450 p.e. Graph 4.13. below shows the percentage of the population equivalent per category of settlements that is in compliance with the Directive for the year 2016.

Exceptions to the high compliance rate of priority A and B settlements are the settlements of Eastern Attica, due to the absence of the necessary infrastructure as well as Thriassio, due to the delays of connections of the inhabitants to the existing treatment plant. It is noted that the country has been convicted of a fine by the Court of Justice of the European Union for the above cases. Until June 2018, €24,388 million had been paid for the case of Eastern Attica and €5 million for the case of Thriassio.

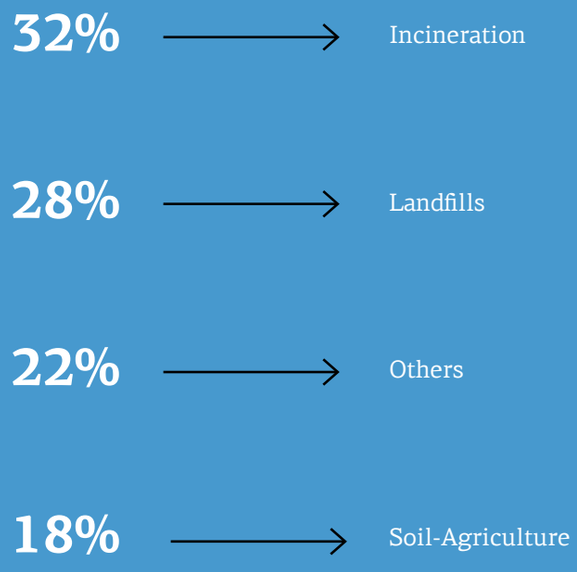
The production of sludge for Greece was estimated at 119,777 tons for the year 2016. The higher percentage of the produced sludge (32%) is used for incineration, followed by the landfill sites (28% of production). 18% is used by agriculture and 22% is managed by other methods (Graph 4.14.).

Reuse of waste waters remains limited. However, the legal framework in place describes the terms, conditions and procedures for the reuse of treated waste waters. Reuse of waste waters is expected to be adopted increasingly in the coming years.

Graph 4.13.
Population equivalent per category of agglomerations in compliance with the Directive



Graph 4.14.
Percentage distribution of disposal of the produced sludge for the year 2016

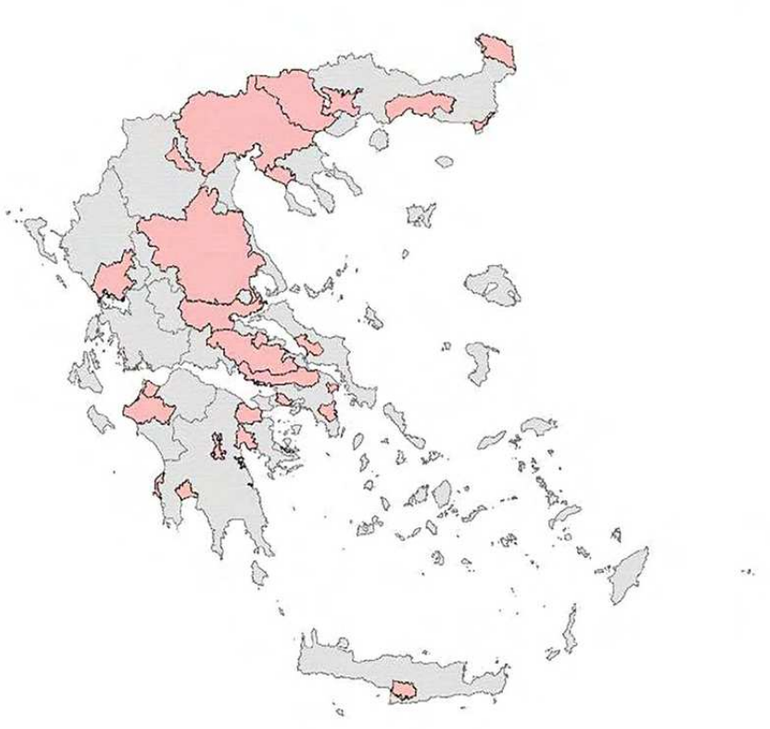


4. Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources

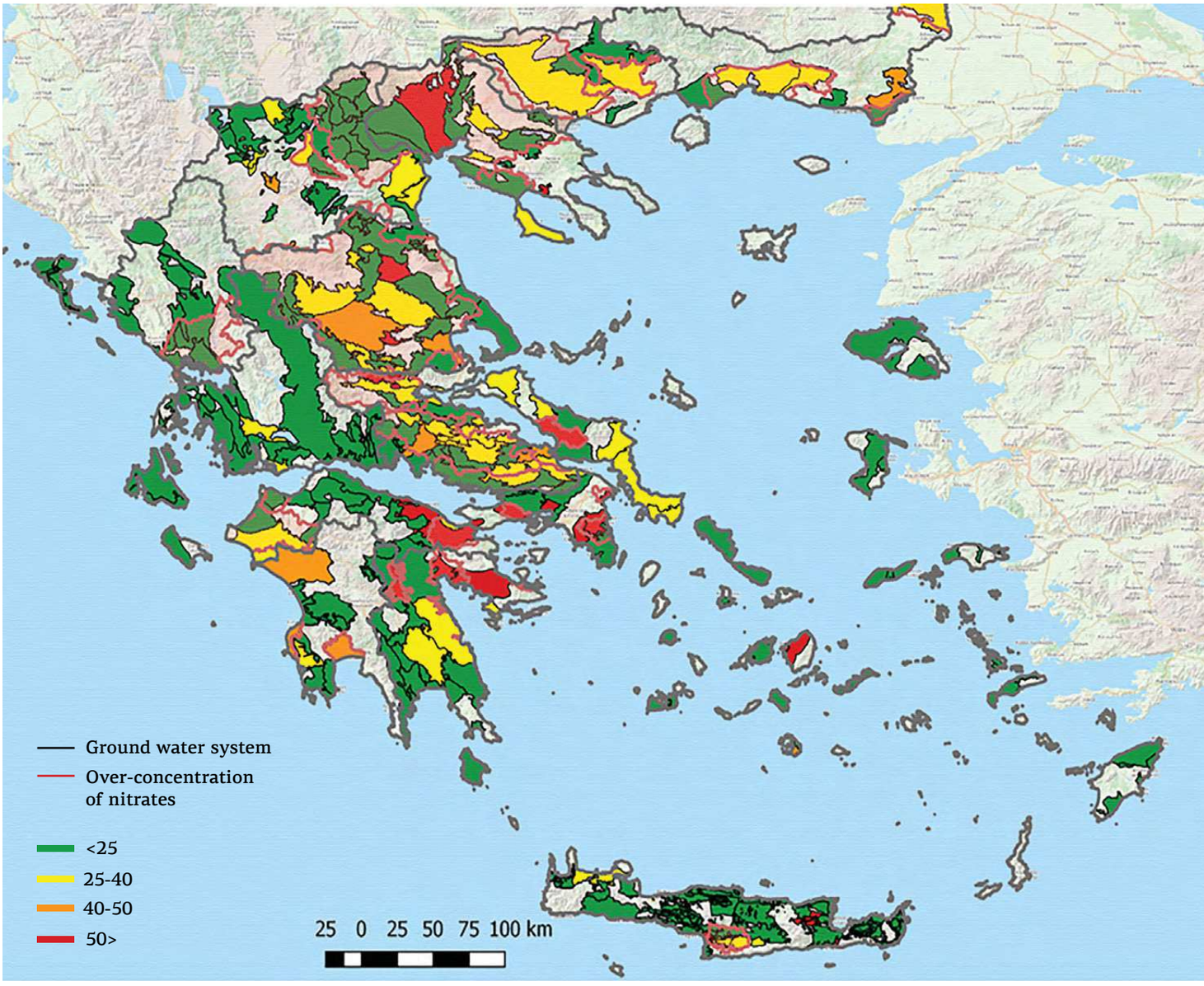
4.1 Implementation of Directive 91/676/EEC "For the protection of waters against pollution caused by nitrates from agricultural sources"

Following the transposition of Directive 91/676/EEC for "the Protection of waters against pollution caused by nitrates from agricultural sources" (JMD 16190/1335/1997), 30 areas were defined as vulnerable to pollution caused by nitrates from agricultural sources zones as can be seen from Picture 4.6. below. For 7 of these vulnerable zones (Thessalia plain, Copais plain, Argolis plain, Pineios river basin in Ilia, Strymonas river basin, Thessaloniki – Pella, Imathia plans, Arta-Preveza plain) action plans are being enacted and implemented according to the provisions of the Directive, aiming to prevent the undermined degradation of waters in these areas. For the update of existing and development of new action plans for all nitrate vulnerable zones, a relevant project was launched in April 2017, in the framework of the Rural Development Programme 2014-2020, and is currently at the final elaboration stage. Picture 4.7 presents the distribution of the average overconcentration of nitrates per water system for the years 2012-2015, based on the results of the National Monitoring Network.

Picture 4.6.
Map of Greece where vulnerable to pollution caused by nitrates from agricultural sources zones are depicted with orange colour (Source: SSW/Ministry of Environment and Energy)



Picture 4.7.
Distribution of the average over-concentration of nitrates per ground water system for the year 2012-2015



5. Marine environment

5.1 Directive 2008/56/EC "establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)"

Based on the Directive 2008/56, sea waters of Greece fall under the Mediterranean Sea subregions:

1. Adriatic sea
2. Ionian sea and central Mediterranean sea,
3. Aegean sea – Eastern Mediterranean sea (Levantine Sea)

The implementation of the Directive has started but there is a time lag of about 2 years compared to the implementation timetable of the Marine Directive. Until now, the initial assessment of the current environmental status of the waters concerned and the environmental impact of human activities thereon, and the determinationof good environmental status has been carried out. Furthermore, a series of environmental targets and associated indicators, a monitoring programme for ongoing assessment and regular updating of targets, and programme of measures designed to achieve or maintain good environmental status have been established.

6. Bathing Waters

6.1 Directive 2006/7/EK “concerning the management of bathing water quality”

The results of the Bathing Waters Monitoring Programme are published with responsibility of SSW on the website of the Ministry of Environment, www.bathingwaterprofiles.gr, at EIONET, on the interactive website of EEA and the webpages of Water Diractorates of the Decentralized Administrations. Alongside all this, Greece participates to the International Programme «Blue Flags» having in 2015 395 and 430 coasts with the award of “Blue Flag” for the years 2015 and 2016 respectively.

6.2 Assessment of coastal bathing waters

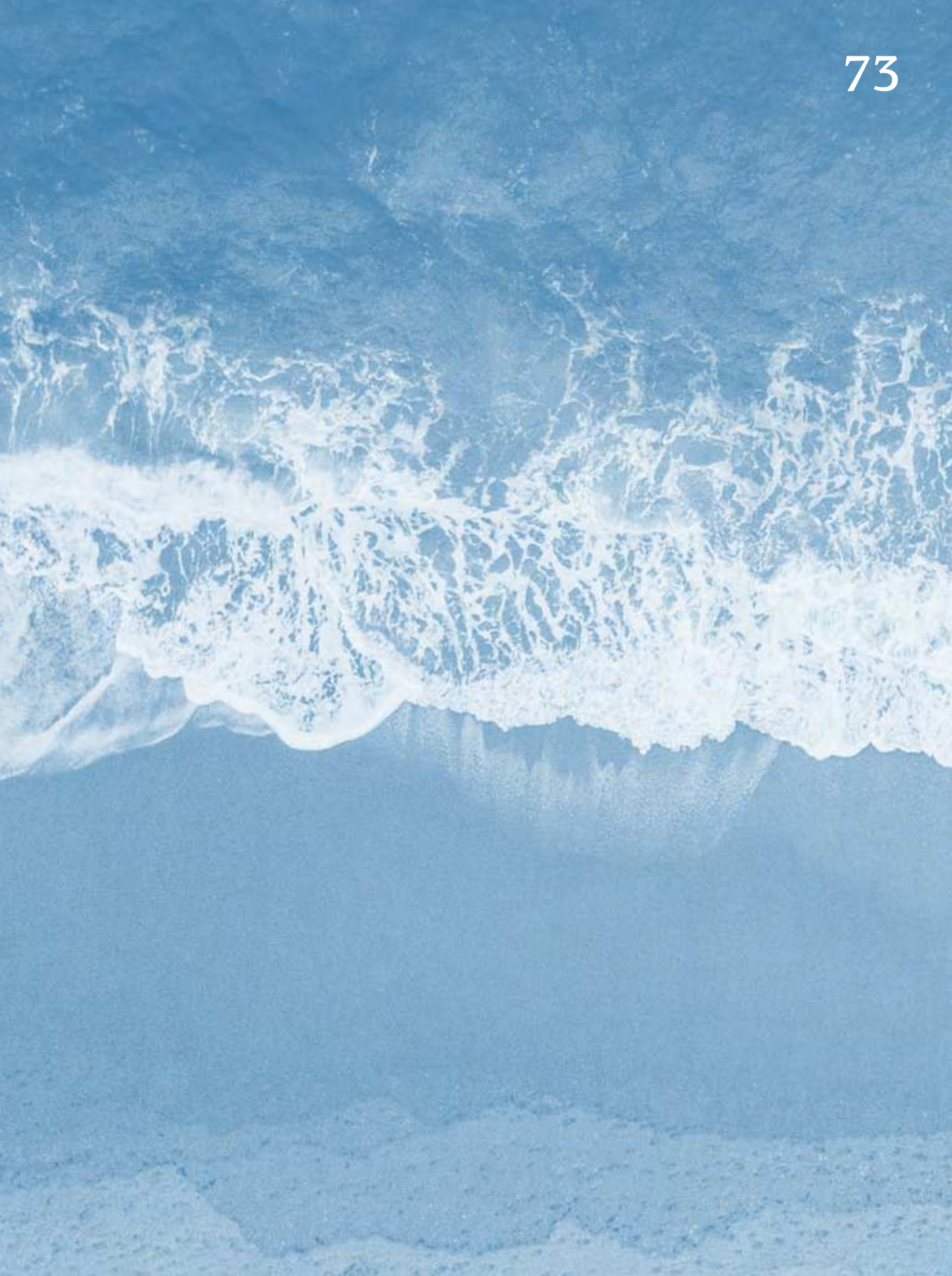
In the year 2016, 100% of the coastal bathing waters is in full compliance with the demand of the Directive for bathing waters of at least adequate quality, as the total of bathing waters are classified as waters of excellent, good and adequate quality, and none at the category of inadequate quality. The 99.33% of the coastal bathing waters are classified as of excellent quality, the 0.6% of the waters as of good quality and the 0.07% of the waters as of adequate quality.

6.3 Assessment of inland bathing waters

In the year 2015, 100% of all inland bathing waters is in full compliance with the demand of the Directive for bathing waters of at least adequate quality, as they are all classified as waters of excellent quality, showing an increase of 50% comparing to the year 2014. None of the inland bathing waters is classified as good or adequate quality. This great increase of the percentage of bathing waters with excellent quality is due to the small number of inland bathing waters (2 inland bathing waters). From the beginning of the monitoring programme in 1990 there were no areas that were closed because of inadequate quality.

6.4 Bathing Water Profiles Registry

The Bathing Water Profiles Registry was established for the first time in 2012 (with annual updates), with the aim of presenting the basic characteristics of bathing waters, the hydrological and meteorological information of the area, maps of the wider region, identification of possible sources of pollution which may affect the water quality and assessment of the phenomenon of eutrophication. The Bathing Water Profiles Registry constitutes a guide for the selection of appropriate response measures for the consequences of pollution in bathing waters and allows for more efficient management of the corresponding resources. The data and information of the Registry of Bathing Water Profiles are available on the http://www.bathingwaterprofiles.gr/. During the years 2015-2016 the Registry of Bathing Water Profiles included 1508 profiles out of 1542 bathing waters that are monitored, as 34 bathing waters were included in the monitoring network during the year 2015. These new waters are not evaluated because the required number of samples, as defined by the Directive 2006/7/EC, has not been filled in yet and concequently their respective profiles have not been compiled.



5

Nature - Biodiversity

Biodiversity conservation in Greece

Greece is a Mediterranean country of exceptional biological wealth. It is a mountainous country (66%) with a pronounced island character (9,800 islands, 18,400 km shoreline). The geographical position of the country, its complex topography, its geological and soil diversity, its landscape heterogeneity, and the impressive co-existence of several micro-climatic conditions explain the high biodiversity value of the country and its high degree of endemism, in the context of its geological and evolutionary history.

Greece still includes ecosystems of high naturalness as well as cultural landscapes that in combination host an outstanding biological diversity. For instance, Greek flora consists of 5,752 species (6,600 taxa) with 22% of them being endemic (1,278 species), whilst 503 algae and 750 bryophyte taxa have been recorded. Greek fauna is estimated to include 50,000 species, including over 24,731 invertebrate species and 1,273 vertebrate species (630 fish, 22 amphibian, 64 reptile, 442 bird and 115 mammal species).

Acknowledging the value of Greek nature and the need for its effective conservation, the Greek State has gradually built a strong institutional frame for environmental protection and nature conservation, adopting several International Conventions (since 1974) and European Directives (since 1983), and enriching them with a series of national environmental protection laws (since 1950). The current legal frame covers a great range of environmental issues, from genetic resources conservation to climate change, but a great part of it concerns the establishment and legal protection of protected areas in the country. The two most important recent legislative acts are the law on biodiversity conservation (2011), and the national biodiversity strategy 2014-2019 and the relevant action plan (2014).

We present here the progress of the country in the field of nature and biodiversity conservation, in terms of a set of 12 indicators. These indicators evaluate the national progress towards achieving 4 out of the 17 Sustainable Development Goals of Agenda 2030 of the United Nations (SDGs), 8 out of the 20 Aichi targets, 4 out of the 6 targets of the European Biodiversity Strategy (EU), and 6 out of the 13 goals of the National Biodiversity Strategy (covering 16 specific targets). The indicators are presented according to the DPSIR system: Drivers, Pressures (3 indicators), State (4 indicators), Impac., Response (3 indicators). This briefing refers to the national report of the National Center of Environment and Sustainable Development on the state of nature and biodiversity.

Indicators

Policy	Target
SDG	2, 15
Aichi	5, 7
EU	1, 2, 3, 6
GR	2.1, 2.2
SEBI	01

1. Abundance and distribution of selected species – SEBI 01

Indicator: The indicator presents the population status of common, farmland, and forest bird species (farmland and forest birds included in common birds) in Greece.

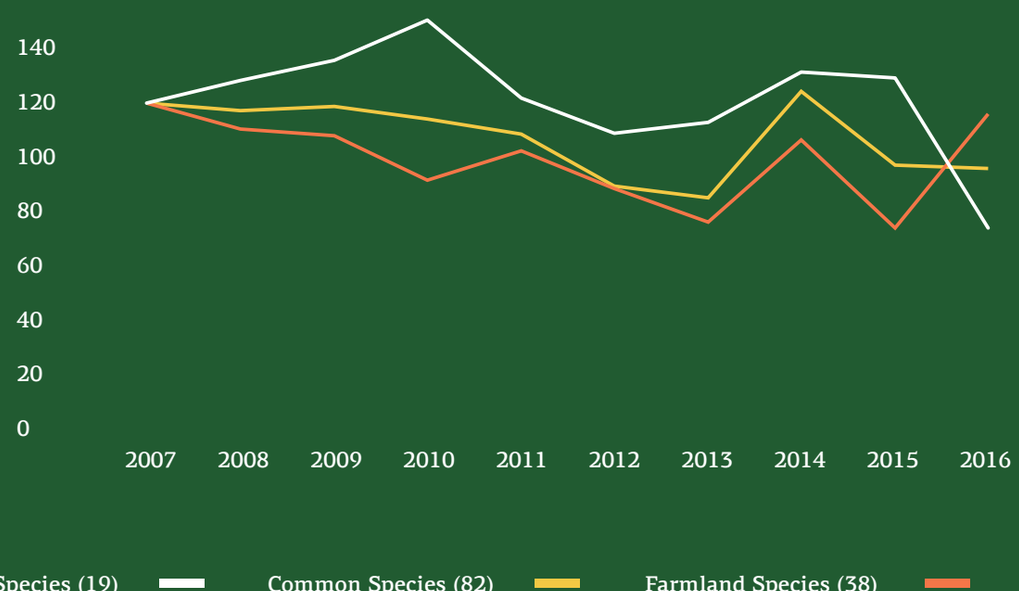
Period: 2007-2016

Source: Since 2007 the three indicators are delivered annually by the Hellenic Ornithological Society (HOS) and are communicated to the Pan-European Common Bird Monitoring Scheme (PECBMS).

Evaluation: The common bird indicator in Greece has decreased (19.81% for the period 2007-2016), as also observed in the rest of Europe (14,23% for the period 1980-2015). Specifically, when applying the indicators, farmland bird populations show a slight decrease (2,6%), whereas those of forest birds show a steep decline (38.15% - Graph 5.1.). Although the national indicators should not be considered as reliable as the European indicators, due to the shorter reference period, the pattern observed in Greece generally contradicts the one observed in the rest of Europe, where the farmland bird indicator shows a steep decline and the forest bird indicator appears to be stable over the last years.

Policy output: Conservation measures should be adopted to improve the status of forest habitats in Greece, for the benefit of forest birds. The Hellenic Common Bird Monitoring Scheme (HCBM) should be supported by the Greek government on permanent basis, in order to conclude to safer evaluations of the long-term trend of the indicator.

Graph 5.1.
Common, Farmland and Forest Bird Indicators in Greece for the period 2007-2016 (Source: HOS 2017)



2. Species of European interest – SEBI 03

Indicator: The indicator presents the changes and trends in the species of European interest that occur in Greece.
It consists of two sub-indicators: a) the conservation status and trends of species listed in Annexes II, IV and V of the Habitats Directive (MED and MMED) and b) the population trend (and range for breeding species) of wild birds, as listed in the Birds Directive.

Period: 2007-2014

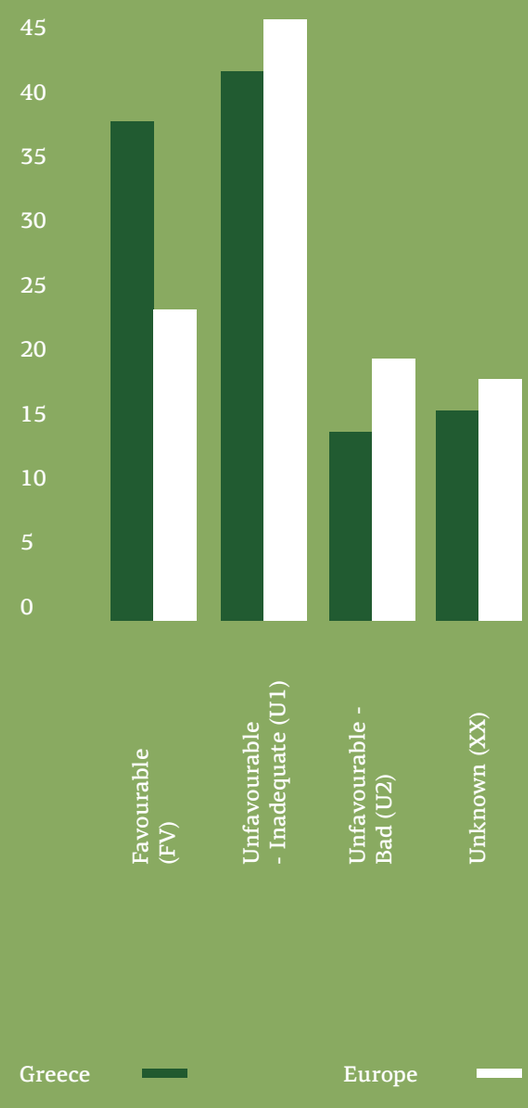
Source: The indicator is based on data collected under the reporting obligations for the implementation of the two Nature Directives (Article 17 of the Habitats Directive and Article 12 of the Birds Directive).

Evaluation: Greece plays an important role in the conservation of Europe's nature, as it hosts 301 species of European interest. In the Mediterranean biogeographical region (MED), 33% of the species are assessed to be in a Favourable conservation status (FV) and only 11% in Unfavourable-Bad (U2). The situation in the Marine Mediterranean biogeographical region (MMED) is not encouraging, as none of the 20 species with Marine distribution is assessed to be in a Favourable conservation status (FV). Overall, species in Greece appear to be in a better conservation status than species in Europe, as 33% of the species in the country are in Favourable conservation status (FV), compared to 23% of species in Europe (Graph 5.2.). For the period 2007-2014, a remarkable improvement of knowledge is observed, as the percentage of species of European interest in an Unknown conservation status (XX) has decreased significantly, and mainly in the Mediterranean biogeographical region (MED). As far as bird species are concerned, 292 species of European interest are distributed in Greece (253 of which breed in our country). Short-term population trends (2001-2012) are recorded as stable (=) for 66% of birds breeding and/or wintering in our country, while long-term population trends (1980-2012) are recorded almost equally as stable (=) (36%) and unknown (x) (33%).

Policy output: Strengthening research in order to further improve the knowledge base on species of European interest and establishment of a permanent monitoring system/program for the assessment of species' conservation status and the fulfillment of the national obligations regarding EU Habitats and Birds Directives, should be priority tasks for the Greek competent authorities.

Policy	Target
SDG	14, 15
Aichi	5, 6, 7, 11, 12
EU	1, 3, 6
GR	2.1, 2.2
SEBI	03

Graph 5.2.
Percentage (%) of species in different conservation status classes, in Greece and the rest of Europe, for the period 2007-2012 (2007-2014 for Greece) (Source: EEA 2015)



3. Habitats of European interest – SEBI 05

Indicator: The indicator presents the changes and trends in the conservation status of natural habitats of European interest (i.e. habitat types included in Annex I to the Habitats Directive) that occur in Greece.

Period: 2007-2014

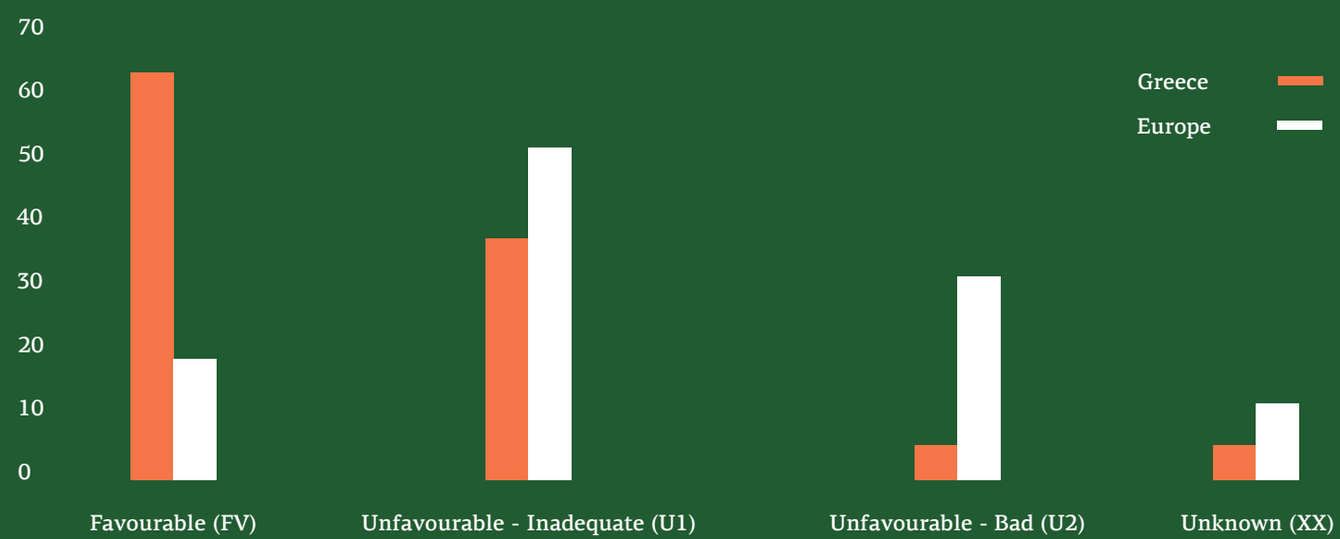
Source: The indicator is based on data collected under the monitoring obligation (Article 11) and submitted to the EC under the reporting obligation (Article 17) for the implementation of the Habitats Directive.

Evaluation: Greece plays an important role in the conservation of Europe's nature, as it hosts 88 habitat types of European interest (80 habitats in the Mediterranean biogeographical region-MED and eight habitats in the marine Mediterranean region-MMED). The situation in the Mediterranean biogeographical region (MED) appears to be much better than in the marine Mediterranean region (MMED), with 66% and 12% of habitat types in Favourable conservation status (FV), respectively. Most habitat types in an Unfavourable conservation status (U1 and U2) show a stable trend (=). Overall, habitat types in Greece (MED and MMED) appear to be in a much better conservation status than the habitat types in Europe, as 61% of the habitats in the country are assessed to be in a Favourable conservation status (FV), compared to 16% of habitats in Europe, and only a small percentage (3% compared to 30% in Europe) are assessed as in an Unfavourable-Bad conservation status (U2) (Graph 5.3.). In what regards the contribution of the Habitats Directive to the improvement of the conservation status of habitats of European interest in Greece, no safe conclusion can be drawn, as the observed changes for the period 2001-2014 are mainly attributed to the improvement of knowledge.

Policy output: Strengthening research in order to further improve the knowledge base on habitats of European interest and establishment of a permanent monitoring system/program for the assessment of the habitats; conservation status and the fulfillment of the national obligations regarding EU Habitats Directive, should be priority tasks for the Greek competent authorities.

Policy	Target
SDG	14, 15
Aichi	5, 6, 7, 11, 15
EU	1, 3, 6
GR	2.1, 2.2
SEBI	05

Graph 5.3.
Percentage (%) of habitat types in different conservation status classes, in Greece and the rest of Europe, for the period 2007-2012 (2007-2014 for Greece) (Source: EEA 2017)



4. Ecosystem coverage – SEBI 04

Indicator: The indicator shows the proportional (%) and absolute (ha) change in extent and turnover of Corine land cover categories aggregated to the main SEBI ecosystem classes.

Period 2006-2012

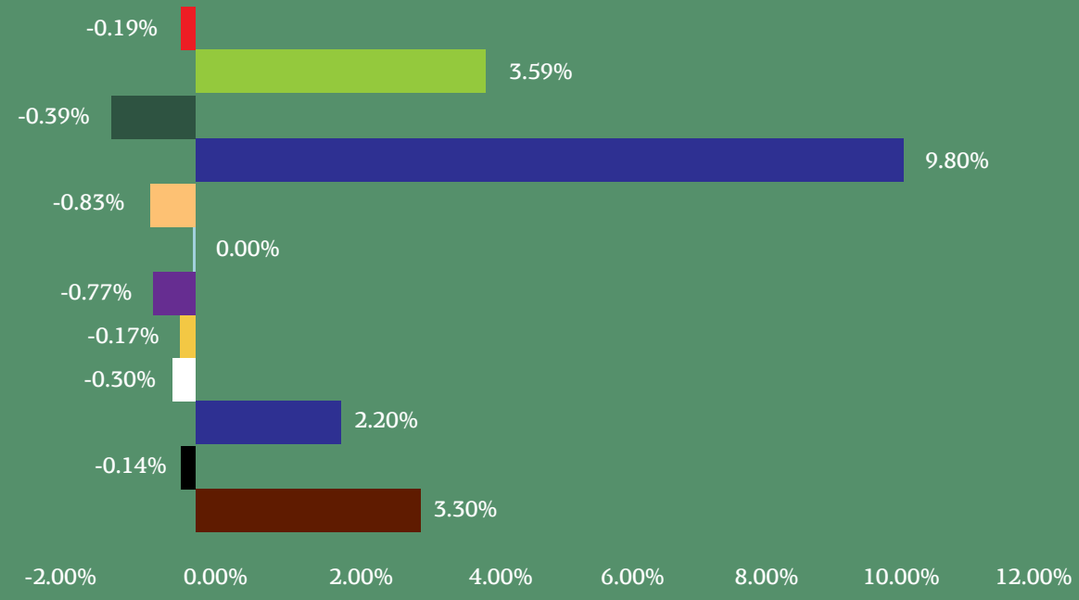
Source: EEA (2017) Corine Land Cover Change (LCC) 2006-2012, V. 18.5. http://land.copernicus.eu/paneuropean/ corine-land-cover/lcc-2006-2012/; EEA (2015) Ecosystem coverage. https://www.eea.europa.eu/data-andmaps/ indicators/ecosystem-coverage-1/assessment-1; ELSTAT (2017) Greece in numbers. April – June 2017. http://www.statistics.gr/documents/20181/1515741/GreeceInFigures_2017Q2_GR.pdf/c48fd272-754a-486d-a463-99c6ab2cb681.

Evaluation:
During the period 2006-2012, 1,08% of the Greek terrestrial area underwent ecosystem cover changes. The most important changes are the decrease in woodland and forest cover, as well as the increase in transitional woodland and sparsely vegetated land (Graph 5.4.). Specifically, woodland and forest was mainly converted to transitional woodland (57.7%) and sparsely vegetated land (33.4%). Cropland also decreased in area, being principally converted to urban areas. Urban areas, rivers and lakes showed a slight increase, while heathland and shrub, agricultural mosaics and grasslands showed a slight decrease.

Policy Output: Natural ecosystems should be safeguarded against habitat loss, degradation and fragmentation.

Policy	Target
SDG	15
Aichi	5, 7, 15
EU	2
GR	2.1
SEBI	04

Graph 5.4.
Ecosystem class changes (ha) recorded in Greece during 2006-2012 and % change in comparison to 2006 (Source: EEA 2015)



5. Pressures and threats to species of European interest – SEBI 03

Indicator: The indicator shows the number of pressures and threats of low, medium and high intensity to species of European interest in the Mediterranean (MED) and Marine Mediterranean biogeographical region (MMED).

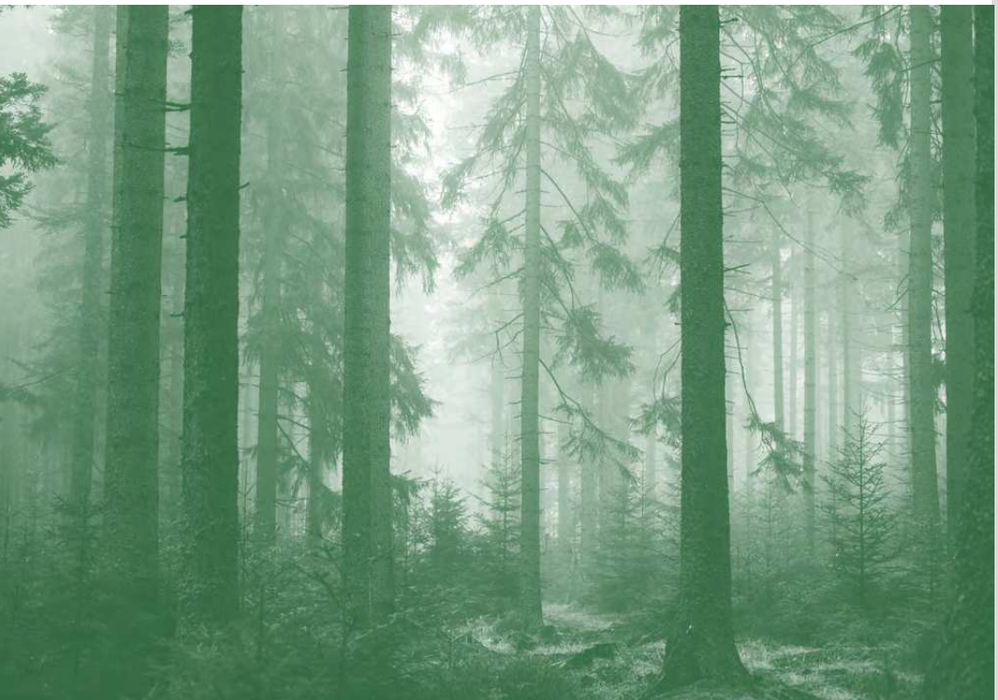
Period: 2007-2014

Source: EEA (2015) National submission of Article 17 of Habitats Directive (92/43/EU) reporting for the period 2007–2012 (actual period is 2007-2014). Eionet - Central Data Repository. http://cdr.eionet.europa.eu/gr/eu/art17.

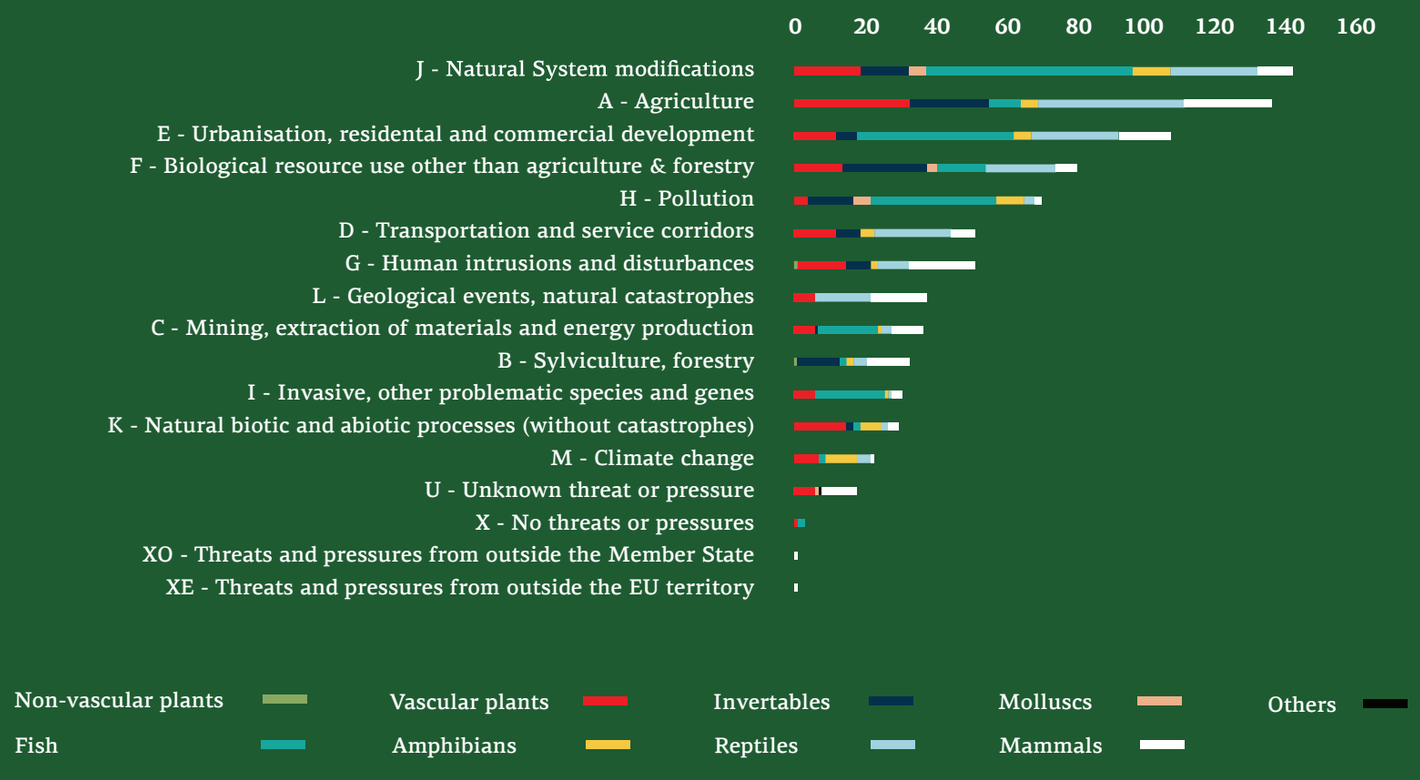
Evaluation: Overall, 193 different types of pressures and threats to species of European interest were recorded in Greece. Most threats recorded both in the Mediterranean (MED) and the Marine Mediterranean (MMED) biogeographical regions were of low intensity. Greece should focus on the conservation of freshwater icthyofauna (MED) and marine mammals (MMED), as these groups face the highest number of threats (Graph 5.5.). Specifically, the country should undertake coordinated actions against natural system modifications, agriculture, as well as against urbanisation, residential and commercial development, which were, in descending order, the most common threats to the species of Community interest in terrestrial areas. Management actions in the MMED region should also focus on the reduction in biological resource use. In addition, a large number of pressures was recorded for bird species (128), most of which were of medium intensity. Natural system modifications were the most severe pressure of high intensity for birds, followed by agriculture.

Policy Output: Conservation measures should be adopted to reduce threats to species of European interest, especially freshwater icthyofauna, marine mammals and birds.

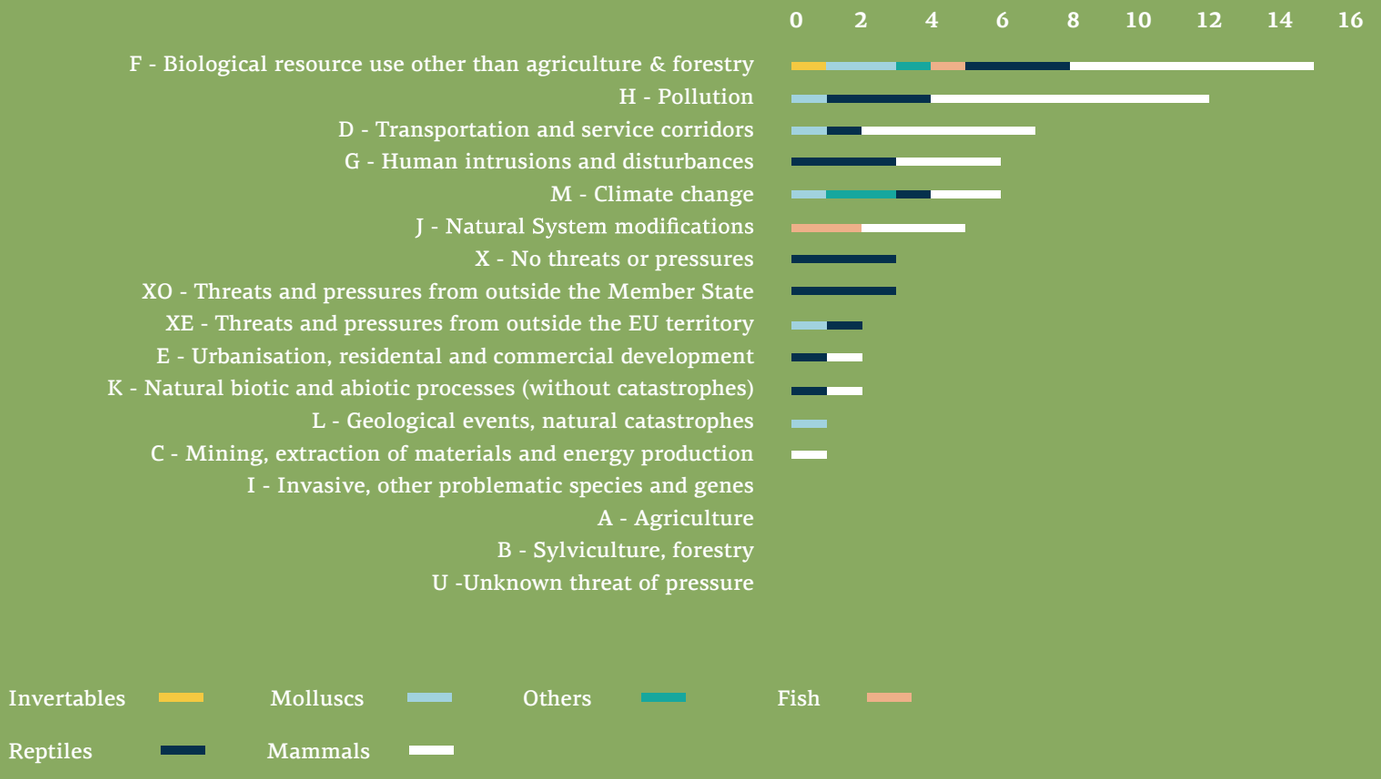
Policy	Target
SDG	14, 15
Aichi	5, 6, 7
EU	1
GR	2.1
SEBI	03



Graph 5.5a.
Number of species per threat category recorded in the Mediterranean biogeographical region (MED) in Greece (2007-2014) (Source: EEA 2015)



Graph 5.5b.
Number of species per threat category recorded in the Marine Mediterranean biogeographical region (MMED) in Greece (2007-2014) (Source: EEA 2015)



6. Pressures and threats to habitats of European interest – SEBI 05

Indicator: The indicator provides an assessment of pressures and threats of low, medium and high intensity to habitats of European interest in the Mediterranean (MED) and Marine Mediterranean biogeographical region (MMED)

Period: 2007-2014

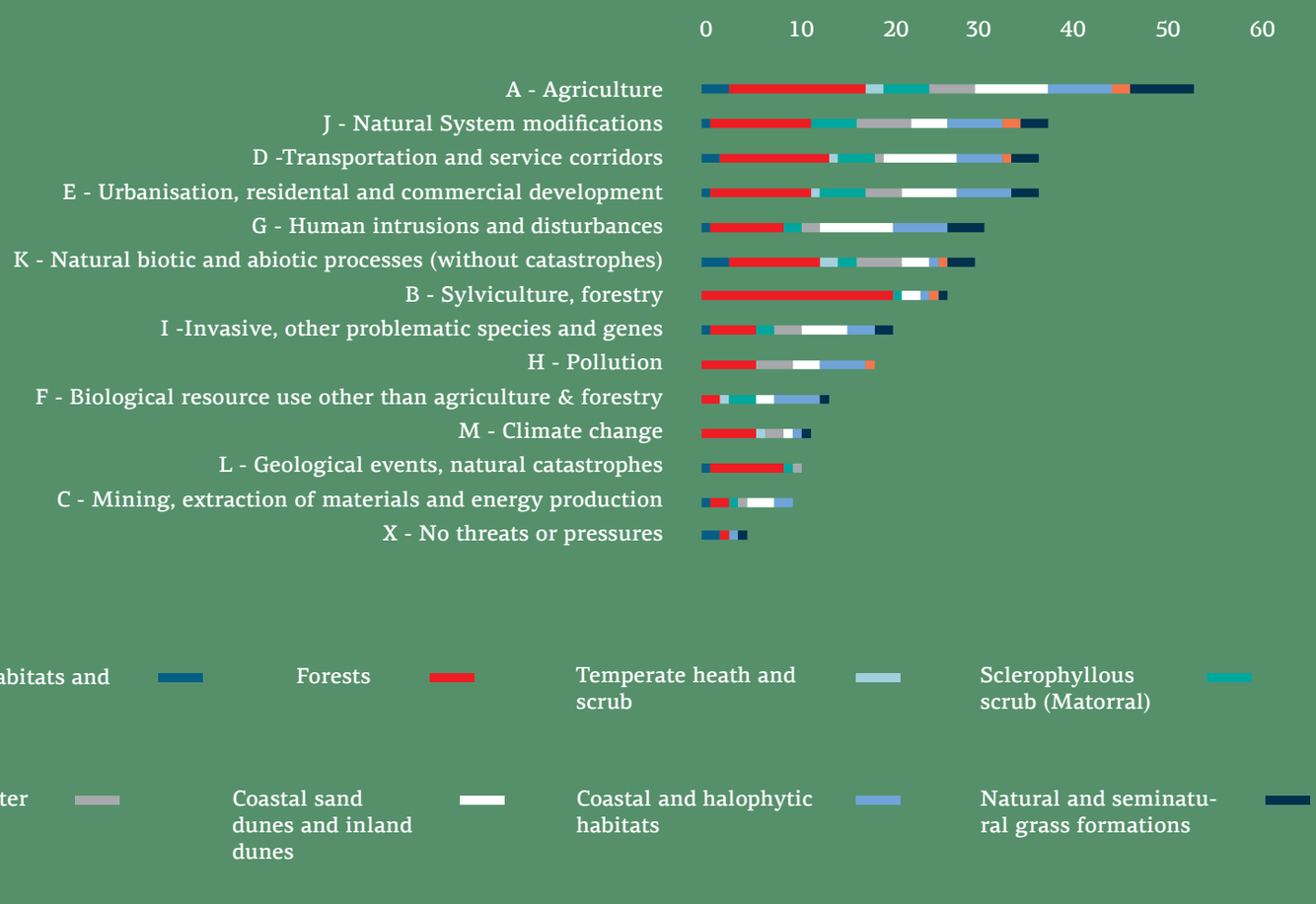
Source: EEA (2015) National submission of Article 17 of Habitats Directive (92/43/EU) reporting for the period 2007 – 2012 (actual period is 2007-2014). Eionet - Central Data Repository. http://cdr.eionet.europa.eu/gr/eu/art17.

Evaluation: 83 types of pressures and threats were recorded to the habitats of European interest in Greece. Most pressures and threats to the terrestrial habitats were of low intensity, whereas those to the marine habitats were of medium intensity, which explains the better conservation status of the former in relation to the latter. Most threats to the terrestrial habitats are induced by agriculture, whereas marine habitats are mostly affected by biological resource use and pollution (Graph 5.6.).

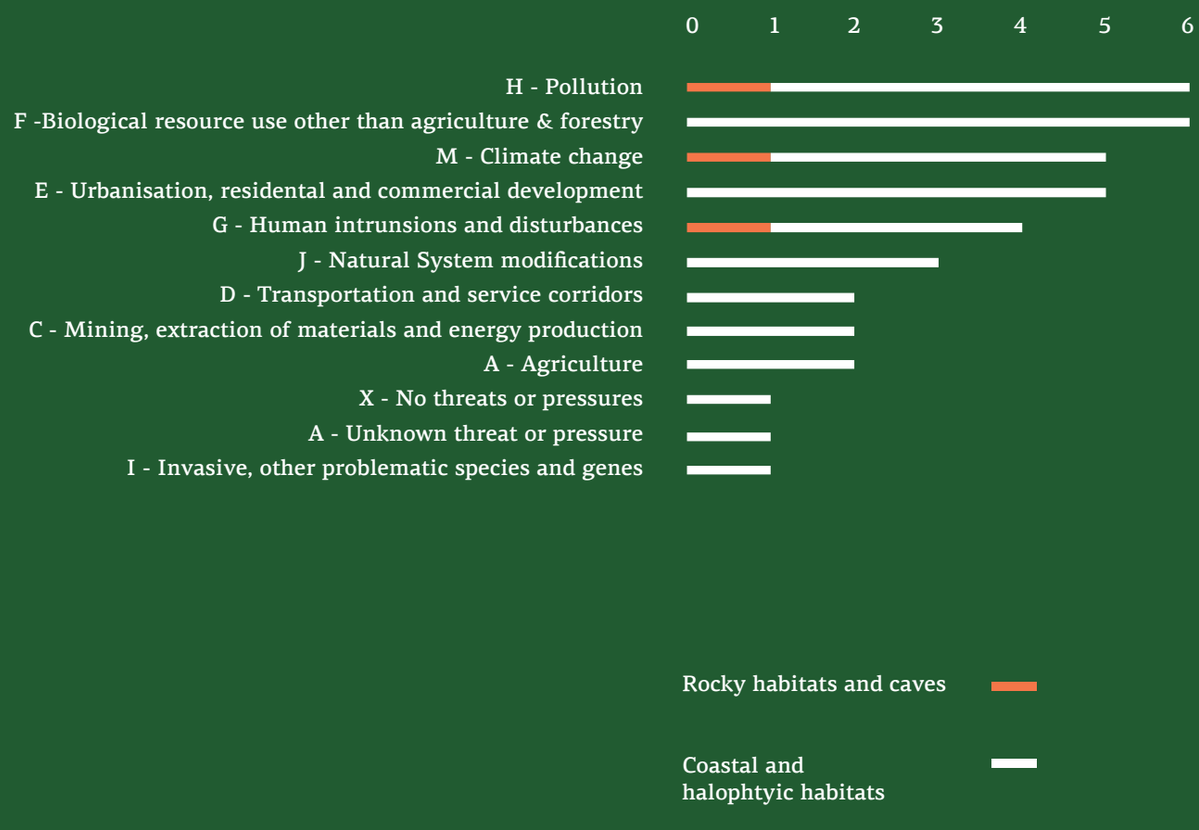
Policy output: As a result, Greece should primarily focus on the elimination of pressures and threats of high intensity, i.e. in the reduction of natural system modifications and climate change, which appear more often compared to the European average. Furthermore, Greece should target at the elimination of pressures and threats recorded in the forest ecosystems, which suffer the highest number of pressures and threats.

Policy	Target
SDG	15
Aichi	5, 6, 7, 15
EU	1, 2
GR	2
SEBI	05

Graph 5.6a.
Number of terrestrial habitats of European interest
per threat category recorded in Greece (2007-2014) (Source: EEA 2015)



Graph 5.6b.
Number of marine habitats of European interest
per threat category recorded in Greece (2007-2014) (Source: EEA 2015)



7. Loss of natural and semi-natural ecosystems – SEBI 04

Indicator: The indicator presents the area of natural and semi-natural areas that has been converted to artificial land. It serves the European aim of no net land take by 2050 according to the Resource Efficiency Roadmap.

Period: 2006-2012

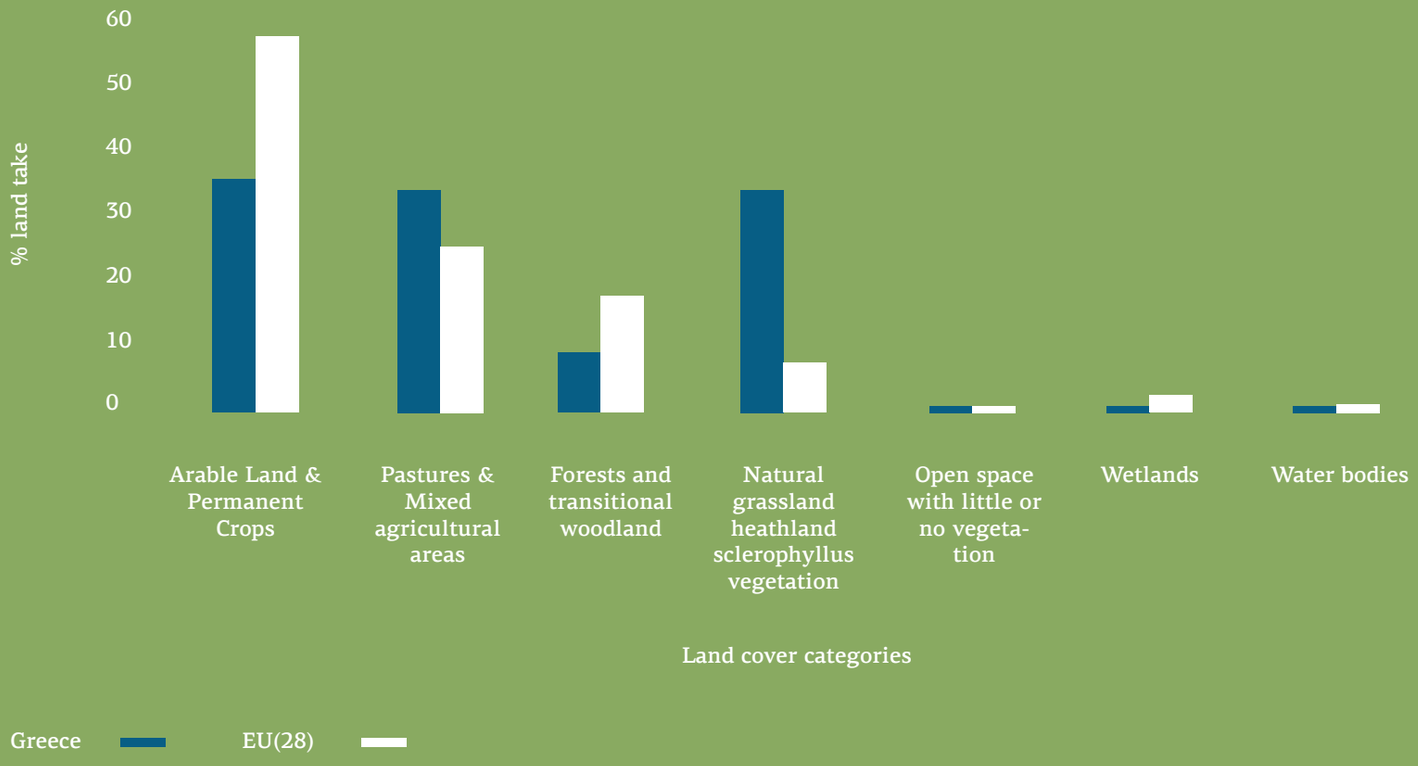
Source: EEA (2017) Land take indicator (CSI 014/LSI 001). http://www.eea.europa.eu/data-and maps/indicators/land-take-2/assessment-1.

Evaluation: Natural and semi-natural ecosystem cover in Greece is higher than the European average. However, the mean annual land take by artificial surfaces is among the highest in Europe (0.701%), with Greece being in the fourth position in the European Union. The new artificial surfaces in Greece were primarily created by the modification of arable land and cropland, mixed agricultural ecosystems, grasslands, heathlands and areas with sclerophylous vegetation (Graph 5.7.). Land take was caused by the expansion of construction sites, mines, quarries, dump sites, industrial, commercial and urban areas, as well as transport networks. According to the European Statistical Service (EUROSTAT), Greece also showed the highest rate of land take in Europe during the period 2012-2015.

Policy output: There is an urgent need for suitable urban planning in the country, aiming at reducing the artificial surface cover and land take rate at national level.

Policy	Target
SDG	15
Aichi	5
EU	2
GR	2,1
SEBI	04

Graph 5.7.
Conversion (%) of natural and semi-natural areas to artificial land in Greece and Europe (28) for the period 2006-2012 (Source: EEA 2017)



8. Fragmentation of natural and semi-natural areas – SEBI 13

Indicator: The number and surface of roadless areas is a new, clear and measurable indicator for the evaluation of landscape fragmentation. Roadless areas are defined as those areas being at least 1 km away from the nearest road.

Περίοδος: 2013

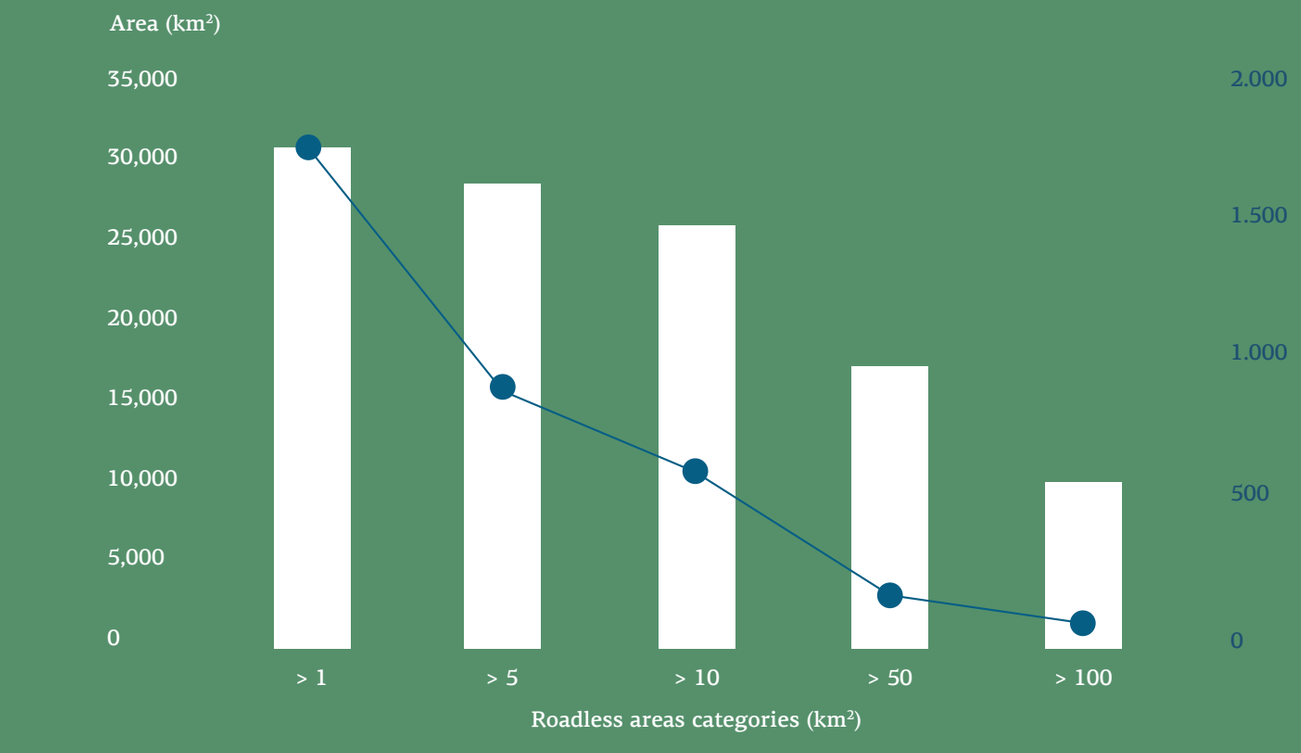
Source: Ibisch P.L. et al. (2016) A global map of roadless areas and their conservation status. Science 354: 1423-1427. http://www.roadless.online/data/

Evaluation: The road network in Greece is quite extensive, leading to severe problems of landscape fragmentation. Only 24% of the Greek terrestrial surface was found to be at a distance higher than 1 km from the closest road, which was much lower than the European and global average proportion recorded in 2013 (42% and 80% respectively). Moreover, most roadless areas in Greece (44%) cover only up to 1 km^2, few areas (142) are larger than 50 km^2 and even fewer (58) are larger than 100 km^2 (Graph 5.8.).

Policy output: The mapping and conservation of large roadless areas (> 50 km^2) should be a national priority, as they are important for the connectivity of natural ecosystems and for maintaining ecosystem services. An updated map of roadless areas on a national level is urgently needed, as a guideline for the adoption and implementation of national spatial policies.

Policy	Target
SDG	15
Aichi	3, 5, 11, 14, 15
EU	2
GR	2, 3, 5, 6, 7, 8
SEBI	13

Graph 5.8.
Area (km^2) and number of roadless areas (areas at least 1 km away from the nearest road) in Greece in 2013 across their different size categories (Source: Ibisch et al. 2016)



9.Ecological footprint of Greece – SEBI 23

Indicator: Ecological Footprint measures the ecological assets that the Greek population requires to produce the natural resources it consumes, and to absorb its waste (including carbon emissions). Biocapacity represents the productivity of the national ecological assets (cropland, grazing land, forest land, fishing grounds and built-up land), which can also absorb much of the waste generated. Both concepts are expressed in global hectares, as a globally standardized unit, comparable with world average productivity.

Period: 1961-2013

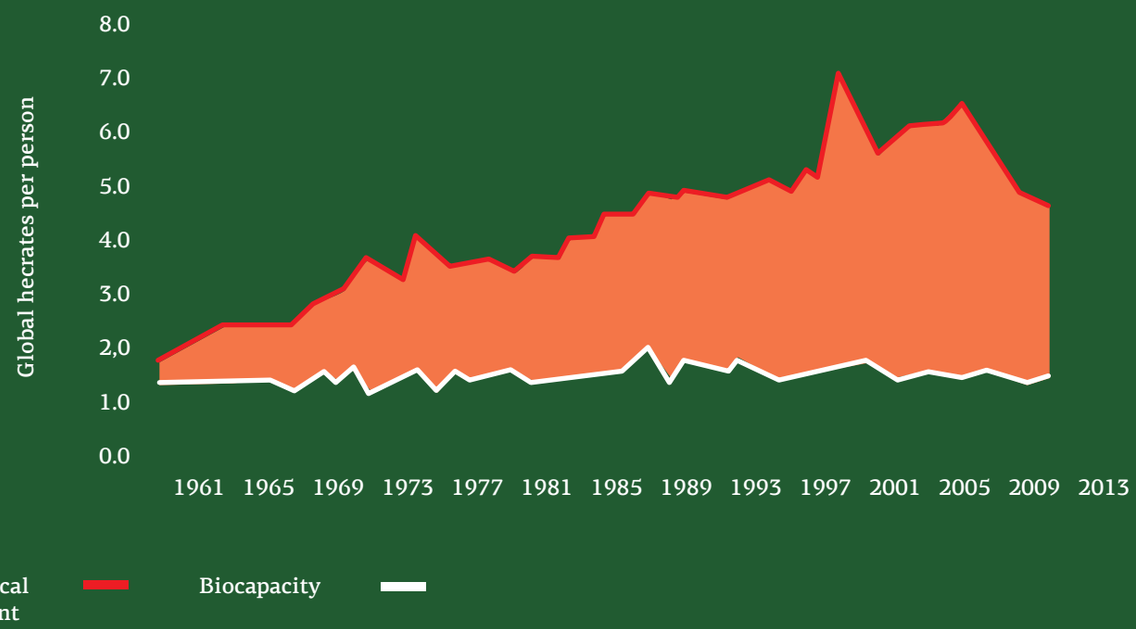
Source: Global Footprint Network (2017) National Footprint Accounts. Available at: http://data.footprintnetwork.org.

Evaluation: Consumption of environmental resources in Greece exceeds the national production to such an extent that an area equal to 2.47 times the surface of the earth would be needed in order to satisfy consumer needs. In 2013, the ecological debt of Greece was - 2.71 Gha per person, which was more than double the global average, with carbon use accounting for 91% of the total debt. The country has been showing a constant ecological debt in the last 52 years, with a long-term increasing trend (Graph 5.9.). Nevertheless, it was among the lowest in Europe (21st position) in 2013, since the situation has been recently improved (starting in 2007), mainly due to the reduction in fossil fuel use and general consumption, deriving from the economic crisis. A great reduction in the ecological footprint (35%) and a respective decreasing trend in the footprint of carbon, agriculture, livestock farming, forestry and fisheries, were recorded.

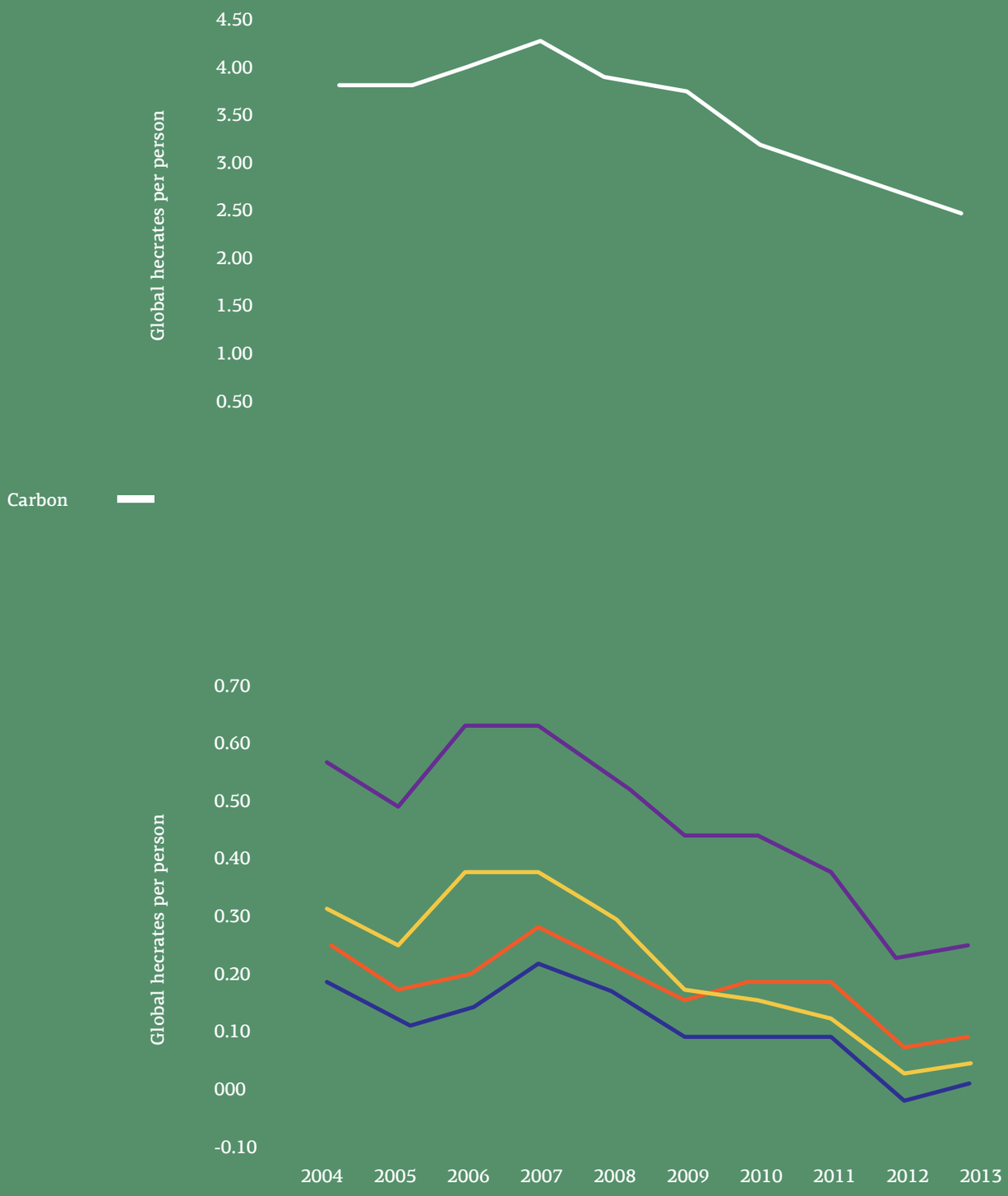
Policy Output: Political initiatives in Greece should aim at the reduction of the ecological footprint of carbon, as well as of the ecological debt, without degrading the quality of life.

Policy	Target
SDG	12
Aichi	4
EU	6
GR	5.3, 5.7, 7.4
SEBI	23

Graph 5.9a.
Ecological footprint and biocapacity in Greece from 1961 to 2013
(Source: Global Footprint Network 2017)



Graph 5.9b.
Carbon footprint and ecological deficit (ecological footprint – minus biocapacity)
of the different sectors for the period 2004-2013 in Greece (Source: Global Footprint Network 2017)



10. Nationally designated protected areas - SEBI 07

Indicator: The indicator presents the change over time in the total coverage of nationally designated protected areas (areas protected by national law, as a tool to conserve biodiversity) in Greece.

Period: 1938-2016

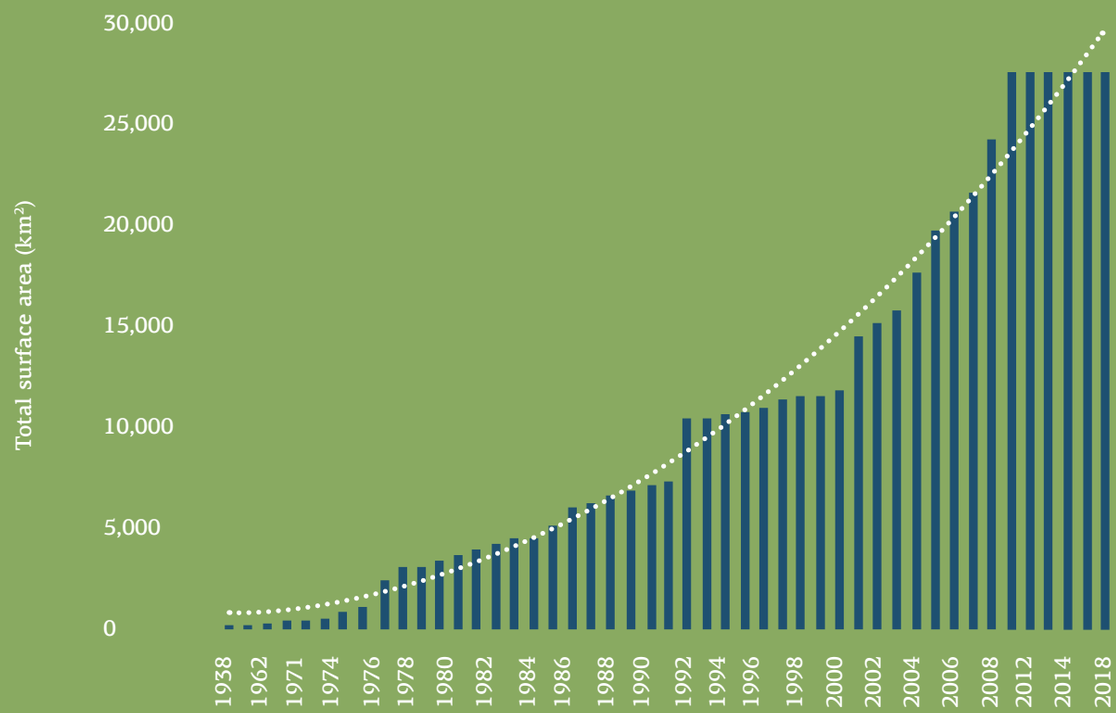
Source: National submission of March 2017 (Common Database on Designated Areas – CDDA), in the Central Data Repository (CDR), European Environment Agency (EEA).

Evaluation: The total surface area of the nationally protected areas in Greece has increased exponentially over time, from year 1938 to date. In 2016, the total surface area (terrestrial and marine) of the nationally designated protected areas amounted to 26158 km^2 (Graph 5.10.). The total area of these protected areas currently covers about 17.7% of the country's terrestrial territory, compared to 21% in Europe. The contribution of Greece to the European system of national protected areas corresponds to about 1.8% of the total surface area (terrestrial and marine) of the nationally designated protected areas at the European level (2016). The Law 3937/2011 for the conservation of biodiversity has organized more efficiently the national system of protected areas, including also the Natura 2000 network, in line with the Community framework.

Policy output: Political and administrative initiatives in Greece should aim to complete the designation of protected areas and to set land use regulations according to Law 3937/2011.

Policy	Target
SDG	14, 15
Aichi	5, 7, 11
EU	2, 6
GR	3.1-3.2
SEBI	07

Graph 5.10
Trends in the coverage of the nationally designated protected areas (km^2) in Greece, for the period 1938-2016 (refers to the total surface area, terrestrial and marine, excluding overlapping) (Source: EEA 2017)



11. Sites designated under the EU Habitats and Birds Directives – SEBI 08

Indicator: The indicator shows the trends over time in spatial coverage of sites designated under the EU Habitats and Birds Directives (Natura 2000 network), in Greece.

Period: 1995-2016

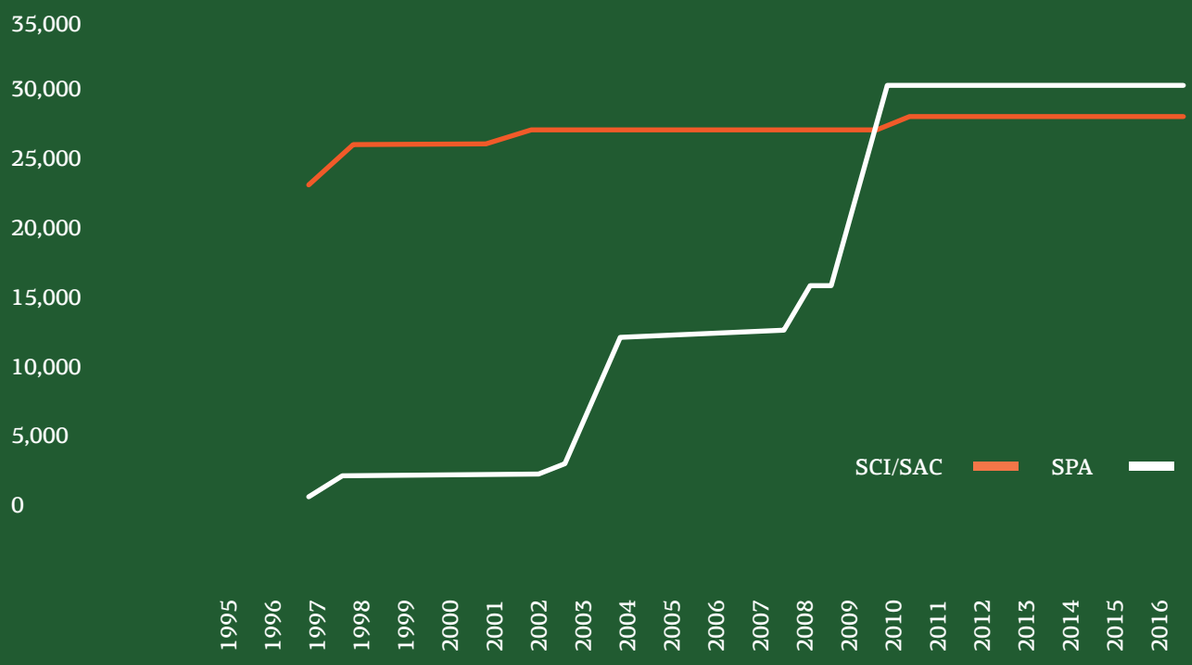
Source: National submission of July 2015 on the implementation of Art. 17 of the Habitats Directive, in the Central Data Repository (CDR), European Environment Agency (EEA).

Evaluation: The Natura 2000 network in Greece comprises 419 terrestrial and marine areas, with a total area of 42946 km^2. Specifically, the network includes 241 Sites of Community Importance (SCIs), 239 of which have been designated as Special Areas of Conservation (SAC), under the Habitats Directive and 202 Special Protection Areas (SPAs) under the Birds Directive (Graph 5.11a.). The Natura 2000 network covers 27.1% of the country's surface area, compared to 18.1% in Europe (Graph 5.11b.). This fact renders Greece's contribution to the network significant and our country is placed 7th among the 28 member states, while the Natura 2000 network in Greece accounts for 3.7% of the total European Natura 2000 network.

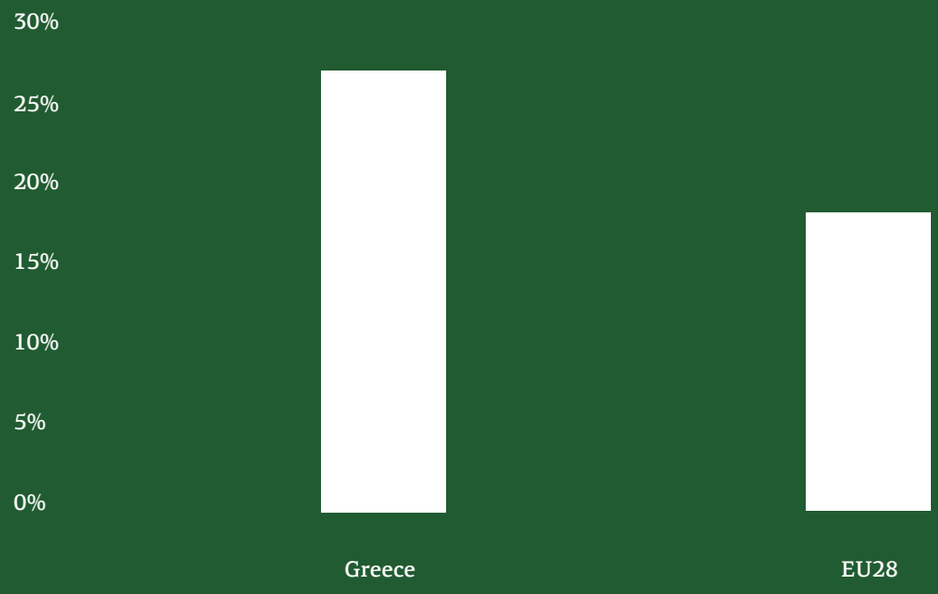
Policy output: Conservation objectives and measures should be adopted and implemented in order to improve the status of habitat types and species of European interest, distributed within the Natura 2000 network in Greece, to fulfill the obligations of the Habitats and Birds Directive.

Policy	Target
SDG	14, 15
Aichi	5, 6, 7, 11
EU	2, 6
GR	3.1-3.3
SEBI	08

Graph 5.11a.
Trends in spatial coverage of the Natura 2000 network in Greece (total surface area, terrestrial and marine, excluding overlapping, in km2), for the period 1995-2016 (Source: EEA 2012)



Graph 5.11b.
Percentage (%) of the Natura 2000 network's spatial coverage (terrestrial), in Greece and Europe (EU28) (Source: EC 2016)



12. Geodiversity conservation

Indicator: The indicator presents the total area (ha) of the country designated as UNESCO Global Geoparks, the main aim of which is to promote geodiversity conservation. Geoparks include a number of geosites, i.e. sites with high geological, geomorphological, ecological and cultural value.

Period: 2000-2016

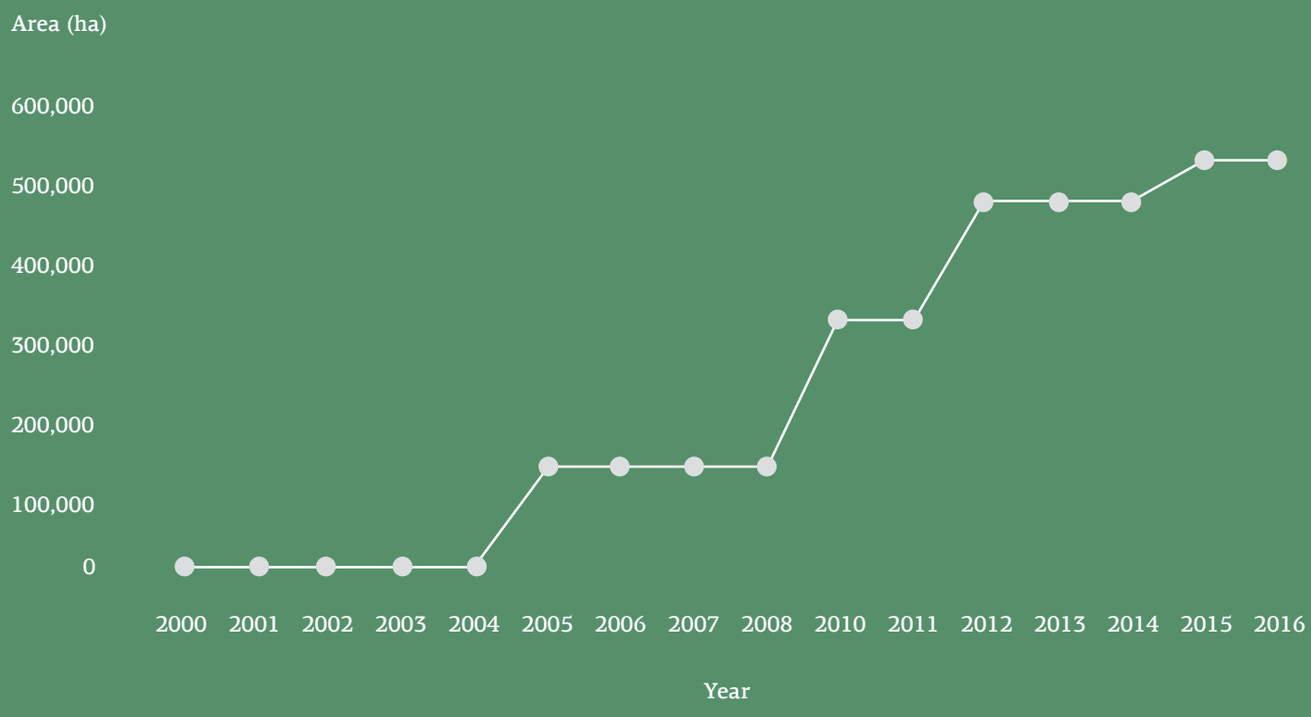
Source: Hellenic Geopark Forum (2017). http://www.hellenicgeoparks.gr/.

Evaluation: To date, five Greek geoparks have been designated as UNESCO Global Geoparks, covering an area of 529435 ha in total (Graph 5.12.). Overall, they contain 330 geosites, i.e. sites with particular geomorphological, geological, tectonic and palaeontological formations, geocultural heritage and remarkable natural beauty. A notable proportion of the Greek Geoparks (44.43%) includes areas that have also been designated as Natura 2000 sites, highlighting the composite geological, ecological and cultural value of these areas.

Policy output: The enactment of legislation for the formal protection of geosites in Greece is needed to ensure geodiversity conservation.

Policy	Target
SDG	15
Aichi	7
EU	3
GR	6.3
SEBI	-

Graph 5.12.
The total area of the UNESCO Global Geoparks in Greece has increased during 2000-2016



Overview

In conclusion, the state of nature and biodiversity in Greece generally appears to be sufficient compared to the rest of Europe, as the indicators used in this report have shown. The country has made notable progress in biodiversity and geodiversity conservation through the establishment of a network of protected areas. However, the Greek State should prioritize the implementation of joint actions and policies in the following sectors: (a) In the construction and development sector, natural and semi-natural land take should be diminished; (b) In transport, road network expansion should be minimized in order to halt landscape and natural ecosystem fragmentation; (c) For woodland and forests, special conservation actions should be applied aiming to maintain their area, to restrict pressures and threats within their boundaries and to establish woodland bird monitoring and conservation schemes. Further actions and policy measures should target at improving the conservation status of species and habitats of community interest, primarily through the restriction of pressures and threats on vulnerable biological groups, emphasizing marine ecosystems. Moreover, it is very important to bring into effect effective policies for minimizing the ecological debt and, in particular, fossil fuel use in the country. Finally, joint initiatives are needed in order to enact formal legal protection of geodiversity. Table 5.1 shows a synopsis of the general state of the natural environment in Greece.

Table 5.1.
Synopsis of the state of nature and biodiversity in Greece in terms of 12 indicators, national trends, and comparison with the state in the European Union (EU)

Type	N	Indicator	Description	Period	Trend	EU
State	1	Abundance and distribution of selected species – SEBI 01	Population trend of common birds	2007-2016	↓	😐
			Population trend of farmland birds		↓	🙂
			Population trend of forest birds		↓	☹
State	2	Species of European interest – SEBI 03	Species of Directive 92/43/EEC with Favourable status	2001-2006 & 2007-2014	↑ ●	🙂
			Species of Directive 92/43/EEC with Unfavourable - Inadequate status		↓ ●	😐
			Species of Directive 92/43/EEC with Unfavourable - Bad status		↓ ●	🙂
			Knowledge improvement: species with Unknown status		↑	🙂
			Short-term population trend of birds of Directive 2009/147/EC	2001-2004	→ ●	?
State	3	Habitats of European interest – SEBI 05	Habitats of Directive 92/43/EEC with Favourable status	2001-2006 & 2007-2014	↑ ●	🙂
			Habitats of Directive 92/43/EEC with Unfavourable - Inadequate status		→ ●	🙂
			Habitats of Directive 92/43/EEC with Unfavourable - Bad status		↓ ●	🙂
			Knowledge improvement: Habitats with Unknown status		→	🙂
State	4	Ecosystem cover – SEBI 04	Annual rate of land use change	2000-2006 & 2006-2012	↓	?

Type	N	Indicator	Description	Period	Trend	EU
Pressures	5	Pressures and threats on species of European interest – SEBI 03	-	2007-2014	X	?
Pressures	6	Pressures and threats on habitats of European interest – SEBI 05	-	2007-2014	X	?
Pressures	7	Natural and semi-natural land take – SEBI 04	Expansion rate of artificial surfaces	2006-2012 & 2015	↑	☹
Pressures	8	Fragmentation of natural and semi-natural ecosystems and areas – SEBI 13	Percentage of roadless areas	2013	X	☹
Pressures	9	Ecological footprint of Greece – SEBI 23	Trend of ecological debt	1961-2013	↑	☺
				2007-2013	↓	☺
Δράσεις	10	Nationally designated protected areas – SEBI 07	Terrestrial areas (%) designated as national protected areas	1938-2016	↑	
Δράσεις	11	Sites designated under the EU Habitats and Birds Directives – SEBI 08	Average cover of terrestrial area	1995-2016	↑	☺
Δράσεις	12	Geodiversity conservation	Number and area of UNESCO Global Geoparks	2000-2016	↑	☺

Trends: ↓ Decreasing ↑ Increasing → Stable X Unknown state or trend ● questionable trend

State in Greece in relation to the European Union: ☺ Good ☹ Bad 😐 Similar ? Comparison not possible

6

Waste Management

1. Municipal Solid Waste

According to data included in the National Waste Management Plan, MSW collection and transportation is implemented by the cleaning services of 325 Municipalities, their Associations or Solid Waste Management Organizations. In addition, there are 502 licensed non-hazardous waste collection and transportation companies, to which Municipalities assign the collection/ transportation of MSW. The collection of MSW covers 100% of the territory.

According to the 2016 data of the Hellenic Recovery Recycling Corporation, 94% of the country's population is served for separate collection of Recyclable Materials by the Blue Bins Network and autonomous collection (297 Municipalities). The quantitative data for the years 2015 and 2016, regarding the management of MSW are presented in the following table:

Table 6.1.
Quantities of MSW generated and managed
(source: Ministry of Energy and Climate Change)

MSW Production	2015 Quantity (tn)		2016 Quantity (tn)	
	5,277,209.28		5,362,628.43	
MSW management	2015		2016	
	Quantity (tn)	%	Quantity (tn)	%
Disposal in landfills	4,160,935.45	78.85	4,215,701.21	78.6
Illegal disposal	265,000.00	5.02	200,000.00	3.7
Incineration	---	---	---	---
Recycling	698,414.91	13.23	738,144.00	13.8
Composting (Mechanical Waste Treatment Plant + domestic composting buckets + rural areas)	135,005.94	2.56	182,016.50	3.4
Energy recovery (R1) (waste cooking oils)	17,852.98	0.34	26,766.72	0.5

The comparison between the quantitative data for the years 2015 and 2016 and the quantitative elements of the National Waste Management Plan (2011) is presented in the following tables.

The below data show that, both in 2015 and 2016 there was an increase in the quantity generated per million € GDP, indicating that despite the decline in GDP, the consumption of basic commodities has not been reduced. Another important fact is that in 2016, compared to 2015, there was an increase in the quantities undergoing management, with a simultaneous decrease in those disposed in licensed and illegal landfills.

Table 6.2.
Quantitative data and indicators for Municipal Solid Waste Production

	2011	2015	2016
MSW Production (tn)	5,569,000	5,277,209.28	5,362,628.43
MSW Production (tn/inhabitant)	0.5149	0.4879	0.4958
MSW Production (tn/ million euro GDP)	26.90	29.93	30.78

Table 6.3.
Quantitative data for Municipal Solid Waste management

	2011	2015	2016
MSW quantities (tn) undergone Disposal Operations (D)	4,565,000	4,425,935.4	4,415,701.21
MSW quantities (tn) undergone Recovery Operations (R)	1,004,000	851,273.83	946,927.22

Table 6.4.
Performance – Target achievement for MSW

	Current Targets	Performance 2016	EU Performance 2016
MSW disposal in landfills		**82.3%** Licensed Landfills - illegal landfills	**24%**
MSW Recycling	50% to 2020	**13.8%**	**29%**
Bio-waste	---	**3.4%**	**16%**

1.1 Fines imposed

The decision of the EU Court of December 2, 2014 against Greece (Article 260 TFEU) for the uncontrolled disposal of waste has obliged the country to pay a flat-rate amount of 10,000,000 euro, as well as a six-month penalty payment on the basis of the initial amount of 14,520,000 euro, from which it would be deducted:
⇢ an amount of 40,000 euro per uncontrolled waste disposal site which either ceased to operate or has been restored as of May 13, 2014, and
⇢ an amount of 80,000 euro for those of the above sites that would have both cease to operate and have been restored by the same date.

According to the Commission's latest assessment for the 6th semester, there were still 80 infringements (from an initial total of 363), namely:
⇢ 16 active and not-restored illegal landfills (34 infringements)
⇢ 28 not-restored illegal landfills
⇢ 20 restored illegal landfills for which it has not been proven that they have ceased to operate.

It should be noted that cases of inactive illegal landfills have not been accepted, although relevant evidence has been sent, as the EU calls for further guarantees for the lawful management of MSW, such as legally binding procedures.

2. Non-hazardous industrial waste

Non hazardous industrial waste and waste from other activities include all industrial and associated waste arising mainly from the manufacturing and power generation sectors, as well as other waste activities, in particular waste from health services, public services, etc. The comparison between the quantitative data for the year 2014 resulting from the Annual Waste Producer Reports and the quantitative data of the National Waste Management Plan (2011) for non-hazardous industrial waste is presented in Tables 6.5. and 6.6.

The non-hazardous waste recovery network includes waste treatment and recycling companies for the production of alternative raw materials and fuels, as well as companies using secondary materials (cement, iron and steel, metallurgy, ceramics industries etc.), which total in 150 facilities. The quantitative data show that in 2014 there was an increase of ~ 3% to the non-hazardous industrial waste disposal operations. With regard to recovery operations, out of a total of 807,947.06 tn of non-hazardous waste in 2014, 4,944.17 tn, corresponding to 0.61%, were sent to energy recovery, while the remaining 803,002.89 tn (percentage 99.39%) were sent for recycling.

Table 6.5.
Quantitative data and indicators for non-hazardous industrial waste production

	2011	2014
Non-hazardous industrial waste production (tn)	17,186,000	17,663,438
Non-hazardous industrial waste production (tn/ inhabitant)	1.589	1.633
Non-hazardous industrial waste production (tn/ million euro GDP)	83.01	98.87

Table 6.6.
Quantitative data for non-hazardous industrial waste management

	2011	2014
Quantities of non-hazardous industrial waste (tn) undergone Disposal Operations (D)	13,835,000	13,674,801.39
Quantities of non-hazardous industrial waste (tn) undergone Recovery Operations (R)	1,313,000	807,947.06

3. Hazardous Waste

The following table presents the 2014 quantitative data for the production and management of hazardous waste, which have been collected from the National Hazardous Waste Management Plan.

The comparison between the quantitative data for the year 2014 resulting from the Annual Waste Producer Reports and the quantitative data of the National Hazardous Waste Management Plan (2011) for hazardous industrial waste is presented in Tables 6.8. & 6.9.

Table 6.7.
Current hazardous waste production (years 2011 - 2014)
(Source: National Hazardous Waste Management Plan)

Waste category	2011	2012	2013	2014
	(tn)			
I - INDUSTRIAL HW & HW from Other Activities	**272,427**	**231,296**	**222,902**	**218,789**
1/ Industrial HW (excluding waste falling within the waste categories listed below)	136,236	112,885	107,066	104,342
2/ HW from public utilities, public service, etc.	16,400	13,590	12,888	12,560
3/ HW from health services plants	16,299	16,500	16,650	16,800
4/ Waste oils	55,560	40,050	37,113	35,244
5/ Vehicle and industrial accumulator waste	46,900	47,150	47,950	48,600
6/ HW from depollution of end-of-life vehicles	1,032	1,121	1,235	1,243
II - HAZARDOUS URBAN WASTE	**6,500**	**6,512**	**6,527**	**6,539**
1/ Electrical and Electronic Equipment Hazardous Waste	1,137	1,183	1,132	1,139
2/ Portable batteries and accumulators waste	1,110	1,000	960	960
3/ Other	4,253	4,329	4,435	4,440
III - HW from EXCAVATION, CONSTRUCTION AND DEMOLITION (*)	**598**	**820**	**890**	**721**
1/ Waste containing asbestos	598	820	890	721

The quantitative data presented above shows that in 2014 there was an increase of 6.45% to the hazardous waste disposal operations. This fact is in agreement with both the reduction of GDP and the usually increased costs of recovery operations for waste producers. With regard to recovery operations, out of a total of 77,057.26 tn of hazardous waste in 2014, 21.84 tn, corresponding to 0.03%, were sent to energy recovery, while the remaining 77,035.42 tn (percentage 99.7%) were sent for recycling. The existing collection and transportation network for hazardous waste (of about 30 companies) covers the country's needs for both domestic and cross-border transportation. The existing disposal network includes two private Hazardous Waste Disposal Sites, the Industrial Waste Disposal Landfill of PPC S.A. at Kardia, Ptolemais, and of Aluminum of Greece S.A. at Viotia. The existing hazardous waste management network includes a significant number of companies engaged in recycling - recovery of waste, deriving mainly from alternative management waste streams.

3.1 Fines imposed

With the Decision of the EU Court of September 7, 2016, a penalty payment was imposed on Greece for failing to comply with a previous Decision (Decision of September 10, 2009, Commission vs. Greece, C-286/08) because Greece:
⇢ had not yet adopted a specific plan for the management of hazardous waste
⇢ had not created an integrated and appropriate network of hazardous waste disposal facilities
⇢ had not implemented the management of «historical waste» in accordance with the provisions of Union law.

Amounts paid:

Flat-rate amount
10,000,000 euro (paid in December 2016)

1st semester (7 September 2016 - 7 March 2017)
4,558,914.36 euro (paid in late August 2017)

2nd semester (7 March 2017 - 7 September 2017)
4,357,270.26 euro (to be paid by early January 2018)

Total amount paid so far: 18.916 million €

Table 6.8.
Quantitative data and indicators for hazardous waste production

	2011	2014
Hazardous industrial waste production (tn)	279,525	219,286
Hazardous industrial waste production (tn/ inhabitant)	0.0258	0.0203
Hazardous industrial waste production (tn/ million euro GDP)	1.350	1.227

Table 6.9.
Quantitative data for hazardous waste management

	2011	2014
Quantities of hazardous industrial waste (tn) undergone Disposal Operations (D)	37,500	38,661.59
Quantities of hazardous industrial waste (tn) undergone Recovery Operations (R)	101,600	77,057.26

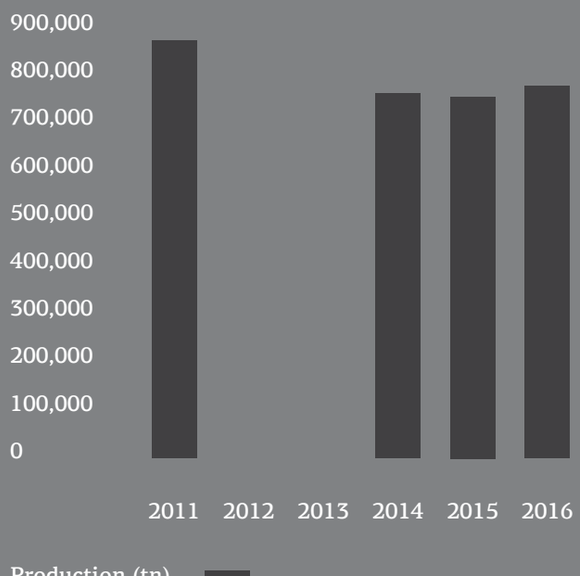
4. Packaging And Packaging Waste

To this date, 3 collective and 1 individual alternative management schemes have been approved for packaging and packaging waste. The quantitative data and the indicators for packaging and packaging waste production are presented per packaging category for the years 2014-2016:

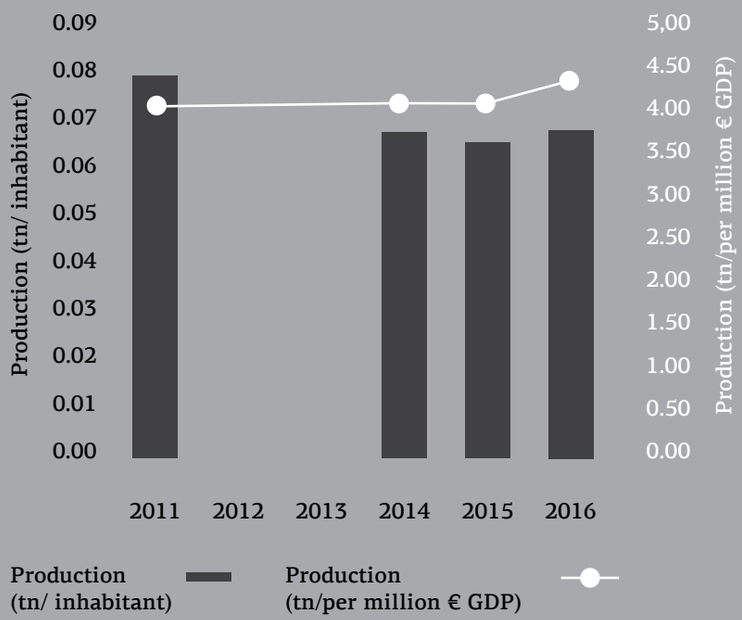
Table 6.10.
Quantitative data and indicators for packaging waste production

Material		2014	2015	2016
Glass	Production (tn)	**98,000**	**88,800**	**90,500**
	Production (tn/ inhabitant)	0.0091	0.0082	0.0084
	Production (tn/ million euro GDP)	0.54854	0.50365	0.51952
Plastic	Production (tn)	**184,400**	**183,800**	**186,600**
	Production (tn/ inhabitant)	0.0170	0.0170	0.0173
	Production (tn/ million euro GDP)	1.03215	1.04247	1.07119
Paper & Paperboard	Production (tn)	**330,700**	**326,100**	**334,300**
	Production (tn/ inhabitant)	0.0306	0.0301	0.0309
	Production (tn/ million euro GDP)	1.851043	1.849562	1.919070
Metals	Production (tn)	**88,800**	**87,800**	**84,600**
	Production (tn/ inhabitant)	0.0082	0.0081	0.0078
	Production (tn/ million euro GDP)	0.497045	0.497981	0.485651
Wood	Production (tn)	**45,600**	**50,200**	**50,800**
	Production (tn/ inhabitant)	0.0042	0.0046	0.0047
	Production (tn/ million euro GDP)	0.255239	0.284723	0.291621
Other	Production (tn)	**5,400**	**5,300**	**5,500**
	Production (tn/ inhabitant)	0.0005	0.0005	0.0005
	Production (tn/ million euro GDP)	0.030226	0.030060	0.031573
TOTAL	Production (tn)	**747,900**	**742,000**	**752,300**
	Production (tn/ inhabitant)	0.0691	0.0686	0.0696
	Production (tn/ million euro GDP)	4.18626	4.20845	4.31862

Graph 6.1.
Packaging waste production.
According to the National Waste Management Plan, the production of packaging waste for the year 2011 amounted to 866,000 tn



Graph 6.2.
Indicators for packaging waste production



As indicated by the analysis of the quantitative data presented above, although the production of packaging waste is decreasing compared to 2011, the indicator of production/per million euro GDP has remained almost unchanged over the years, a fact that demonstrates the correlation between the packaging waste production and the country's economic figures.

Table 6.11.
Performance – Target achievement for packaging and packaging waste

		Current Targets	Performance 2016	EU Performance 2016
Recovery (recycling, other material recovery, energy recovery)		60%	**67.2%**	**79%**
Recycling		55%	**66.1%**	**65.8%**
Minimum recycling target per material	wood	15%	**21.9%**	---
	paper	60%	**98.5%**	---
	plastic	22,5%	**38.2%**	---
	aluminum	50%	**61.7%**	---
	metal	50%	**61.7%**	---
	glass	50%	**36.9%** *	---

* The failure to achieve the set EU target is noted with orange color

5. Waste Electrical And Electronic Equipment

The recycling of Waste Electrical and Electronic Equipment (WEEE) is of particular importance both for the recovery of the materials from which the appliances are composed of and for the management of hazardous materials that may be present in many of them. Since 2016, the minimum collection rate to be achieved on an annual basis has been set at 45%, and calculated on the basis of the total weight of WEEE collected in a given year. It is expressed as a percentage of the average annual weight of electrical and electronic equipment (EEE) placed on the market over the previous three years.

For waste electrical and electronic equipment, the indicators that are important to be mentioned are:
⇢ the quantities of EEE placed on the market (PoM)
⇢ the collected quantities of WEEE
⇢ the managed quantities of WEEE.

The total quantities of EEE placed on the market according to the data of the 2 Collective Alternative Management Schemes operating are 123,552.87 tn, which correspond to 63,932,069 invoiced pieces of all categories of EEE.

The total quantity of WEEE collected for the year 2016 by the 2 Alternative Management Schemes corresponds, at a rate of 47%, to the average annual weight of EEE placed on the market during the years 2013, 2014, 2015, leading to the result that the national target (45%) has been achieved in the year 2016.

Table 6.12.
Quantitative data and indicators for EEE placed on the market

	Invoiced Quantities (tn)	Invoiced Pieces
PoM	123,552.87	63,932.069
PoM/ inhabitant	0.0114	5.9107
PoM/ million euro GDP	0.71	367

Table 6.13.
Performance – Target achievement for Waste Electrical and Electronic Equipment
Target completion period 15/8/2015 - 14/8/2018

Category	Targets of preparation targets for recycling and reuse	Targets for recovery	Performance 2016*	EU Performance 2015 (Recovery)
1/ Large household appliances	80%	85%	**91.6%**	**89.1%**
2/ Small household appliances	55%	75%	**89.2%**	**87.8%**
3/ IT and telecommunications equipment	70%	80%	**96.50%**	**86.5%**
4/ Consumer goods	70%	80%	**94.30%**	**90.9%**
5/ Lighting equipment	55%	75%	**80.10%**	**88.0%**
5a/ Gas discharge lamps	80%	---	**93.10%**	**90.5%**
6/ Electrical and electronic tools	55%	75%	**98.90%**	**85.8%**
7/ Toys, leisure and sports equipment	55%	75%	**73.30%***	**92.3%**
8/ Medical devices	55%	75%	**100%**	**88.4%**
9/ Monitoring and control instrument	55%	75%	**89.80%**	**89.6%**
10/ Automatic dispensers	80%	85%	**100%**	**86.9%**

* It is noted that recovery coincides with recycling and reuse
* The failure to achieve the set EU target is noted with orange color

6. Waste Batteries And Accumulators

Under Greek law, batteries and accumulators are subjected to alternative management and therefore all companies that produce or import batteries and accumulators on the Greek market are obliged to organize a scheme for the alternative management of waste batteries and accumulators. From this obligation the producers who place on the market exclusively batteries or accumulators incorporated into electrical and electronic devices or vehicles are exempt, only if they participate in the respective WEEE or End-Of Life Vehicles Schemes, covering the associated costs of managing such batteries and accumulators.

The produced amounts of waste batteries and accumulators according to the National Waste Management Plan in 2011 were:

⇢ **1,100 tn**
of waste portable batteries and accumulators

⇢ **47,000 tn**
of waste vehicle and industrial accumulators

Moreover, the quantitative production data for the years 2011, 2014-2016 are presented in the following table.

Table 6.14.
Quantitative data and indicators for waste batteries and accumulators

	2011	2014	2015	2016
Portable batteries and accumulators	1,100	608	567	632
Vehicle and industrial accumulators	47,000	25,526	33,319	36,498
Total batteries and accumulators	**48,100**	**26,134**	**33,886**	**37,130**
Production of B. & A. (tn/ inhabitant)	0.0044	0.0024	0.0031	0.0034
Production of B. & A. (tn/ million euro GDP)	0.232	0.146	0.192	0.213

Table 6.15.
Performance – Target achievement for waste batteries and accumulators

	Current Targets	Performance 2016	EU Performance 2016
Portable batteries and accumulators	**Collection rate of at least 45%**	**38.9%**	**41%**
Vehicle and industrial batteries and accumulators	**Collection of the total quantity of waste**	**76.43%** (Lead-acid accumulators) **194.11% *** (Nickel-cadmium, accumulators)	**No EU-level data available**

*** The quantity collected is greater than the quantity of products placed on the market, possibly due to the small amount of collection during the previous years, and the long life of the Ni-Cd accumulators**
*** The failure to achieve the set EU target is noted with orange color**

Recycling facilities should achieve the following minimum recycling efficiencies:

⇢ Recycling of the 65% by average weight of lead-acid batteries and accumulators, including the recycling of lead content to the highest possible degree technically feasible, without excessive costs. The average recycling efficiency of Pb-acid accumulator recycling plants for the year 2016 amounted to **76.2%**

⇢ Recycling of the 75% by average weight of nickel cadmium batteries and accumulators, including the recycling of cadmium content to the highest possible degree technically feasible without excessive costs and - recycling of the 50% by average weight of other waste batteries and accumulators. The Greek market does not currently have a recycling infrastructure for their recycling.

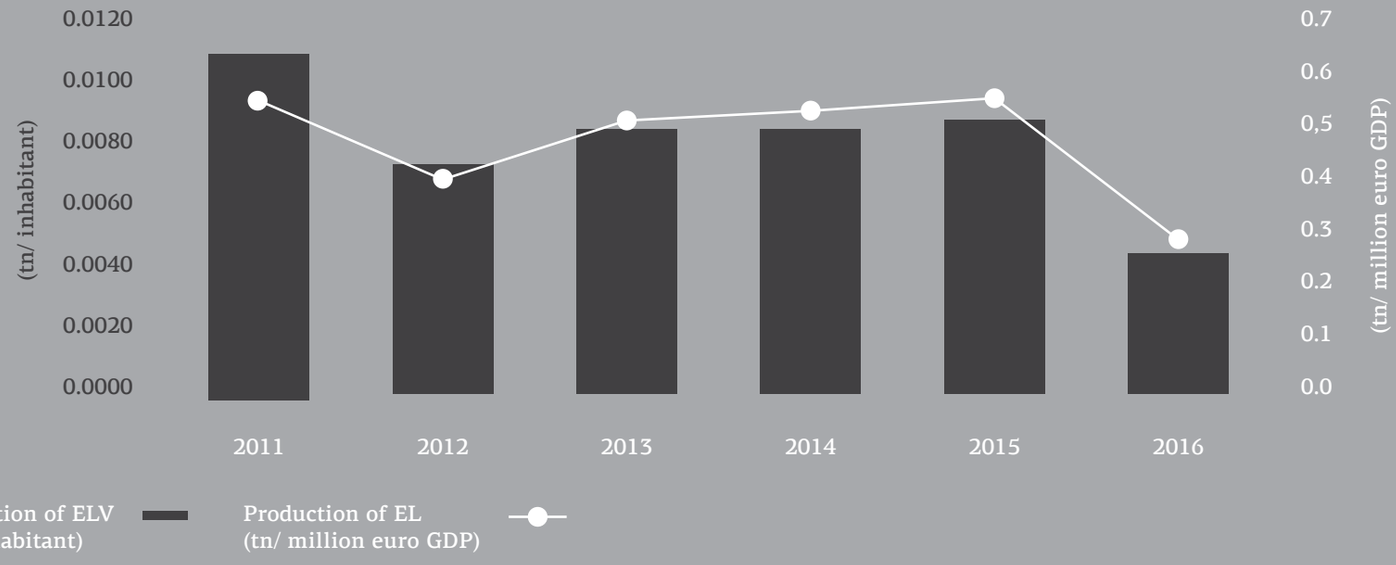
7. End-Of Life Vehicles

The management of end-of-life vehicles is regulated by Presidential Decree No 116/2004, which was issued in line with Directive 2000/53/ EC of the Council of the European Communities. Pursuant to Article 11 of Presidential Decree No 116/2004, from 1 January 2015 onwards the target for the recovery and re-use of products resulting from the management of end-of-life vehicles is 95% by weight, and the re-use and recycling should be at least 85% by average weight per vehicle per year.

Table 6.16.
Quantitative data and indicators for end-of-life vehicles waste

	2011	2012	2013	2014	2015	2016
Production of ELV (tn)	117,189	81,495	89,844	90,406	93,645	46,572
Production of ELV (tn/ inhabitant)	0.0108	0.0075	0,0083	0.0084	0.0087	0.0043
Production of EL (tn/ million euro GDP)	0.56605	0.42622	0.49733	0.50603	0.53113	0.26735

Graph 6.3.
Indicators for the production of end-of-life vehicles waste



At this point, it should be noted that the significant variations observed for end-of-life vehicles waste compared to the other waste streams examined in this report are largely due to the subsided withdrawal measure in force, during these years.

Table 6.17.
Performance – Target achievement for end-of-life vehicles

	Current Targets	Performance 2016	EU Performance 2015*
Recovery and reuse of products resulting from the management of end-of-life vehicles	95%	**107.37%**	**94.1%**
Reuse and recycling	85%	**94.68%**	**88.4%**

*** The rate includes quantities of products resulting from the management of end-of-life vehicles which were stored from previous years within the end-of-life vehicles plants**

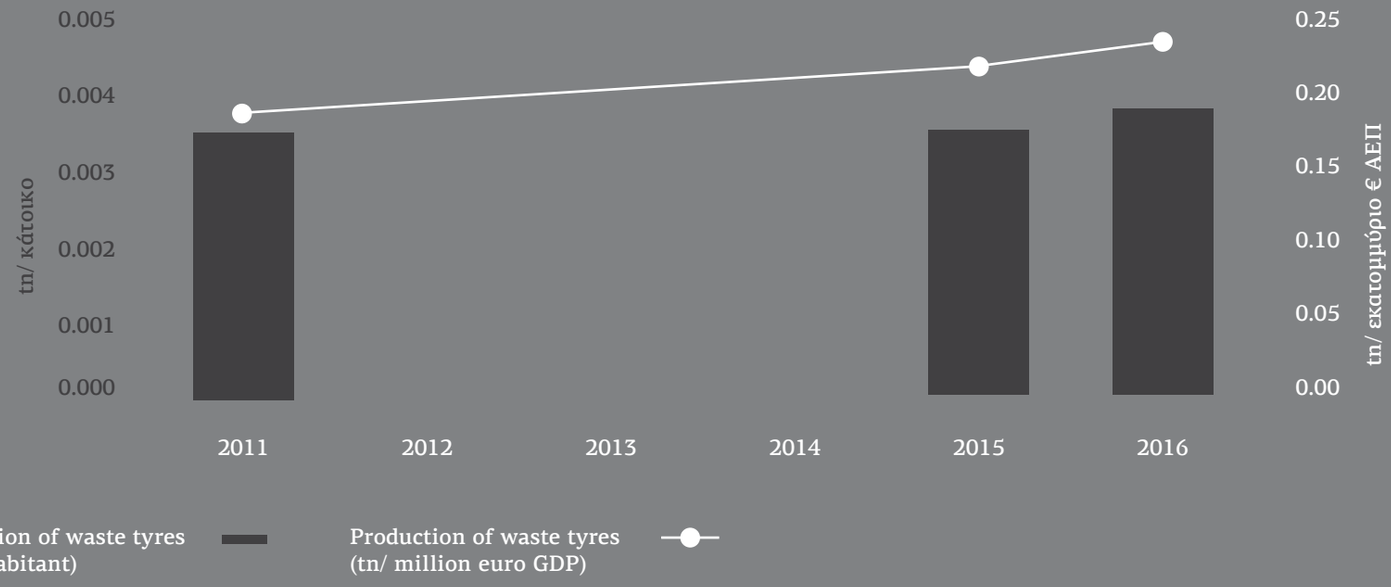
8. Waste Tires

All vehicle tyres in Greece are imported. All tire importers as well as vehicle importers, who are obliged to participate in the Scheme under the Presidential Decree No 109/04, sign a cooperation contract with ECOELASTIKA for tyres fitted as spare parts on vehicles. The number of the liable tyre importers contracted with ECOELASTIKA on 31.12.2016 amounted to 138 and the corresponding number of the vehicle importers amounted to 67. As far as waste tyres are concerned, the quantitative data and the indicators for their waste production are presented in the following Table and Graph.

Table 6.18.
Quantitative data and indicators for waste tyres

	2011	2015	2016
Production of waste tyres (tn)	38,000	37,440	40,999
Production of waste tyres (tn/ inhabitant)	0.00351	0.00346	0.00379
Production of waste tyres (tn/ million euro GDP)	0.184	0.212	0.235

Graph 6.4.
Indicators for the Production of waste tyres



There are no EU-set targets for used tyres, but only the targets set by national legislation.

Table 6.19.
Performance – Target achievement for waste tyres

	Current Targets	Performance 2016	EU Performance 2013*
Recovery	65%	**90%**	**98%**
Recycling	10%	**53%**	**46%**

*The EU performance refers to 2013 data
(Source: European Tyre & Rubber Manufacturers' Association)

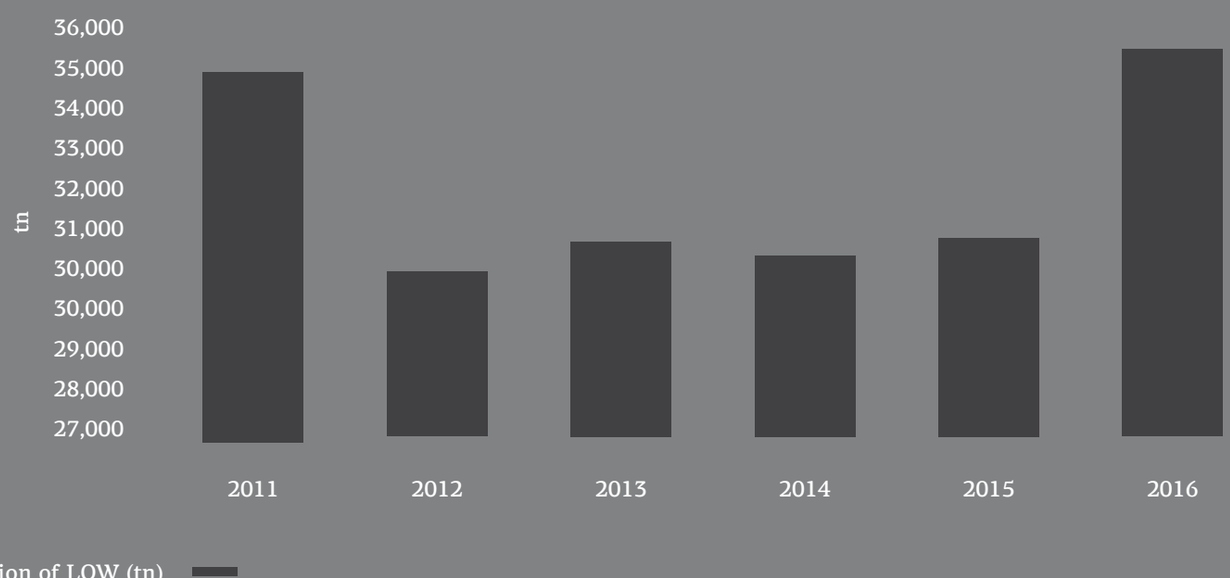
9. Waste Oils

Waste oils include used engine and gearbox lubricants, hydraulic oils, cutting oils, insulating oils, and mixtures/ emulsions with water or other organic solvents.

Table 6.20.
Quantitative data and indicators for lubricating oil waste

	2011	2012	2013	2014	2015	2016
Production of LOW (tn)	34,948	29,905	30,611	30,235	30,707	35,100
Production of LOW (tn/ inhabitant)	0.00323	0.00276	0.00283	0.00280	0.00284	0.00325
Production of LOW (tn/ million euro GDP)	0.169	0.156	0.169	0.169	0.174	0.201

Graph 6.5.
Quantities of lubricating oil waste generated



From the above data, it is noteworthy that while from 2011 to 2015 there was a significant decrease in lubricating oil waste generated, of the order of ~ 4.000 tn, in 2016 the quantities generated returned to the level of the year 2011.

Table 6.21.
Performance – Target achievement for lubricating oil waste

	Current Targets	Performance 2016
Collection	70%	**71.2%**
Regeneration	80% of the quantities collected	**99.7%**

10. Excavation Construction And Demolition Waste

According to the National Waste Management Plan, in 2011 the estimated quantities of Excavation Construction and Demolition Waste were 1,307,000 tn. For the years 2014-2016, the quantities of ECDW traded by Collective Alternative Management Schemes from the Hellenic Recycling Agency data, as well as the indicators are presented below.

It is clear that the abovementioned quantities of ECDW are part of the quantities generated, which cannot be determined with certainty in their entirety.

Table 6.22.
Quantitative data and indicators for ECDW

	2011	2014	2015	2016
Production of ECDW (tn)	1,307,000	176,112	176,783	525,276
Production of ECDW (tn/ inhabitant)	0.1208	0.0163	0.0163	0.0486
Production of ECDW (tn/ million euro GDP)	6.313	0.986	1.003	3.015

11. Mining Waste

Mining waste must be managed:
a/ without endangering human health,
b/ without using processes or methods which could harm the environment, and in particular without risk to water, air, soil and fauna and flora,
c/ without causing a nuisance through noise or odors and without adversely affecting the landscape or places of special interest.

For mining waste, the data presented below relates to the quantities processed outside their production facility on the basis of the data of the Annual Report of Waste Producers for 2014.

Table 6.23.
Quantitative data for mining waste management

	2014		
	Nonhazardous waste	Hazardous Waste	Total
Quantities of mining waste (tn) undergone Disposal Operations (D)	904,547.23	7,413.49	**911,960.72**
Quantities of mining waste (tn) undergone Recovery Operations (R)	8,928.00	200.04	**9,128.04**

12. Contaminated Soils

Two projects have been implemented concerning the investigation and assessment of contaminated sites:
1/ "Study for the investigation, evaluation and reclamation of uncontrolled contaminated sites/ facilities from industrial and hazardous waste in Greece", completed in 2009, with the contractor being the Department of Environmental Engineering of the Technical University of Crete.
2/ Following this, the project "Recording and initial risk assessment of contaminated sites from industrial and hazardous waste in the Region of Attica and in the following prefectures of Greece: Thessaloniki, Viotia, Euboea, Kozani, Achaia, Heraklion, Magnesia, Kavala and Halkidiki" which was implemented by the Contractor Consortium "ENVIROPLAN S.A. - EPEM S.A. - ENVECO S.A." and was completed in the year 2017.

In these projects a first assessment on contaminated sites, for operating facilities on one hand and on uncontrolled sites on the other, was carried out. The reading of the Technical Reports shows that further investigation is necessary for reasons such as the choice of pollutant parameters, the measurement of ecotoxicity only in uncontrolled sites, the selection of reference samples, the limited sampling. Consequently, the results of the project, with regard to the rating of the sites examined, are indicative.

It should be noted that since these projects were only a first assessment, further investigation is needed in order to finally conclude on the hazardousness of contaminated sites.

It should also be noted that the only officially contaminated sites in the country are the Illegal Disposal Areas which through the coordinated actions of the Ministry of Environment and Energy have been reduced from about 2,500 to 80. Their full reclamation is estimated to be completed, according to planning, by the end of 2019.

7

Horizontal Environmental Issues

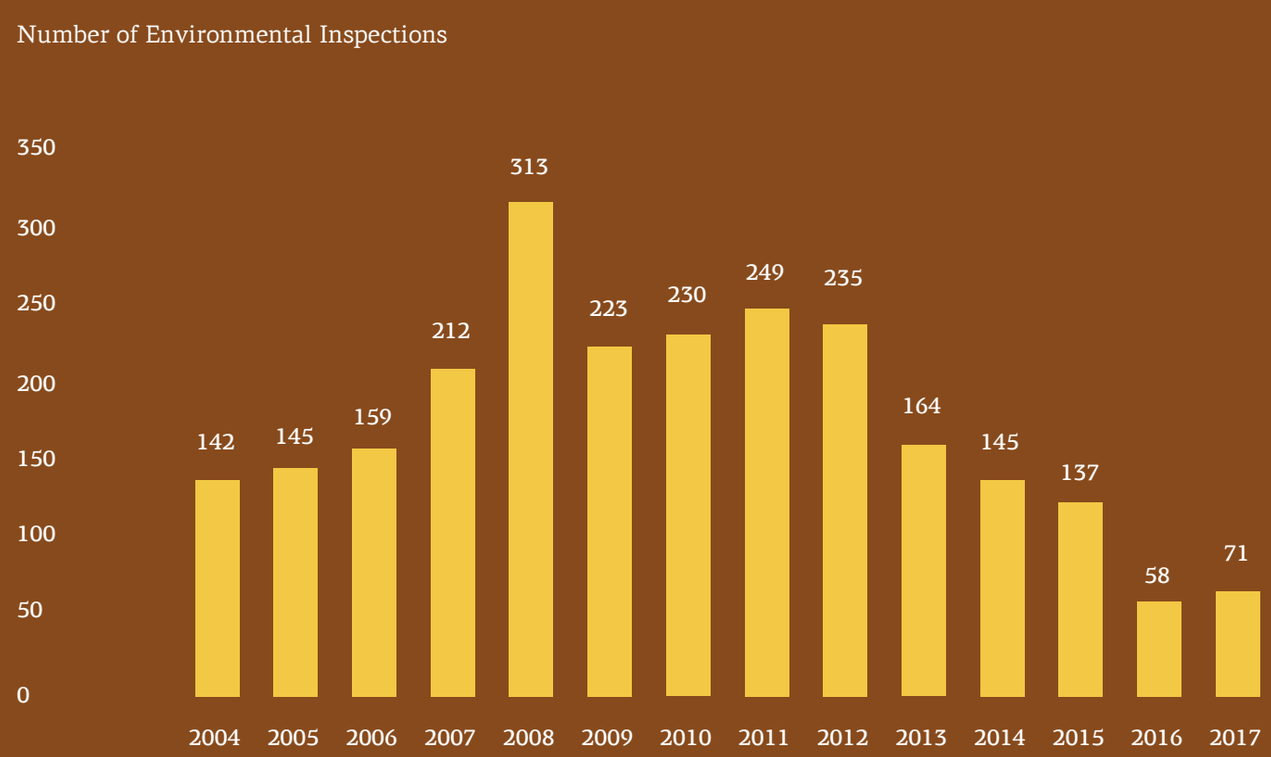
1. Environmental inspections

Due to the inadequate staffing in Environmental Inspectorate of the Ministry of Environment and Energy, in recent years there has been a continuous reduction of environmental audits carried out by Environmental Inspectors.

The graph 7.1. illustrates the total amount of inspections of Northern and Southern Greece Environmental Inspectors from 2011 to 2017, where in recent years there has been a significant reduction in audits due to the reduced number of inspectors and, hence, the accumulation of a large number of cases which require a substantial time period to be completed.

80% of the 2017 inspections refers to activities of the public sector (including waste management and sewage treatment plants), whereas the rest 20% referred to activities of the private sector. In addition to the limited number of audits, the gradual under-staffing of the EnvironmentalInspectorate in recent years has a negative impact on the total number of administrative acts that are required for the closure of the infringement cases (audit reports, infringement documents and imposition of fines) as illustrated in Graph 7.2.

Graph 7.1.
Number of environmental inspections carried out by the Environmental Inspectors, 2004-2017



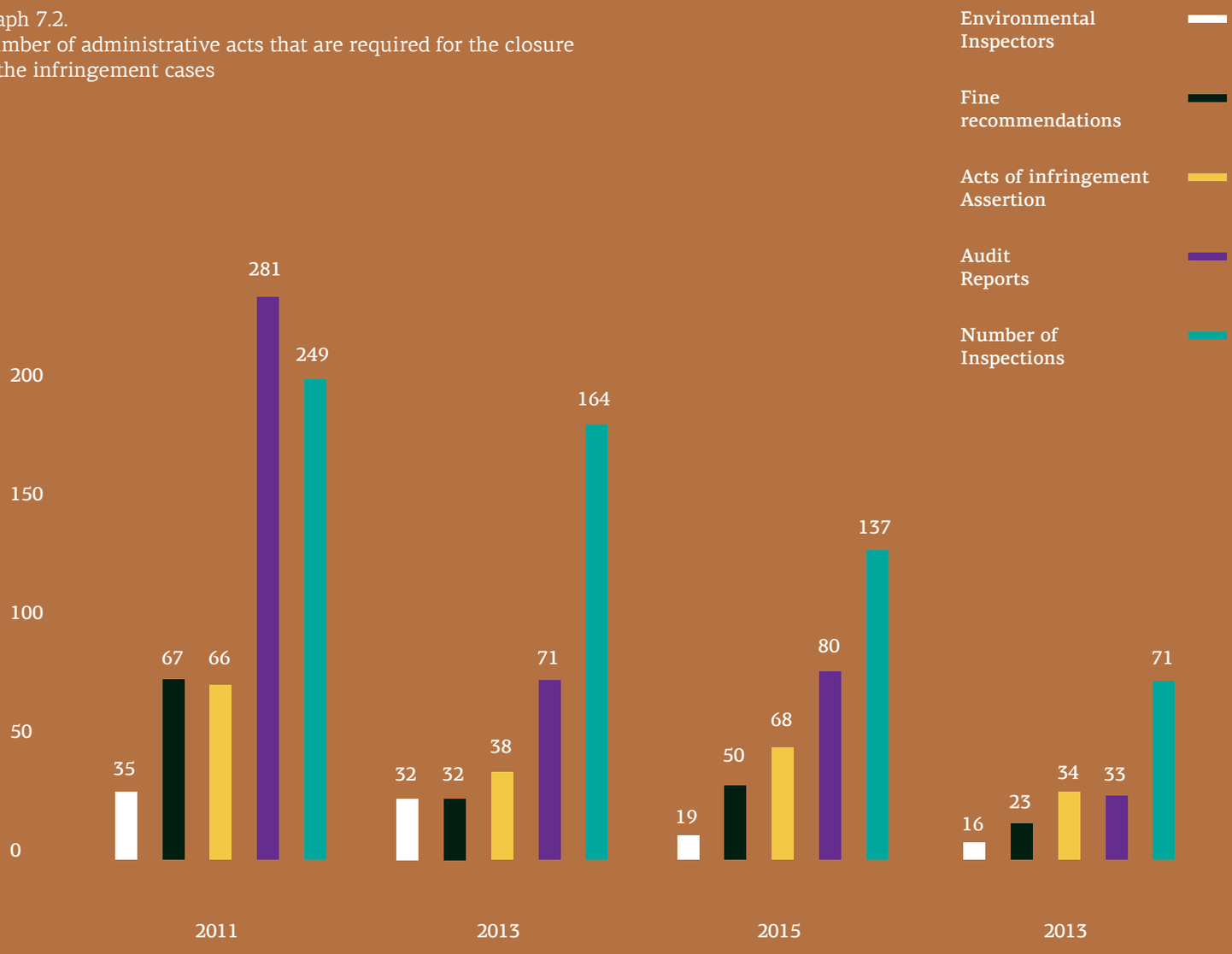
Most of the inspection (72%) of 2017 were non-routine (29% of them upon ministerial order, 20% upon complaint, 10% on the order of the public prosecutor or General Inspector of Public Administration, etc.). Only 28% of the inspections were routine inspections according to the program of the Inspectorate, a significant increase compared to just 13% of the previous year.

In 2017, the Environmental Inspectorate submitted 23 decisions imposing a fine totaling 672,250 euros to the Minister of Environment and Energy. The largest proportion of the fines submitted (70%) ranges from 700 to 25,500 euros.

It should be noted that in the country, multiple environmental inspections are carried out mainly by the services of the Regions (Directorate of Environment and Spatial Planning, etc.), but also by other services such as port authorities, Decentralized Administration, Forestry Offices, etc. Overall, the number of environmental audits is estimated at over 1000 but there are no accurate statistics. There is an ongoing work for the construction of a relevant database that will allow the recording of the highest percentage of environmental audits.

Finally, by the end of 2017, there were 72 cases of Directive 2004/35 (environmental liability directive). Furthermore, from 2011 to 2017 the remedial measures in the context of the liability directive have been completed for another 26 cases.

Graph 7.2.
Number of administrative acts that are required for the closure of the infringement cases



2. Environmental Impact Assessments

The environmental licensing procedure has been radically reviewed by the law 4014/2011 that became operational at the beginning of 2012 with the enactment of the MD 1958/2012 on the classification of projects (it has been modified several times since then with the aim of further rationalize the classification of projects). The main objectives of Law 4014/2011 are to simplify, abbreviate and rationalize the Environmental Impact Assessment (EIA) procedures, while simultaneously guaranteeing a high level of environmental protection.

The previous legal regime required an EIA report for significantly more projects and activities compared to those required by the Directive 2011/92. In addition, the previous law required a compulsory preliminary environmental assessment report for a large number of projects and activities. Thus, between 2005 and 2009, the number of environmental licensing cases-files in Greece exceeded 21,500 annually, of which approximately 13,300 were evaluated by the Regions, about 7,500 by the Decentralized Administrations and about 650 by the Ministry for the Environment. These numbers were very high compared to all other EU countries in absolute numbers (France that presents the highest number requires less than 4,000 EIAs per year) but even more so in terms of numbers per inhabitants or per GDP.

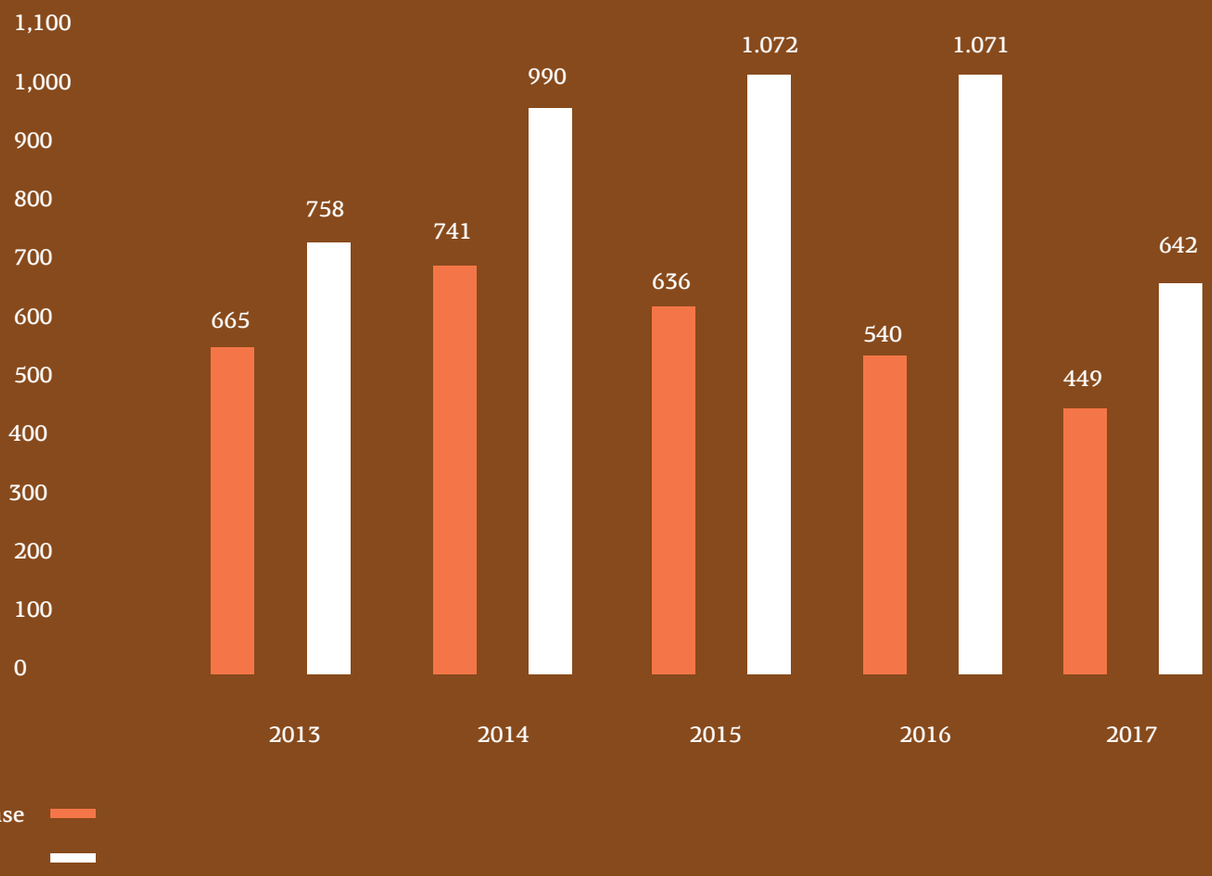
At the same time, the average time for completion of the total procedure for environmental licensing in Greece exceeded 20 months for a A1 project whereas the respective required time in 8 EU member states was 9.8 months.

The new legal framework was gradually completed from 2012 to 2014 with the issuances of over 25 secondary legal acts. Some minor additions and amendments were carried out later on. The main element of the current system is the reduction of the number of projects for which environmental licensing is required and a reduction of the number of projects for which an EIA is required. The projects are classified in 12 thematic groups and in 2 main categories, i.e. A and B. Category A projects refer to larger projects with wider environmental impacts and require an EIA whereas category B projects have only local environmental impacts and get predetermined environmental terms (mainly from the regional authority or annexed to the operation license). Category A is divided into subcategory A1 (the largest projects with more severe impacts) where the EIA is submitted to the Ministry of Environment and Energy and subcategory A2 (projects with less severe impacts) where the EIA is submitted to the competent Decentralized Authority.

Furthermore, the environmental permit has incorporated a number of other licenses and permits that were required under the previous legal regime. In terms of the quality of the EIAs, the new legal framework provides for specifications of the content and the accompanying documents for all types and categories of EIA reports depending on the type of project and for the complete standardization of the procedures for the evaluation of the EIA report. The creation of the Digital Environmental Registry (DER) for the online licensing of projects is also foreseen and expected to become operational by the summer of 2018.

Finally, to improve transparency, all environmental licenses are required to be uploaded to a dedicated website (http://aepo.ypeka.gr). According to the statistical data provided through this website, since 2015 there is a gradual decrease of the EIAs carried out every year (1.091 EIAs in 2017, 35% less compared to 2015) reflecting both the state of the economy and the reduction of the projects that require an EIA report via the amendments of the classification MD 1958/2012.

Graph 7.3.
Environmental licenses (new and renewals) per year
(Source: http://aepo.ypeka.gr)



About 60% of them refer to renewals and amendments of existing licenses and the remaining 40% refers to new projects. 85% of the total number of projects that are subject to an EIA is classified as an A2 subcategory and 15% as A1. The industrial projects represent the highest percentage among the 12 thematic groups (about 20%) followed by renewables (about 13.5%) and mining activities (about 12%).

3. Environmental certifications

As regards EMAS (Eco-Management and Audit Scheme), at the end of 2017 there were 36 certified organizations with 1333 sites (source: National Report to the European Commission). It should be noted that the EMAS restarted its operation in November 2016 after a period of more than 3 years.) Concerning ecolabel, its general statistics at the end of 2017 were as follows:

⇢ 12 companies / producers of interior and exterior paint and varnish with 278 products.

⇢ 2 companies / producers of detergents / detergents with 13 products.

⇢ 2 cotton ginning companies concerning integrated management AGRO-2 ginned cotton fiber, wrapped in packages of 210-240 Kg, harvested 2017 with around 7000 tons for export.

⇢ 12 hotels, including 3 hotels that are not located in Greece

Conclusions

The state of the environment varies depending on the specific sector examined and its monitoring is a necessary step for its continuous improvement. In many indices but not all, there is an improvement over time. This is due to the inherent characteristics of the country (geomorphology, density and population distribution), but also to the implemented policy measures, many of which are also EU policies.

The last 10 years, the economic crisis has also played an important role in improving environmental performance, but the observed improvements cannot be attributed exclusively to it. The Achilles' heel remains, in some cases, the inadequate implementation of EU or national legislation, a problem that is not purely environmental but has important consequences to the overall protection and conservation of the environment.

More specifically, **the state of nature and biodiversity** in Greece is rather satisfactory compared to the rest of the EU, and the country has made significant progress. In recent years, there has been a considerable reduction (35%) of the ecological footprint (Greece has been placed on one of the best positions in Europe) and a respective downward trend in the carbon footprint of agriculture, livestock, forestry and fishing. Terrestrial ecosystems appear to be in better status than marine ecosystems, mainly because of overfishing and illegal fishing practices. The recent significant increase of the marine protected areas that have been included in the NATURA 2000 network is a positive advancement. The elimination of threats to forest ecosystems, which receive the majority of pressures from various activities (mining, industry, agriculture and tourism), should be among Greece's priorities. The progress in establishing the forest maps has been particularly positive, which on its completion will have contributed decisively to the ability to monitor and protect the Greek forests.

Furthermore, in the transport sector, the expansion of the road network should be reduced in order to curb the landscape and natural ecosystems fragmentation. It should be noted that there is considerable scope for further improvements, via the introduction of the Presidential Decrees for the protection of NATURA 2000 sites, which regulate land use, and of specific management measures that today exist in very few areas. Undertaking an IP LIFE program in 2018 ensures that this problem will be resolved within the next five years. The new Law No 4519/2018 that has recently been adopted aims to ensure that all protected areas have a responsible management body. It should be noted, however, that in addition to the institutional framework, the necessary resources are needed to ensure that the operational capacity of the management bodies is strengthened.

The **air quality** in Greece has improved the last decades. The reduction of national emissions of the main pollutants (NO_x, SO_2, $PM_{2,5}$, NH_3) is significant, mainly due to the cleaner electricity production (decrease of lignite power plants in the overall energy mix, decrease of their emissions due to secondary abatement measures, energy efficiency, RES, cleaner motors for vehicles etc.). The national reduction targets of the NEC Directive for 2020, compared to 2005, have been exceeded for the majority of pollutants as early as in 2016.

As regards the urban air pollution, the evolution of measured concentrations of air pollutants over time shows that there is a downward trend or stabilization tendency, depending on the pollutant. This progress can be attributed to the reduction of pollutant emissions due to measures adopted in the previous decades which mainly concerned the technological upgrading of the passenger car fleet, the mandatory introduction of exhaust emission inspection and certification, the emission control measures from various sources, the use of fuels with higher quality standards/ specifications, the expansion of metro lines and the introduction of tram in the public transport, the facilitation of circulation of public transports, the penetration of the natural gas in the domestic, industrial and tertiary sector and the completion of large road traffic projects. However, despite the improvement of the air quality, there are some exceedances of the air quality limit values of certain pollutants, mainly in Athens, as can be seen from the comparison of concentrations of measured pollutants with the applicable air quality limit or target values set out in the European Directives. Meeting European air quality standards should be a priority for forthcoming energy and other environmental policies, also by applying the relevant European legislation.

The main characteristics of the air pollution in Greece are summarized per pollutant as follows:

- There is a general decrease of concentrations of the primary air pollutants, such as CO, NO and SO_2
- O_3 remains almost stable whereas exceedances of limit values are frequent during the warm period of the year mainly in Athens
- PM_{10} exceed limit values (steady trend over time) in Athens and Thessaloniki, mainly at traffic monitoring stations, with biomass burning for central heating and Saharan dust transport being additional factors
- There is no exceedance of the limit values for $PM_{2,5}$, CO, and SO_2 in any monitoring station
- NO_2 exceedances of the limit value are monitored only in Athens in road traffic monitoring stations
- Benzene exceeds the limit value in the single monitoring station in downtown Athens
- Heavy metals such as As, Cd. Ni, Pb are below lowest assessment thresholds.

The renewal of car fleet, the upgrading of the energy efficiency of buildings, the further penetration of natural gas in central heating, new metro lines etc. are expected to result in further improvement.

In terms of **climate change mitigation**, in Greece, in 2016 (most recent data), the decrease of total greenhouse gas emissions (GHG) continued both due to the gradual transition of the energy system to a lower-emission system and due to the reduced activity because of the economic crisis. In particular, total GHG were reduced by 3,703 kt CO_2 compared to 2015 (the 4th largest decrease in the EU after the UK, Spain and Italy, based on EEA data). For the post-2020 period, an immediate and ambitious targeting by the state will help to achieve more pronounced

reductions through appropriate investments to transform the energy system. To this end, the national plan for energy and climate is currently under development for 2030 and beyond, until 2050. The target for reducing greenhouse gas emissions for 2030 are expected to be combined with targets for energy saving and renewable development sources of energy, within the framework of the European institutional and legal framework. It is noted that with the completion of some forthcoming projects such as the interconnection of the islands to the electrical grid of the mainland that will result in the decommissioning of the oil stations in the non-connected islands, in combination with the decrease of the lignite power plants, the reduction is expected to be even stronger. The new special fund for Greece that is created in the review of the ETS Directive (that corresponds to the revenues from 25 million allowances for the period 2021-2030) will greatly contribute to that direction.

With regard to **climate adaptation**, and especially climate change that cannot be avoided despite the mitigation measures, for the first time there is an officially adopted national plan, a National Commission has been set up involving the co-responsible Ministries, NGOs, economic stakeholders and the academia, and an institutional framework for the drawing-up of regional strategies has been completed. All regional plans are expected to be completed by 2019. However, it is stressed that the coordinated actions of the state will be effective when climate adaptation becomes a planning parameter of any future major country project. In addition, horizontal integration of climate change adaptation policies into sectoral development policies is recommended.

As regards the **management of water resources**, generally the quality of water in Greece is good. In terms of ecological status, coastal water systems are achieving predominantly high to good status, rivers good to moderate state, while lakes and transitional waters are predominantly in moderate and / or unknown condition, due to insufficient data and lack of observation station. In terms of chemical status, all categories of surface waters are predominantly in good condition and only a small percentage is unknown and / or inferior to good. Finally, as regards the ground waters, their vast majority is in good condition, both in qualitative (85%) and quantitative (80%) terms. The qualitative degradation of groundwater is mainly due to nitrate pollution as a result of intensive cultivation and excessive use of fertilizers and pesticides, as well as due to the salinisation (excess of chloride ions) due to overexploitation and over-discharge of coastal groundwater and aquifers (through a plethora of illegal drillings). Furthermore, the bathing water quality is excellent.

As regards **sewage treatment plants**, despite the inherent difficulties because of the geomorphology of the country (mountains, many small islands) and the seasonal population fluctuation in many tourist areas, there is steady progress with an increase in the proportion of the population served. However, it should be noted that there are no sewage treatment plant in settlements where there should be according to the EU acquis.

The main problem, apart from the two cases of sewage treatment plants in Thriassio Plain and East Attica for which the country has been paying fines to the EU, is the delayed implementation of the obligations arising from EU legislation, with the longest delay being observed in the Marine Strategy Directive.

As very positive developments, the 1st review of the Water River Basin Management Plans should be highlighted, the preparation of flood risk management plans as well as the JMD of the costing and pricing of water services.

The main challenges for the next 2-3 years is the completion of the remaining sewage treatment plants in category 3 agglomeration (smaller settlements), in Thriassio Plain (pending the connection of the inhabitants of the area with the already constructed network) and in East Attica, to ensure the good operation of many small sewage treatment plants scattered in small municipalities in the country (problems due to seasonal variation in waste water supply, over-dimensioning and bad design), the implementation of the new JMD of the costing and pricing of water services, recording and monitoring water drilling as well as the synchronization of the six-year cycle of implementation of the various Directives with the required deadlines of the EU acquis.

Waste management remains the most problematic sector in Greece. Greece, due its long-standing problem of illegal landfills and the lack of satisfactory (industrial) hazardous waste disposal infrastructure, is paying significant fines to the EU. Also, there are several cases of legal landfills, which operate with serious problems or do not operate at all, due to local reactions. The state has to deal with chronic social pathogens and implement the existing legal framework. Local stakeholders must address the issue of household solid waste (HSW) management with due responsibility and contribute to the adoption of a new culture of HSW management by local communities so as to accept technical, environmentally and economically sound solutions and socially equitable sharing of the cost.

It is well noted that, after decades of delays, the construction of the remaining necessary infrastructure facilities has now been streamlined and the funding of the rehabilitation of 50 illegal landfills which still operate or are closed but not rehabilitated, mainly in Peloponnese and in some islands, has been secured as well in order to complete the closure and rehabilitation of all illegal landfills by 2019. On the contrary, a comprehensive plan to address the problem of the hazardous waste management is still expected to be publicized.

At the same time, the recycling of household waste remains constant at about 14%, one of the lowest rates in the EU, with multiple problems in the functioning of the recycling structures. The disposal of HSW into landfills is consistently the main choice at rates above 80%. Despite the GDP decrease of 25% in the last seven years, the amount of HSW produced has remained steady. Respectively, excavation, construction and demolition waste recovery rates, as well as separate collection and composting rates of biodegradable waste, remain very low.

The adoption of the new National Waste Management Plan (NWMP) was a radical breakthrough, promoting recycling and composting by means of separate collection of multiple waste streams but its implementation remains a major challenge for all levels of government but also for citizens. The visionary character of the new NWMP does not seem to have accelerated the transition towards a more modern model of HSW management as there has been no increase in recycling to date. In any case, such radical reforms require time to mature and produce tangible results.

On the other hand, the extended producers responsibility schemes have shown some very good results in some cases (e.g. waste lubricants, ELVs, tires, WEEE etc.). The new Recycling Law 4496/2017 was a very important positive intervention which explicitly establishes the obligation to separately collect the four waste streams (paper, glass, metals, plastics) and introduces control mechanisms. However, its full implementation and the effective control of the recycling systems from the state remains a challenge for immediate future. The introduction of a plastic bag fee (under the same law) that has led to a significant reduction in consumption as well as the postponement of one more year of the implementation of the landfill tax are also noted.

As far as it concerns **other environmental issues,** it is particularly favorable the reduction of the EIAs that are carried out every year in numbers closer to the EU average and its replacement by predetermined environmental conditions, depending on the type of project, is a very positive development that reduces redtape. On the other hand, the continuous reduction of environmental audits, despite national and EU legal provisions that require systematic regular inspections on the basis of objective criteria is a negative development.

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ISBN: 978-960-99033-3-2