

Coastal Protection Measures

Greece scale





Co-Evolve4BG

Analysis of Threats and Enabling Factors for Sustainable Tourism at Pilot Scale

Coastal protection measures Greece Scale



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OVERVIEW

The present document was produced in the framework of **Co-Evolve4BG** project “Co-evolution of coastal human activities & Med natural systems for sustainable tourism & Blue Growth in the Mediterranean” in relation to Threats and Enabling Factors for maritime and coastal tourism development on a national scale” Co-funded by ENI CBC Med Programme (Grant Agreement A_B.4.4_0075).

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List of abbreviations

CH₄	Methane
CO₂	Carbon dioxide
CVI	Coastal Vulnerability Index
EU	European Union
NO₂	Nitrous oxide
SLR	Sea Level Rise

Abstract

Greece has the 11th longest coastline in the world with approximately 16,000 km constituting the border between land and sea. The rich natural environment, the numerous islands as well as the ideal Mediterranean climate are only a few of the factors attracting millions of tourists in the country every year. Coastal and marine tourism constitute the most common types of tourism in Greece, significantly supporting the national economy. Coastal and marine tourism include all the tourist activities that take place in coastal areas and the sea, which according to national statistics seem to attract most tourists (Hellenic Statistical Authority, 2019). However, coastal areas are currently facing a variety of threats that can be divided into two main categories, namely human activities and climate change. Their effects in these areas may not be very distinct yet, but it is of high importance that protective measures are implemented in order to minimise these factors and protect the natural environment without greatly affecting tourism and subsequently the country's economy. Proper implementation of the legislation and the suggested protection measures can contribute to the integrated coastal management and ensure the sustainability of coastal areas.

I. Introduction

Greece, located in the Balkan peninsula in South-eastern Europe, has a land area of 132,049.0 km² (Hellenic Statistical Authority, 2021) and is strategically positioned at the crossroad of three continents, namely Europe, Asia and Africa.

Greece has a very interesting geomorphology. The country is characterised by mountain ranges and an elevation that can reach up to 2,918 m (Mount Olympus). On the other hand, Greece also has the longest coastline in Europe and the 11th longest coastline in the world with approximately 16,300 km constituting the border between the land and sea (Hellenic Ministry of Environment and Energy, 2016).

Its unique geomorphology and geography, as well as its Mediterranean climate characterized by hot, dry summers and mild, wet winters, play a major role in Greece's main source of income: **tourism**.

This deliverable provides information regarding the coastal areas in Greece and their main threats, which can be distinguished in two categories, namely human activities and climate change. In addition, the key points of the legislation concerning the protection of coastal areas are also presented, along with examples of coastal management practices. The main objective of the deliverable is to showcase how the state of coastal areas impacts tourism and how negative effects on this sector could be avoided in order to ensure the sustainability of the natural environment without severely affecting the sources supporting the national economy.

In particular, this document is organised according to the following structure:

- Section 1 - Introduction: it describes the purpose and scope of the deliverable and its structure.
- Section 2 - Coastal areas: it explains the importance of Greek coastal areas for the country, as well as the dangers that threaten these areas.
- Section 3 - Vulnerability of coastal areas: it analyses the factors threatening Greek coastal areas and consequently affect tourism.
- Section 4 - Coastal management: it explains the objectives and main principles of good coastal management practices and presents the relevant legislation. An environmental assessment of coastal areas is also presented, along with examples of indicative protective measures for the natural environment and tourism.
- Section 5 - Conclusion: it provides an overview of the previous sections.

II. Coastal areas

II.1. Importance of coastal areas in Greece

As mentioned in the introduction of the deliverable, Greece is one of the countries with the longest coastlines in the world; approximately 16,300 km. Greece features over 6,000 islands and islets, only 227 of which are inhabited, and therefore most of its coastline is located there (Fig. 1, dashed squares).

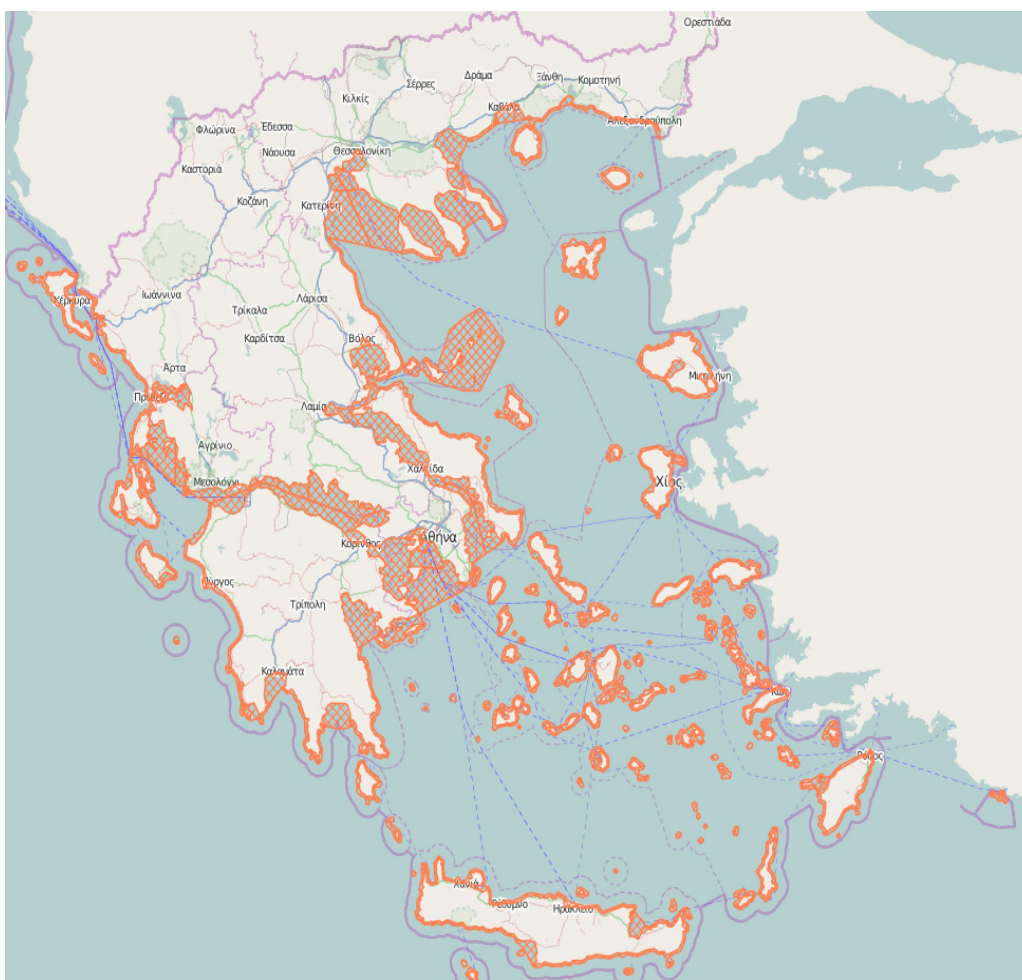


Figure 1. Greek coastline (Geodata.gov.gr)

The long Greek coastline has always played a key role in the prosperity of the country, starting from the ancient years. People preferred to live close to the sea since it constituted a great source of food and they could also transport their goods from one place to another, developing a successful trade network and thus encouraging more and more people to move to areas closer to the sea (European Commission, 1999).

Nowadays, coastal areas remain a pole of attraction, with approximately 70% of the Greek population gathered in coastal zones. Due to their high biological, geophysical, cultural, and economic value, these areas offer numerous possibilities to people living or visiting them. Several sectors that are dependent on coastal areas are the following:

- Fishing industry
- Agriculture
- Energy
- Trade
- National defence, and
- Tourism

Coastal and marine tourism are two of the most widespread types of tourism in modern societies. In countries with long coastlines, *e.g.*, Greece, it constitutes one of the main, if not the main, sources of national revenue. Coastal and marine tourism include all the activities that are carried out in coastal areas, such as living accommodations, restaurants, shopping, cruises, swimming, fishing, diving, *etc.*

Every year, Greece attracts millions of tourists and since many regions of the country border with the sea, it would be safe to assume that Greece is very dependent on its coastal and marine tourism. Figure 2 displays the percentage of overnight stays of tourists for 2018 and it can be easily observed that most of them, both native people and foreigners, visited coastal areas and particularly islands (Hellenic Statistical Authority, 2019).

To promote coastal and marine tourism and subsequently strengthen the national economy, a lot of effort has been devoted to the development of coastal areas by exploiting natural resources without taking into consideration the disastrous impacts on the environment. However, coastal areas are extremely vulnerable to human activities, which are among others, responsible for the current accelerating climate change, causing degradation of the natural environment. Therefore, society needs to adapt to the new conditions.

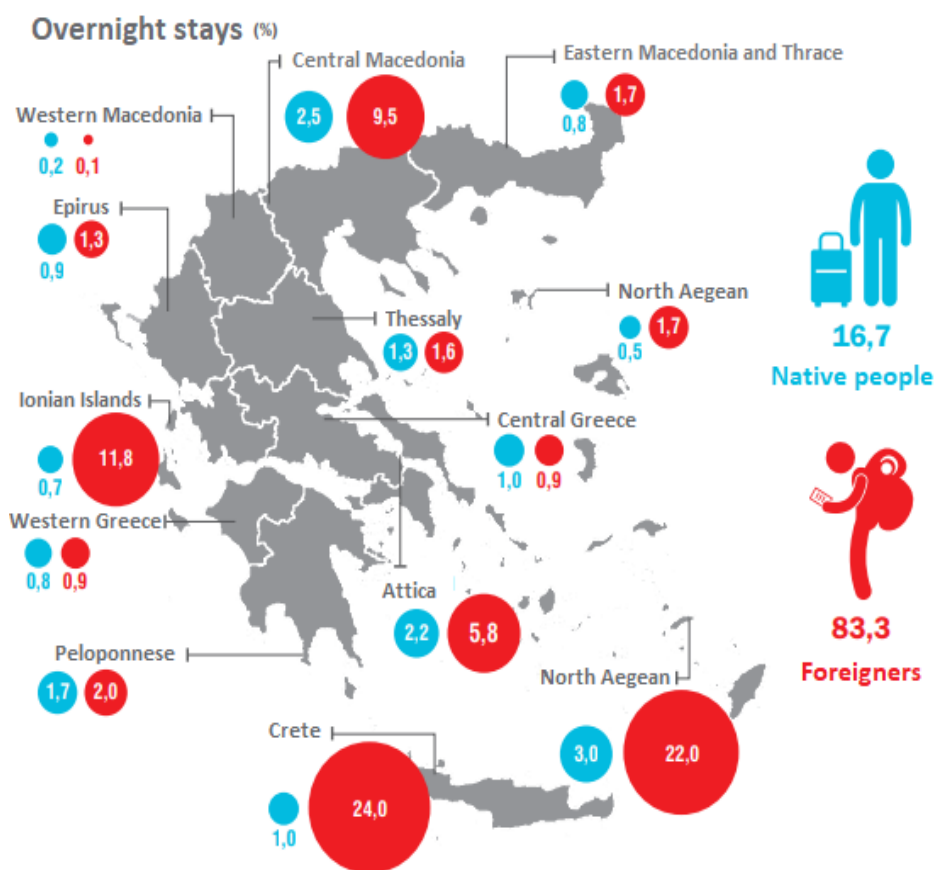


Figure 2. Overnight stays (Hellenic Statistical Authority, 2019)

II.2. Greek coastal areas in danger

Greek coastal areas are no stranger to the threats caused by human activities and climate change and in particular, a coastline of approximately 1,000 km in Greece is considered as vulnerable to these threats (Hellenic Ministry of Environment and Energy, 2016). Some of the biggest consequences of climate change in coastal areas are the rise of the sea level, the accelerated soil erosion, the degradation of aquatic ecosystems and the increasing frequency of extreme weather phenomena.

In the years to come, it is expected that many coastal areas in Greece will be severely affected by the rise of the sea level (SLR; Hellenic Ministry of Environment and Energy, 2016). Many regions will be flooded, constituting a direct danger for most of the Greek citizens, since most of the population lives close to the sea. Beyond the economic and social impacts, it will also threaten people's lives.

In 2011, Alexandrakis et al. made use of the Coastal Vulnerability Index (CVI), a method developed by Hammar-Klose and Thieler to assess coastal vulnerability, to discover the

vulnerability of the coastal areas in the Aegean. It was estimated that approximately 90% of coasts were very vulnerable to the rise of sea level (Hellenic Ministry of Environment and Energy, 2016).

Apart from the SLR, pollution constitutes another big threat to the Greek coastal areas. Most of the coastal and marine pollution comes from industrial, agricultural, and urban human activities. In addition, marine traffic is another source of pollution and includes all the transportation activities that take place in the sea such as shipping, cruises, *etc.*

According to the Hellenic Centre for Marine Research (HCMR), a governmental research organisation in Greece, even though there are still coastal areas facing pollution threats due to urban and industrial activities, most coastal areas are characterised by “Good” Ecological Quality Status (Fig. 3; Hellenic Ministry of Environment and Energy, 2018).

The sustainability of the natural environment as well as the main sectors that support the Greek national economy and are linked to the coastal areas, *e.g.*, tourism, clearly depends on the environmental state of these coastal areas. Therefore, it is imperative that appropriate strategies are developed and implemented in an effort to reduce the natural and anthropogenic factors that contribute to the vulnerability of these areas and are described in detail on the following section of the deliverable.

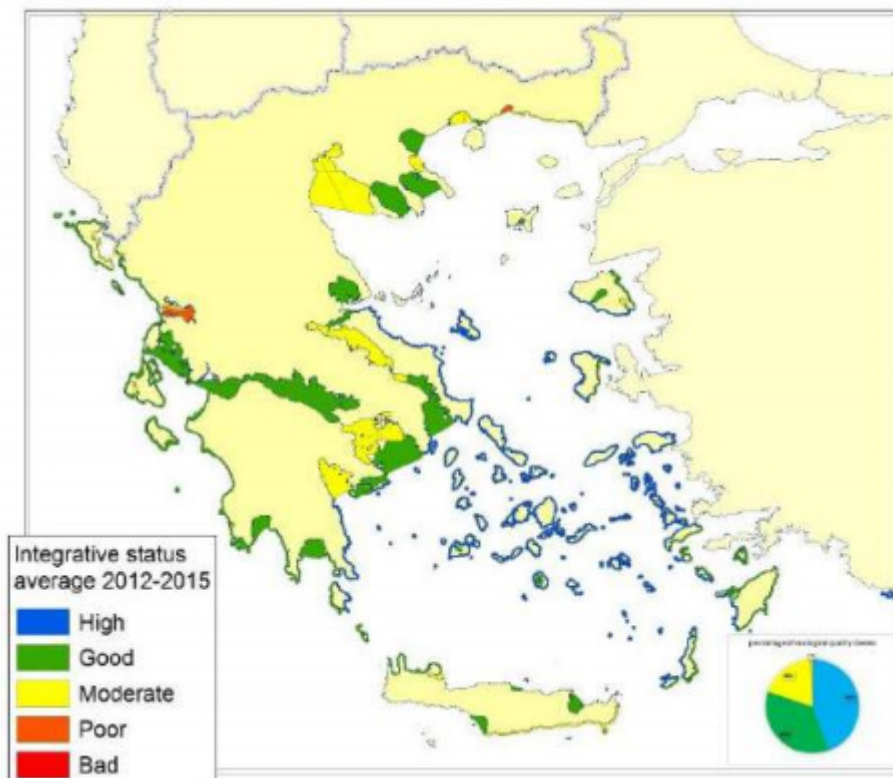


Figure 3. Quality status of Greek coastal areas (Simboura, 2019)

III. Vulnerability of coastal areas

For the past years, human activities have increasingly influenced the climate and natural environment, leading to the amplification of the phenomenon known as greenhouse effect. Fossil-fuel combustion, deforestation and farming are only a few of the activities contributing to the rising concentrations of greenhouse gases in the atmosphere and the subsequent global warming. This section of the deliverable presents the main human activities that affect the coastal environment, as well as the ensuing climate change and its effects on coastal zones. Finally, the impact of the tourism sector is presented along with the sector's contribution to the further degradation of the natural environment.

III.1. Human activities

III.1.1. Chemical pollution

Excessive nutrient outflows are responsible for the more frequent occurrence of eutrophication phenomena in coastal environments. Combined with chemical pollutants, they can have negative impacts on the fauna and flora of coastal and marine environments (Hellenic Ministry of Environment and Energy, 2018).

Areas that are close to river discharges are directly affected by the outflows of large amounts of nutrients carried out from the land and are often suffering from eutrophication phenomena. Industrial and urban waste, use of excessive fertilisation in farming, fish farms and port activities (e.g., transportation) constitute the main sources of nutrients that end up in the coastal and marine environments.

This is also the case in Greece, where the accumulation of excessive amounts of nutrients in coastal areas comes from agriculture, fish farming and fishing (Pavlidou *et al.* 2015). According to Figure 4, a few coastal regions seem to receive more pressure from these activities than others, namely the Thermaikos gulf, the gulf of Elefsina, the Inner Saronic gulf, the bay of Itea, the northern gulf of Evia, the sea area near the city Patras, the Pagasitikos gulf and the Amvrakikos gulf.



Figure 4. Anthropogenic pressure on coastal areas (Pavlidou et al. 2015)

III.1.2. Marine Waste

Approximately 5,000,000 people, most of the population in Greece, lives in coastal areas and therefore human waste often ends up in the coastal and marine environments, either intentionally or unintentionally (Hellenic Ministry of Environment and Energy, 2018). Even though approximately 90% of this waste consists of plastic products, such as packages or single-use plastics (*e.g.*, coffee caps, bags, *etc.*), cigarette butts are the primarily marine litter. This form of pollution poses a serious threat to the natural environment, as well as the organisms inhabiting it.

It is estimated that an individual is producing about 500 kilos of solid waste per year, from which 20% correspond to plastic waste. In addition, about 500 kilotons per year are estimated to be the total production of plastic waste from the coastal population in Greece.

III.1.3. Noise pollution

Noise pollution constitutes one of the principal threats of the coastal and marine environments, since it can negatively affect natural habitats and organisms, and sectors such as tourism. Marine traffic, military exercises with naval sonars, construction sites on coastal zones, airguns used for seismic surveys are all sources of underwater noise pollution (Hellenic Ministry of Environment and Energy, 2018). Table 1 distinguishes the sources of noise depending on whether the noise is impulsive or constant.

Marine traffic seems to be the principal noise source in Greece, due to the large number of tourists that visit the country every year. This results in a significant increase in marine traffic, especially during the summer.

Moreover, the Aegean Sea constitutes the route that connects the Black Sea with other Mediterranean ports via the Bosphorus and the Dardanelles. Therefore, it is used for the shipping of oil/gas, which further contributes to marine traffic.

In general, marine transport is considered environmentally friendlier than other means of transportation (Hellenic Ministry of Environment and Energy, 2018). However, the excessive increase in marine traffic is forcing marine animals to change their habits and become more vulnerable when trying to adapt to the new environmental conditions. The natural environment is also deeply affected, since the maritime traffic is closely linked to the income derived from the arrival of more tourists in the country, which therefore increases the pollution caused by human waste.

Table 1. Noise pollution sources

Impulsive noise sources	Constant noise sources
Airguns used for seismic surveys	Marine traffic
Sonars for military exercises	Drilling (e.g., for the extraction of fossil fuels)
Pile driving on coastal construction sites (e.g., ports)	

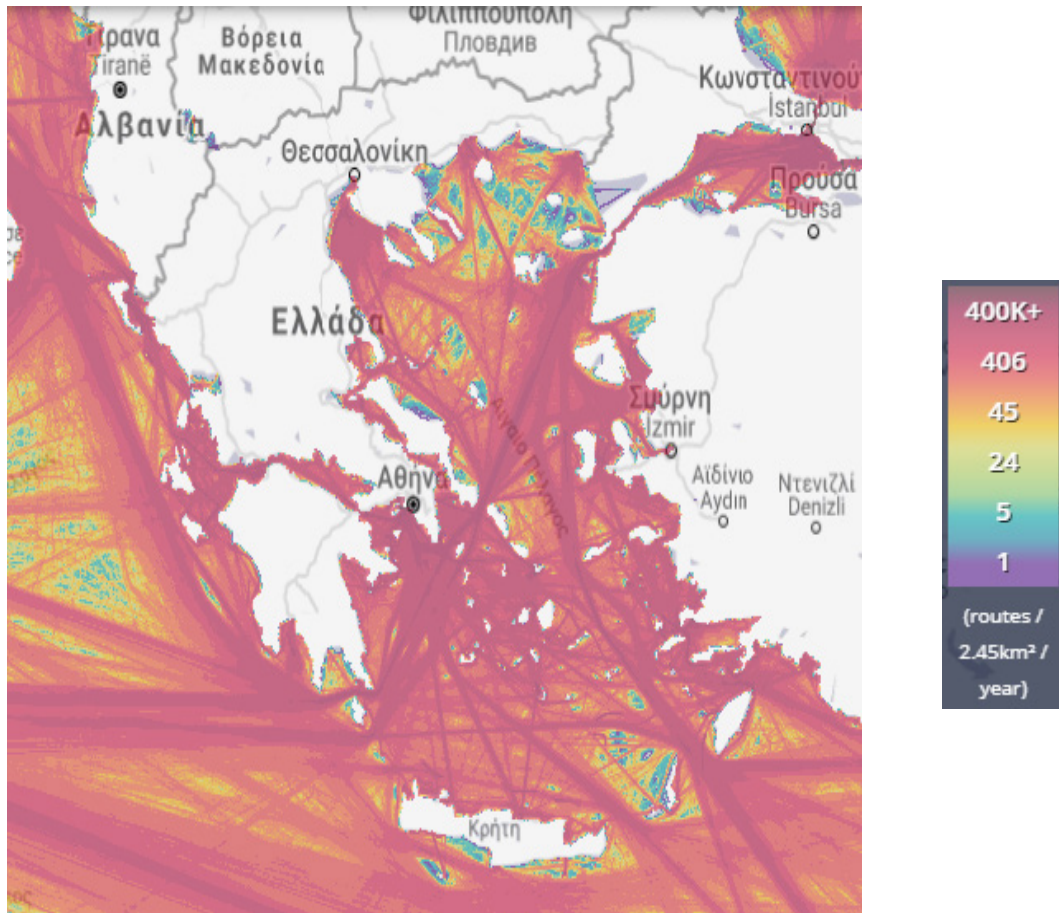


Figure 5. Density of marine traffic in Greece (www.marinetraffic.com)

III.2. Climate change

In recent decades, excessive human activities have had a significant impact on the environment, leading to changes in ecosystems and biodiversity, and depleting natural resources. The increasing levels of greenhouse gases, especially carbon dioxide (CO₂), Methane (CH₄) and nitrous oxide (N₂O), are considered responsible for the current global warming and the phenomenon known as climate change (World Meteorological Organization, 2020).

The rising air temperature has various serious consequences for the environment. Loss of sea ice, melting glaciers, rising sea levels, extreme weather events (*e.g.*, more intense heat waves) and coastal erosion are just some of the effects of climate change.

According to NASA, some changes that are expected to come in the future due to the constant rise of the air temperature are the following (NASA, 2021):

- Further rise of the air temperature
- Extension of the frost-free season and the growing season of plants
- Changes in precipitation patterns
- Increase in the frequency of droughts and heat waves
- Amplification of hurricanes (intensity, frequency, and duration)
- Significant SLR
- Loss of the Arctic Sea ice

Not all areas will be experiencing them at the same time or at the same intensity. Depending on their geographical position and/or the societies' ability to adapt to climate change, some areas will be more affected than others (NASA, 2021).

Greece is one of the countries expected to be significantly affected by climate change. Severely dependent on fossil fuels used in the energy sector, Greece emits approximately 3% more greenhouse gases per capita than the EU27 average. One of the country's main goals is the full delignification of the energy system by the end of this decade (IOBE, 2020). In addition, the transport sector is also responsible in a great extent for the emission of greenhouse gases that contribute to the rise of the air temperature, but there are plans to reduce this emission source by 2030 as well (e.g., increase in the electric passenger vehicles).

All in all, according to several scenarios run by the Intergovernmental Panel on Climate Change (IPCC) for the Greek region, it was suggested that an increase in the mean air temperature between 0.15-0.48 °C per decade will occur, along with a reduction in precipitation levels of 4.5 mm to 6.5 mm per decade (IOBE, 2020).

The SLR, one of the main effects of climate change, is expected to change global coastal geomorphology, especially in areas with low elevation, deltaic systems, alluvial fields, and coasts. Some of the effects of SLR on coasts include erosion, frequent floods, and changes in coastal ecosystems (Hellenic Ministry of Environment and Energy, 2016).

In Greece, it is expected that SLR will range between 0.2 and 2 m by 2100, which along with geomorphological, tectonic, and other factors, add to the vulnerability of the Greek coastline. A projection based on 0.5 m SLR by 2100, indicated that approximately 15% of the current total coastal areas in Greece will be flooded, resulting in tremendous economic losses (Hellenic Ministry of Environment and Energy, 2016).

Apart from the direct consequences to the environment, the effects of climate change have serious impacts on all sectors since they are threatening water resources, public health, food supply, industry, agriculture, transport, and tourism.

III.3. Tourism

As mentioned above, tourism is considered as one of the principal drivers of the Greek national economy, promoting job growth and economic prosperity. The mild Mediterranean climate as well as the rich natural environment mark Greece as an ideal destination for individuals of all tastes. However, due to all the factors increasing coastal vulnerability, *i.e.*, human activities and climate change, tourism is nowadays at risk.

According to simulations from climate models, not all regions of Greece will be affected simultaneously or at the same level, but in general terms the spatial and temporal distribution of tourism will be significantly affected. For example, the tourist season is expected to be moved earlier or later than it is now. Several elements that will contribute to such changes are the increase in the air temperature, the increase of extreme weather events and the water scarcity which is very common for Mediterranean countries, especially during the summer season (Hellenic Ministry of Environment and Energy, 2016).

In coastal areas, the key environmental threats are SLR, coastal erosion and extreme weather events (*i.e.*, more intense heat waves), all mainly caused by climate change (Jarratt and Davies, 2019). Due to the country's long coastline, these changes will have significant impacts on Greek society and national economy.

However, tourism can also be held responsible for the degradation of the natural environment, especially on coastal zones which are the areas attracting most tourists (Fig. 2). In an effort to revive tourist activities, the coastal population, whose sustainability depends on it, exerts intense pressure on the natural habitat.

In summary, the problems caused by excessive tourism, otherwise known as over tourism, in a coastal area are the following:

- Concentration of a great number of people in a limited area
- Contribution in the increase in water consumption, air pollution, litter
- Overexploitation of natural resources
- Cause of difficulties in decision-making, policy implementation and coordination of competent authorities

IV. Coastal management

Coastal management and planning are essential for the sustainability of the natural environment as well as the continuous growth and development of modern societies. Tourism is one of the sectors that are most affected by climate change and its side effects, such as SLR, flooding and extreme weather events.

Due to the danger that coastal areas face, adaptation to the effects of climate change is necessary. It is important that an integrated plan is developed and adopted in order to reduce the impact of SLR in coastal areas. Such an integrated plan is based on four main principals, namely the definition of regions at risk, the outlining of the exact coastline, the assessment of the impact of climate change on different sectors and the continuous monitoring of coastal zones (Hellenic Ministry of Environment and Energy, 2016).

IV.1. Objectives and principles

Integrated coastal management includes all the activities relevant to information acquisition, planning, decision-making, management and monitoring of coastal areas to minimize the impact of human activities and climate change on these regions. In addition, it coordinates the implementation of policies of different sectors, which operate in coastal areas, such as aquaculture, fisheries, agriculture, industry, offshore wind energy, transport, tourism, *etc.* (European Commission, 2021a).

There are six main objectives to the integrated coastal management plan proposed by the European Union (EU; European Union, 2009), namely:

1. Facilitation of the sustainable development on coastal areas based on the principal that socio-economic development is closely linked to the environment.
2. Conservation of coastal areas to ensure their sustainability.
3. Sustainable exploitation of natural resources with extra caution on the water usage.
4. Maintenance of the integrity of ecosystems and natural habitats on coastal areas.
5. Prevention and/or reduction of the impact of human activities and subsequently the effect of climate change on coastal areas.
6. Successful coherence between initiatives from the public and private bodies and decisions taken by public authorities, at national, regional, and local levels.

For the implementation of the integrated coastal management, it is important that every EU member with direct access to the sea follows several principles (European Union, 2009). These principles include:

1. The coastal natural environment, biodiversity, and the physical dynamics (*e.g.*, tides) should be taken into account.
2. The coastal hydrology and geomorphology, as well as the climate and human activities should be considered in such a way as to ensure the sustainability of coastal areas and minimize the negative effects caused by natural disasters.
3. An ecosystem-based approach should be applied when designing and managing coastal areas. This will contribute to their sustainable development.
4. Proper governance should encourage the participation of interested citizens in transparent decision-making.
5. Coordinated action by the various administrative services and regional and local authorities concerning coastal zones should be ensured.
6. Spatial planning strategies, plans and programs covering urban development, socio-economic activities, *etc.* should be developed.
7. The diversity of coastal areas should be considered and, if necessary, activities that require proximity to the sea should be prioritised.
8. Excessive urban development on coastal areas should be avoided and activities should be distributed in such a way as to not impact the environment negatively.
9. The impact of human activities on coastal areas should be assessed in advance to prevent or reduce it.
10. Protective measures should be implemented to prevent damage to the coastal environment.

IV.2. Legislation

The Greek legislation regarding the protection of coastal areas and the marine environment is based on both European policies and national directives.

Main European directives and programmes

- Demonstration Programme on Integrated Coastal Zone Management (ICZM)
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
- EU Marine Strategy Framework Directive 2008/56/EC (MSFD)
- Commission Decision (EU) 2017/848: establishing criteria and methodological standards for good environmental status of marine waters, as well as specifications and standardized methods for monitoring and assessment, and repealing Decision 2010/477/EU

- Mediterranean Action Plan (FIGURE)
- Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention)

Main National legislative framework

- National strategy for the protection and management of the marine environment 3983/2011 (ΦΕΚ 144/A/17-6-2011);
- The Convention for the Protection of the Mediterranean Sea against Pollution and other related protocols (Punitive) (Amending) [L.17 (III) /2019].

IV.3. Environmental assessment of coastal areas and future goals

In July 2008, the EU Marine Strategy Framework Directive 2008/56/EC (MSFD) were adopted by the European Commission aiming at the protection, management and sustainability of European seas. The directive set a target of “good environmental status” to be achieved in EU marine waters by 2020. After 2020, the results of the first implementation cycle of the MSFD were reviewed and the second cycle of MSFD implementation was set off.

The “Good Environmental Status” is defined as the environmental status of marine waters that ensures their sustainability and continuity for future generations. To ensure that human activities will not affect the environment irreversibly, the Directive set out eleven qualitative descriptors estimating the condition of the environment when the “Good Environmental Status” has been achieved. This will also help EU Member States to keep in line with the measures set, as well as fulfil their responsibilities regarding the MSFD.

The qualitative descriptors mentioned in the MSFD refer, among others, to the biodiversity, the alteration of the ecosystem by non-indigenous species, the population of commercial fish species and food webs and the integrity of the sea floor, the water quality, and hydrographical conditions. Table 2 presents the list of descriptors as well as their main goal (European Commission, 2021b).

Table 2. "Good Environmental Status" descriptors

Descriptor	Goal
Descriptor 1 - Biodiversity	Maintenance of the biodiversity
Descriptor 2 - Non-indigenous species	Non-indigenous species do not alter the ecosystem in a negative way
Descriptor 3 - Commercial fish species	The population of commercial fish species is healthy
Descriptor 4 - Food webs	Elements of food webs ensure long-term abundance and reproduction
Descriptor 5 - Eutrophication	Minimisation of eutrophication
Descriptor 6 - Integrity of the sea floor	The sea floor integrity ensures functioning of the ecosystem
Descriptor 7- Hydrographical conditions	Permanent alteration of hydrographical conditions does not adversely affect the ecosystem
Descriptor 8 - Contaminants	Concentrations of contaminants do not impact the environment
Descriptor 9 - Contaminants in seafood	Contaminants in seafood are below safe levels
Descriptor 10 - Marine litter	Marine litter does not cause harm
Descriptor 11 - Energy	Energy (including underwater noise) does not adversely affect the ecosystem

IV.4. Protective measures

Coastal areas suffer from both human activities and side effects of climate change. This has obligated governments and local authorities to start acting against the negative changes threatening the coastal ecosystems.

One of the major problems coastal areas are facing is that of the SLR, as mentioned on the previous section of this deliverable. Adaptation policies to this problem can be mainly based on three approaches, *i.e.*, retreat, accommodation, and protection. Retreat refers to the transfer of all human activities further away from the coastline, accommodation to the modification of human activities in coastal areas so that these activities are not much affected by SLR, and protection is linked to the implementation of protection measures (Hellenic Ministry of Environment and Energy, 2016).

Managed retreat is an effective method to reduce problems caused in coastal areas by SLR (*e.g.*, erosion, flooding, *etc.*). Several actions included in this method are:

- Development of protection zones between the seashore and the residential zone.
- Discouragement of residential and business development in coastal areas, where erosion constitutes a serious threat.
- Relocation of infrastructures to locations with higher elevation.
- Feasibility of new constructions in coastal areas to be relocated if it is deemed necessary.

To protect coasts against erosion, there are several protective measures that can be implemented, which can be distinguished in two categories (National Research Council, 2007).

- **Hard measures (Hard Engineering):** construction works aimed at wave and tidal resistance, *e.g.*, across and parallel to coastal breakwaters, dykes, *etc.*
- **Soft measures (Soft Engineering):** exploitation of the sea energy (*e.g.*, from waves) for the benefit of the coast, *e.g.* artificial beach replenishment, sand bypass systems, submerged breakwaters, *etc.*



Figure 6. Transversal breakwaters
(intersailclub.com).



Figure 7. Parallel breakwaters.
(eleftheriaonline.gr)



Figure 8. Seawall (Gittman *et al.* 2016)



Figure 9. Artificial beach replenishment (Bandeira *et al.* 2014)



Figure 10. Sand bypass system (Loza, 2008)



Figure 11. Submerged breakwaters (Coastal Zone Management Unit)

Apart from the measures described above, the Hellenic Ministry of Environment and Energy has also developed a [Management Plan](#) which strictly corresponds to a River Basin District (RBD) and which provides information about appropriate water management practices (Hellenic Ministry of Environment and Energy, 2021). This plan includes the following information:

- A report on the main human activities that contribute to the vulnerability of areas close to water surfaces, *e.g.*, rivers, lakes, coastal areas.
- The Greek water monitoring network and the results deriving from this monitoring which present the status of the waters, *i.e.*, their ecological, chemical and quantitative status.
- The principal environmental goals set for the water surfaces.
- An economic analysis of the water uses.
- A short summary of the programs and measures that could be adopted in order to protect and sustain the water surfaces.

According to the Management Plan, the monitoring of water in Greece can be carried out in three different ways and is therefore distinguished in three categories, namely the **supervisory monitoring**, the **operational monitoring**, and the **exploratory monitoring** (Government Gazette, 2013).

The **supervisory monitoring** aims to help in the assessment of the anthropogenic pressures to the environment and to the water surfaces. Moreover, it assesses if the environmental goals that have been set can be met and it can also contribute to the effective planning of future monitoring programs, the assessment of long-term changes due to pressures from human activities, *etc.*

The **operational monitoring** estimates the state of areas that are considered at risk of failing to meet the environmental goals set; and assesses all the changes that are observed to these areas due to the implementation of protection measures.

The **exploratory monitoring** is conducted when the supervisory monitoring indicates that specific areas will not meet the environmental goals set for the aquatic environment and before the operational monitoring is implemented. It aims at the identification of the factors leading to this condition, as well as the assessment of the significance of their impact.

Figure 6 and Figure 7 display the current conditions of the Greek coastal areas as measured by their constant monitoring (River Basin Management Plans, 2021). In general, it can be easily observed that the Greek coastline is characterized by a good chemical status, while the ecological status is mainly good, but in some areas and especially in gulfs it can be moderate.

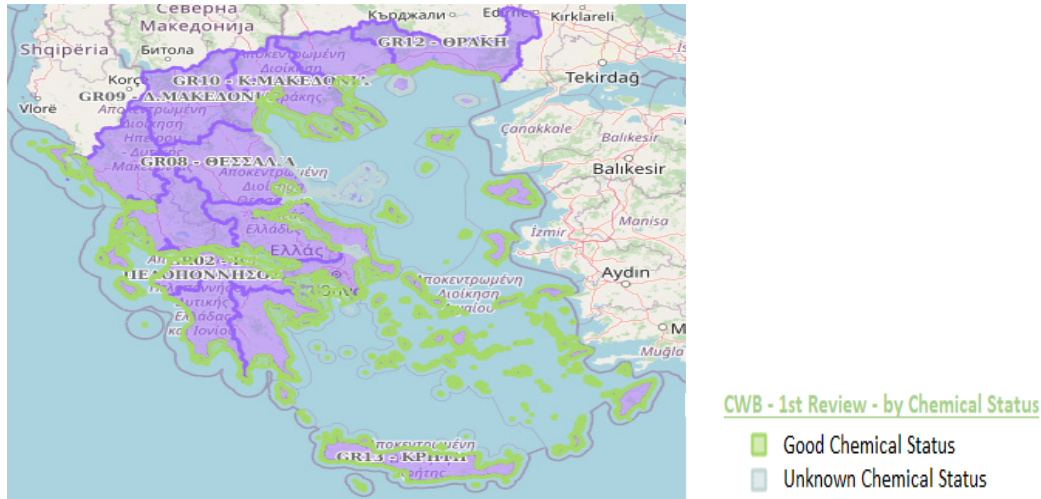


Figure 12. Chemical Status of the Greek coastline

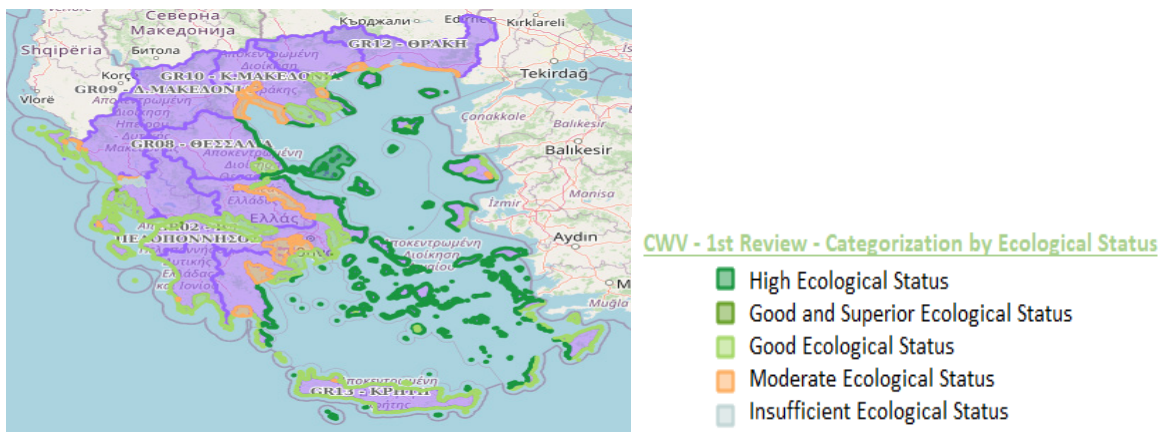


Figure 13. Ecological Status of the Greek coastline, (Interactive Maps of Ministry of Environment and Energy)

The main objective of this document is to provide information that could help meet the goal of sustainable development by integrating appropriate environmental policies, plans and programs (Operational Programme 'Environment and Sustainable Development', 2021).

Considering tourism and the consequences of human activities and climate change on this sector, the Hellenic Ministry of Environment and Energy proposes several actions and measures that may contribute to the reduction of their impact. Table 3 includes several of these suggestions (Hellenic Ministry of Environment and Energy, 2016).

Table 3. Suggested actions and measures to support tourism

Action	Measure
Impact on the appeal of the destination area by taking into account the thermal comfort	Examination of the necessity to improve tourist facilities
	Diversification of the tourism product
	Extension of the tourism season
Impact on the factors supporting tourism and are related to the country's water and energy reservoirs and the required support actions	Potential infrastructure projects
	Incentives for businesses to reduce consumption
Impact on the competitiveness/appeal of tourism destinations in relation to seasonality	Development and promotion of alternative types of tourism (cultural, climbing, nature-loving, ecotourism, <i>etc.</i>)
	Use of existing infrastructure and seasonal activities in a region
	Development of a plan to solve the problem of the changing seasonality of tourism
	Redesign of the tourist product
Impact on the costs of protection projects in tourism infrastructures	Development of the main specifications of protection projects, considering the characteristics of each region
	Recording of the necessary public investments
	Indication of necessary resources and sources of funding (<i>e.g.</i> , programs)
Impact on the costs of tourist units	Indication of the necessary investments in infrastructure and technologies to address environmental conditions (<i>e.g.</i> , high temperatures, lack of water, <i>etc.</i>) in the most efficient way
	Indication of the necessary investments for the reduction of the carbon footprint of the tourism product to reduce the operating costs and to be competitive with environmentally aware tourists
Support actions	Development of guidelines, at regional level, to reflect differences on tourism and climate change which will be addressed separately to representatives of public bodies, industry entrepreneurs and the public. Information and support to cope with extreme events (heat wave, fires, <i>etc.</i>)
	Administrative support, organisation and rise of awareness for climate change in tourist destinations

V. Conclusions

This deliverable presents an overview of the main factors threatening Greek coastal areas, all of which are closely linked to human activities that contribute to global warming and climate change. Tourism is one of the principal sectors that are severely affected by these changes.

Due to the country's long coastline, the Greek national economy is significantly dependent on tourism, which is mostly centered on coastal areas rather than the more continental country. Therefore, it is crucial to find ways to protect these regions by implementing well-thought-out coastal management practices.

In addition to the vulnerability factors of coastal zones, this deliverable presents the main objectives and principles of integrated coastal management, as well as the Greek legislation concerning the protection of the country's coastal zones. Several key environmental goals are also provided, along with suggestions of protective measures which could be implemented to protect and support the coastal natural environment and tourism.

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