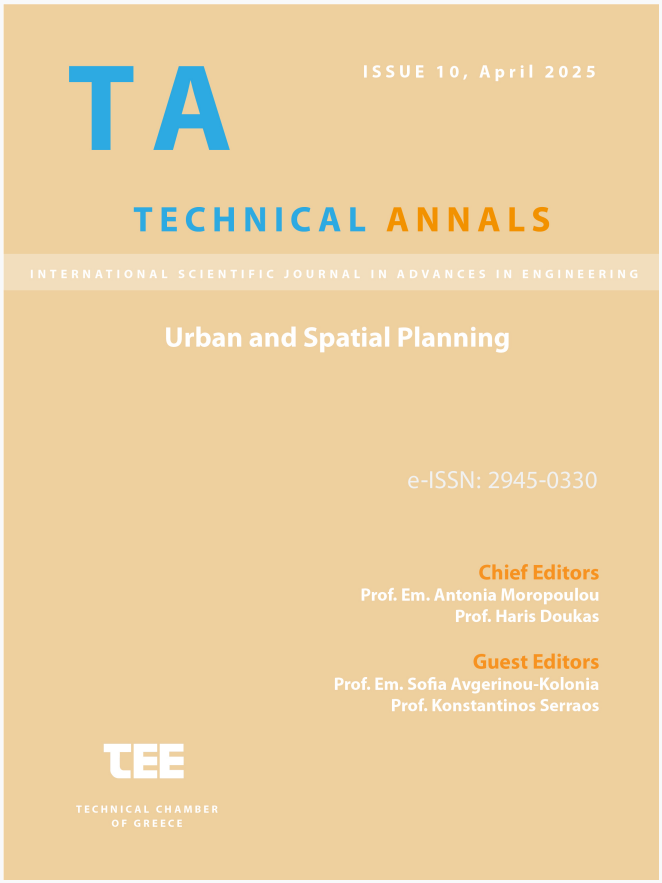
Technical Annals

Vol 1, No 10 (2025)

Technical Annals



Interactions between coastal cities and adjacent protected ecosystems. The case of Preveza and the Amvrakikos Gulf

Vasileios Tzoumas, Rena Klabatsea

doi: 10.12681/ta.41579

To cite this article:

Tzoumas, V., & Klabatsea, R. (2025). Interactions between coastal cities and adjacent protected ecosystems. The case of Preveza and the Amvrakikos Gulf. *Technical Annals*, *1*(10). https://doi.org/10.12681/ta.41579

Interactions between coastal cities and adjacent protected ecosystems. The case of Preveza and the Amvrakikos Gulf

Vasileios Tzoumas[1], Rena Klabatsea[2]

[1]PhD Candidate at National Technical University of Athens
[2]Associate Professor at National Technical University of Athens
vtzoumas@mail.ntua.gr, rklabatsea@arch.ntua.gr

Abstract. The coastal area of Preveza, like much of the country, is under intense pressure from urban development, seasonal housing, tourism, and other land-based and marine activities, including those related to the primary sector. The city lies in close proximity to a unique and environmentally sensitive ecosystem: the Amvrakikos Gulf. Its wetland complex positions it as one of the largest and most ecologically significant wetlands in Greece and in Southern Europe. The city aims to pursue economic growth by leveraging the nearby environmental asset, while simultaneously safeguarding the adjacent ecosystem.
Within this context, the present article focuses on the relationship of coexistence and the examination of the interactions between the development trajectory of Preveza and the preservation of the protected wetland area of the Amvrakikos Gulf. The research objective is to determine whether a method can be recognized that, by considering the protected ecosystem as a local resource for the settlement, can substantiate conditions that promote the sustainable development of this particular duality.

Keywords: coastal area, environmental resource, legislative framework, protected ecosystem, sustainable development

1 Introduction

The trend of population concentration in Mediterranean coastal areas is related both to the general increase in the global population and to the systematic population movement from inland areas to coastal ones, in search of economic opportunities and better living conditions. This is because most Mediterranean coastal cities (Fig. 1) are linked to the presence of ports, which facilitate the easier and more economical transportation of goods, imports, and exports, encouraging the development of industry and trade in the broader area. Due to these conditions, a large portion of coastal areas is being allocated and repurposed.

Greece possesses the longest coastline among European countries, with thirty-three percent of the Greek population residing in coastal settlements situated 1-2 km from the shore [1]. Eighty percent of industrial activities, ninety percent of tourism and

recreational activities, thirty-five percent of agricultural land (usually of high productivity), fisheries and aquaculture (representing 10% of the total aquaculture in the 25 EU member countries), as well as a significant portion of infrastructure, are located in the coastal zone [2].

The coastal zone of the municipality of Preveza has been characterized in recent years by the efforts of local authorities for sustainable tourism development, maritime transport, and diverse activities in the primary sector, gathering significant potential of sustainable development. This zone includes a large natural port at the entrance to the Amvrakikos Gulf. The port of Igoumenitsa, the Egnatia Highway, but primarily the Ionian Highway and the connection of the city with the underwater tunnel of Aktio, represent the four largest infrastructure projects in the Epirus Region, which are linked to the coastal zone via the Amvrakia Road (Fig. 2). The contact with the Ionian Sea to the west and the Amvrakikos Gulf to the east (Fig. 2) increases the multimodality in the dynamics of the city, combining a semi-touristic and semi-agricultural economy, a large portion of which involves aquaculture and fishing.

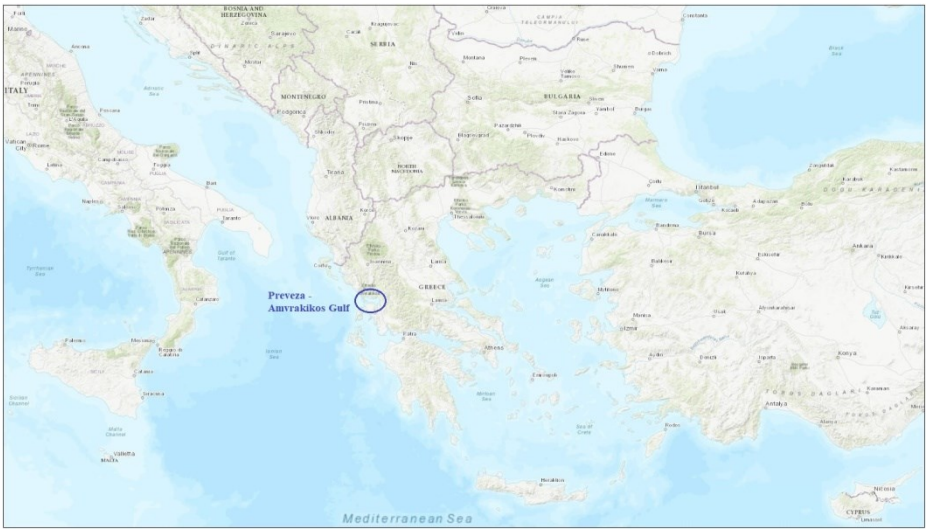


Fig. 1. Location of Preveza and the Amvrakikos Gulf in the Mediterranean area (Map sources: ESRI, OpenStreetMap, GIS User Community etc.)

Wetlands hold a significant position in the hierarchy of coastal biodiversity elements. Worldwide, they cover an area of 8.6 million km², or 6.4% of the Earth's surface [3]. In mainland Greece, 1,390 wetlands and nine wetland complexes with an area of 2,350,000 st. have been documented, while 805 were recorded on islands. Of these, 371 wetland ecosystems are fully or partially included in protected areas, covering an area of 1,963,700 st. [4]. They contribute to half of the global ecosystem services, including flood control and regulation, as well as the reduction of erosion phenomena [5]. However, in recent decades, wetlands have been dramatically decreasing due to human pressures and the climate crisis. Approximately 50% of the world's wetlands have been lost since 1900, with 35% of them disappearing after 1970, at a rate three times faster than

that of forests. In Europe, it is estimated that 17% of mammals are threatened with extinction, as well as 13% of birds, 40% of freshwater fish, and 58% of endemic trees [6]. Only 1-3% of the forests in Western Europe can be considered undisturbed by humans. Seas and coastal ecosystems are among the most threatened but also among the least protected, as marine protected areas internationally make up no more than 5.1% of national waters [7].

It is well known that the Greek coastal zone hosts important habitats, contributing to the survival of the biogenetic reserves of flora and fauna. Additionally, the coastal area contributes to the creation and maintenance of microclimates. The presence of coastal forests and wetlands helps minimize floods, erosion, and other natural disasters, providing valuable regulatory and supporting ecosystem services. The threats to the Greek coastal and marine environment stem on the one hand from natural hazards such as coastal erosion [8] and climate change, but primarily from human-induced pressures, such as urbanization, overexploitation of natural resources, and pollution. As a result of the intense pressures faced by the coastal zone, conflicts arise due to competing interests, and there is a growing threat of depletion of coastal environmental resources.

The pursuit of a golden mean among ecosystem services, with sustainability as a central focus, constitutes a field of research aimed at preserving and/or improving the state of the environment and ensuring sustainable and environmentally responsible development. Adequate environmental protection is an essential factor both for human well-being and for the enjoyment of fundamental human rights.

1.1 Research objective

Within this context, the objective of the present article is to analyze the interactions between the trajectory of development of a coastal urban residential area and the preservation of a neighboring, unique, protected ecosystem. The research objective is to identify, through the investigation of the temporal interactive relationship between the two entities, the terms and conditions under which coastal settlements can be linked in the context of sustainable development and coexist in balance with neighboring protected ecosystems. Specifically, the goal is to determine whether a method can be recognized that, by considering the protected ecosystem as a local resource [9] for the settlement, can substantiate conditions that promote the sustainable development of this particular duality. This is pursued through a case study focusing on the city of Preveza, whose eastern front borders the protected area of the Amvrakikos Gulf.

2 Dynamics of Coastal Space

According to Article 2 of the Protocol concerning Integrated Coastal Zone Management of the Mediterranean, the coastal zone is defined as 'the geomorphological area on both sides of the coastline, where the interaction between the marine and terrestrial components takes the form of complex systems of ecological elements and resources consisting of biotic and abiotic components that coexist and interact with human communities and the related social and economic activities'. Meanwhile, Article 2 of the Special Framework for Spatial Planning and Sustainable Development for the Coastal

Zone and Islands defines the coastal area or coastal space as 'the geomorphological area on both sides of the coastline where the relationship between the marine and terrestrial components is dynamically manifested through complex ecological systems that include biotic and abiotic components'. In general terms, the coastal area can be defined as the section of land and sea that is in direct contact with the coastline and within which various terrestrial and marine activities take place. It serves as the transitional environment from the sea to the land, giving it distinct natural as well as socio-economic characteristics.

The combination of elements that constitute the coastal zone results in a highly heterogeneous environment, which hosts a significant portion of the human population and a wide range of human activities, while also is encompassing a considerable number of ecosystems with rich biodiversity [10]. The significant importance of the coastal zone, at environmental, social, and economic levels, has resulted in continuous and intense conflicts between land uses and anthropogenic activities, which lead to the degradation of the relevant environment. This threatens critical environmental elements, even those under protection, such as wetlands, contributes to the extinction of rare biological species, the deterioration of coastal water quality, the decline in the tourism value of large portions of the coastal zone, the alteration of coastal landscapes, and ultimately, the degradation of the quality of life for coastal inhabitants. Over the last few decades, the coastal zone has gained an additional, paramount environmental value, as coastal areas serve as crucial habitats and act as a protective barrier against rising sea levels and flooding [11].

2.1 Contemporary urban conditions

The ongoing concentration of population in urban environments and the continuous demand for improved living conditions, social functions, and economic opportunities have resulted in the creation of environmental, social, and economic problems, such as social degradation, the depletion of available natural resources, traffic congestion, air pollution, inadequate infrastructure and networks [12], and even the climate crisis. Consequently, climate change, the protection of natural resources, quality of life, ethical governance, circular economy, as well as gender equality, education, fair trade, etc., represent current challenges for organized urban settlements. These challenges test the resilience of contemporary cities, which can be categorized into environmental, social, economic, and technological aspects.

In several areas of the Greek coastal zone, significant land-use conflicts are observed between tourism, primary sector activities, residential expansion, and protected areas. These conflicts often result in local overdevelopment, leading to the degradation of both the natural and built environment, as well as the depletion of natural resources. At the same time, in many cases, the lack of infrastructure—such as water supply and sewage networks, wastewater treatment plants, waste disposal facilities, flood protection works, etc.—exacerbates pollution problems in coastal areas. Additionally, coastal cities face specific risks associated with the climate crisis, including coastal erosion and sea level rise, the latter of which leads to land loss.

Particularly regarding the tourism product, the Mediterranean environment, and especially that of the European Mediterranean coastal zone, constitutes a dominant

component of development models at the local, regional, and national levels, due to the combined comparative advantages it offers over other developmental parameters. This is because the environment of tourist destinations (natural, built, cultural, and social) is an integral part of the tourist experience. The quality of both the tangible elements (buildings, infrastructure, natural resources) and the intangible components (atmosphere, landscape, culture) that make up the tourism product affects both its competitiveness and its attractiveness. Due to this specificity, tourism development is considered a key parameter of the pressures faced by coastal cities and local ecosystems, such as wetlands. As a result of these pressures, negative impacts are recorded, which are related to the degradation of the natural environment (atmosphere, water, soil), the landscape, flora, and fauna, as well as changes in the built environment (urban planning, architectural). There are also impacts related to the depletion of natural resources and the exceeding of the carrying capacity of local ecosystems. The increase in the number of tourists to a destination results in a corresponding rise in the negative consequences for the local community and the environment, defining a threshold of visitors beyond which these consequences can no longer be accepted by either the locals or the tourists.

Coastal protection strategies adopted by cities facing high levels of risk have primarily focused on safeguarding the built environment through coastal protection infrastructure [13]. In contrast, even today, the protection of urban communities through the preservation of the ecosystem services provided by coastal ecosystems is often given limited consideration within these strategies [14]. Coastal protection works play a key role in protecting vulnerable urban coastal areas from erosion and flooding, just as coastal ecosystems contribute significantly to the overall sustainability and resilience of cities and urban populations by supporting coastal protection. These ecosystems demonstrate remarkable resilience to long-term disturbances, as well as adaptive capacity in the face of both urban stressors [15] and climate change [16]. Therefore, the preservation of coastal wetland complexes through management interventions aimed at enhancing ecosystem resilience is a critical issue. Maintaining coastal ecosystems and maximizing their resilience ensures that coastal urban communities can continue to benefit from the services they provide and improve their adaptive capacity in facing adverse future impacts [17].

2.2 Contemporary wetland conditions

As previously mentioned, wetland ecosystems provide half of all ecosystem services globally. Among other functions, they maintain water quality and supply [18], protect coastlines, preserve unique native species, and offer cultural, recreational, and educational resources [19], making them among the most valuable terrestrial ecosystems [20]. They act as natural filters for pollutants and sediments [21], contribute to the regulation of atmospheric gases, and help moderate the temperature of riparian zones [22]. They provide space and refuge for species and can be key factors in climate change adaptation strategies [23], while also helping to mitigate the impacts of natural disasters and the risks posed by harmful organisms and diseases [24]. Beyond their ecological values, wetlands offer numerous direct benefits to society. Their contribution to the primary production sector, hydrological balance, and the overall environmental quality of adjacent lands is well-established. They constitute an ideal area for the practice of

fishing, aquaculture, and livestock activities, as well as a distinctive environment for recreation, ecotourism, and scientific research.

While wetlands provide significant and vital ecosystem services, they are under constant and increasing pressure. Humanity has been destroying them for centuries [25]. Globally, many wetlands were lost and degraded during the 20th century due to anthropogenic activities [26], while in recent decades, their decline has been further exacerbated by climate change. The loss of wetlands, as well as the degradation of their services, is driven by key factors such as the expansion of agricultural land [27] alongside the intensification of agriculture, activities which are the main causes of their loss [28]. This also includes the intensification of industrial production [29], the ongoing evolution of urbanization [30], and the expansion of built-up areas. Furthermore, the development of infrastructure, the construction of dams, and changes in water use and availability [31], climate change, disease control, and aquaculture activities [32], as well as the intensification of the tourism industry, contribute to their degradation.

While economic growth, environmental exploitation, and social progress have proven to be significantly negative for wetland conservation, effective management of these areas can play a crucial role in their preservation, thus ensuring the continued provision of their valuable benefits, while also serving as the cornerstone for the maintenance and promotion of sustainable development. Moreover, in wetland areas, resource management is implemented at the ecosystem level, playing a key role in their sustainable use and consequently in their conservation, enhancing their resilience. The pursuit of the golden ratio by ecosystem services, with a central focus on sustainability, should constitute a field of research within the framework of the conservation and/or improvement of wetland ecosystems [33] and, by extension, the environment. This includes ensuring sustainable and environmentally sound development, as appropriate environmental protection is a crucial factor for human well-being and the enjoyment of fundamental human rights.

Reducing pressures from human activities is a fundamental prerequisite for enhancing the adaptive capacity of wetlands to climate change [34], in order to ensure their preservation. However, the concept of absolute protection—specifically, the total prohibition of all human activities within a wetland—should not be regarded as the foundational strategy for its conservation [22]. Such an approach would not only be practically unfeasible, but also contrary to the lessons of international experience, as in certain cases a discreet human presence and low-impact activity can contribute to this, promoting sustainable development without significant environmental burden.

3 Interactions between Preveza and the Amvrakikos Gulf

3.1 The City of Preveza

Preveza (Fig. 2) is a city that, like many contemporary coastal urban centers, experiences multifaceted economic, social, and environmental challenges, albeit of relatively low intensity. The recent economic and fiscal crisis has led to a downturn in local economic activity, resulting in operational difficulties for businesses and increased pressure on the labor market. Existing challenges with long-term implications for the

city, such as resilience to climate change, the need for sustainable and balanced spatial planning, the reduction of the energy footprint of buildings and infrastructures, the revitalization of the local economy and the enhancement of outward-looking strategies, the strengthening of social cohesion, and the mitigation of inequalities and exclusions, were intensified during the pandemic period and came to the forefront of urban discourse, introduced new parameters and requirements for both the urban environment and its inhabitants. An additional risk threatening Preveza is the coastal erosion and morphological instability of its shoreline, driven by the impacts of climate change.

Fig. 2. Geographical Correlation of Preveza and Amvrakikos Gulf
(Cartographic base map: ESRI, OpenStreetMap, GIS User Community etc.)

The position and role of Preveza within the Region of Epirus is documented through the study of the revised in 2018 Regional Spatial Planning Framework (RSPF). According to this, Preveza constitutes a second-level settlement network as the center of the Regional Unit and is considered, in its entirety, a "touristically developing area." The goal for the city of Preveza should be to increase tourism activities and support the Ionian tourism corridor. Preveza maintains its character as an agricultural-livestock and manufacturing center. This, however, does not undermine its tourist orientation; instead, it provides opportunities for the development of supportive synergies between the primary sector and tourism. Priorities include the protection of agricultural land (especially irrigated land) from incompatible uses (mainly urban development) and the modernization of agricultural production through the regulation of fertilization, pesticides, etc.

The RSPF recommends that intensification through fertilizers and pesticides, as well as monoculture farming, constitute problems. Addressing these issues requires both strengthening scientific and technical support actions and enhancing control and certification processes for high-quality final products. It is recommended to rationally manage water resources, gradually concentrate production units in organized hubs, and

orient agricultural production towards high-quality products. The goal is to retain the agricultural population and support it through better organization of agricultural holdings and livestock production, as well as promote agrotourism. It is also recognized that the coexistence of irrigated agricultural land with land used for intensive poultry farming, along with the fact that both activities place a burden on the Amvrakikos Gulf, constitutes a problem in the organization of land uses. Thus, it is necessary for the underlying planning to foresee these specific land uses, establish restrictions to prevent the spread of production units, and expedite the processes for the establishment, creation, and operation of designated hubs. The habitat of the Amvrakikos Gulf, like other lagoonal, fishing, and diving tourism resources, can be utilized through appropriate promotion, contributing to tourism development. At the same time, it is emphasized that the area of the Amvrakikos Gulf is not suitable for the development of infrastructure such as accommodations, dining, etc., except within the existing coastal settlements of the gulf. Moreover, even in these settlements, the potential for locating accommodations is limited due to the protection regime.

The main directions of the RSPF regarding other technical infrastructure focus on the completion and modernization of the water supply and sewage systems in the tourist settlements of the coastal area, with the sensitive ecosystem of the Amvrakikos Gulf being the receiving environment. The RSPF, therefore, recognizes the value of protecting the Gulf from terrestrial human activities, addressing it as a unified receptor for areas of organized aquaculture development, and promoting its gentle highlighting and utilization as a valuable ecosystem. A key direction focuses on the protection of the ecosystem and its mild tourism development, avoiding interventions that would require construction. It also proposes the prohibition of construction at the river mouths along the Amvrakikos Gulf, through the establishment of Special Protection Area Zones, and the implementation of environmental measures that contribute to the drastic reduction of pollution load from industrial and agricultural waste in the water receptors of the Gulf.

The urban planning of the Municipality of Preveza has been regulated in recent years through the provisions of the General Urban Planning Scheme of 2009, which remains in effect to this day, and outlined the division of the city into nine Urban Planning Units. Preveza is not a typical example of a coastal city that develops linearly, along the coastline, in direct continuation and connection with its maritime space. The city's relationship with the sea has also determined the way in which the relevant land uses were organized. The urban planning schemes that have been applied over time have allowed for a gentle urban diffusion, as an extension of the development of the city's historic center, where the urban fabric is compact, as a result of the regulatory framework for construction within its boundaries. The expansion of the discontinuous urban fabric of the city center occurred parallel to the southwestern part of the western peninsula on the side of the Ionian Sea, as well as on the eastern peninsula towards the side of the Amvrakikos Gulf. In both sides, a gentle densification is observed in the locations of the settlements, as the residential expansion in these areas is governed by clear construction regulations that respect the environment. Recently, the Special Urban Planning Scheme (SUPS) for the Coastal Front of Epirus is being developed, which includes Preveza. It appears, therefore, that the prevailing urban and spatial planning model

advocates for balanced coastal urban diffusion, which has taken place in a relatively moderate manner—evident from the absence of pronounced urban sprawl. This planning approach has contributed, on the one hand, to the relatively sustainable preservation of a compact urban fabric and, on the other hand, to the upgrading of the transitional peri-urban zone. The eastern coastal frontage, where the port and the Preveza Marina are located, plays a significant role in the recent development model adopted by the municipal authority, while investment interest is also directed towards the western coastal frontage, along the Ionian Sea, for the establishment of hotel facilities.

In relation to the sectors of economic activity, the agricultural sector is particularly developed in the wider region of Preveza. In the area located between the Louros and Arachthos rivers, both of which discharge into the Amvrakikos Gulf, there are land improvement infrastructure serving cultivated areas, which have been progressively decreasing over time (between 2015 and 2021, a reduction of approximately 50% in these areas was observed). The impacts of agricultural production are widespread and highly dispersed throughout the protected area of the Amvrakikos Wetlands National Park (AWNP). It should be noted that the critical control points for agricultural impacts pertain to inputs of nutrients (organic and chemical fertilizers, growth hormones, etc.) and plant protection products, as well as the outputs of residues from the aforementioned elements [35]. The livestock sector is also significantly developed in the Regional Unit of Preveza. The majority of the related operations are located in the plain area, with their units appearing to potentially impact the ecosystemic balance of the Amvrakikos Gulf. In the past decade (2011-2021), populations of cattle, sheep and goats, pigs, and poultry have increased by between 31.30% and 317,000% [36]. In addition, the city relies heavily on economic activities such as fishing, aquaculture, and the processing of fishery products. It boasts extensive fishing grounds along its coastlines, both in the Amvrakikos Gulf and the Ionian Sea, as well as a rich network of inland waters.

Preveza is a coastal city where tourism has never been a monoculture. The recent attempt to gradually intensify tourism activities, starting when the city decided to develop through tourism as well, has not yet resulted in issues regarding carrying capacity [37]. The period of economic and fiscal crisis that affected Greece from 2009 appears to have impacted Preveza until 2014. After 2012, when the lowest visitor arrivals and overnight stays were recorded, a positive trend in tourism influx to Preveza was observed. Between 2010 and 2020, the arrivals of foreign tourists increased by 187.25%, making it crucial to plan for a holistic approach to the tourism product [38].

3.2 The Amvrakikos Gulf

It is one of the most important wetland areas in the country, with its ecological richness attracting attention at both the national and international levels. In addition to the marine ecosystem of the Gulf, wetland ecosystems surrounding it cover an area of over 220,000 st., making it one of the most complex wetland complexes, at least in Greece [39]. The significant biological, ecological, aesthetic, scientific, geomorphological, and educational value of the area has been internationally recognized through its inclusion in the Ramsar Convention's list of wetlands of international importance, its designation as a "special protected area" under the Barcelona, Bern, and Bonn Conventions, and the delineation of four areas within the Natura 2000 Network. The diversity of habitats

found in the Amvrakikos Gulf is shaped by the deltas of the Louros and Arachthos rivers, which flow into the northern part of the gulf. The ecological, economic, and cultural significance of the Gulf's ecosystems has both necessitated the understanding of their structure and dynamics and, as a particularly important ecological complex, led to its inclusion under a national protection regime, in the context of numerous conventions and decisions. Indicatively, the following are mentioned: Laws 2742/1999 (207/A'), 3044/2002 (197/A'), 4519/2018 (25/A'), 4685/2020 (92/A') and 4964/2022 (150/ A'), as well as the Joint Ministerial Decisions 30027/1193/1990 (194/B') and 11989/2008 (123/D').

Pollution phenomena in the Gulf were officially identified and documented for the first time during the 1970s, primarily as a result of waste discharges from livestock farming units transported via the Louros and Arachthos rivers, as well as the direct disposal of untreated urban wastewater. Concurrently, elevated concentrations of phosphates were first detected at the estuaries of these rivers and associated streams, a consequence of the intensification of agricultural practices. In recent decades, the degradation of water quality in the Gulf has intensified. Over 50% of its surface area is now characterized by oxygen-deficient water masses (hypoxic or anoxic zones). At depths below 20 meters, oxygen concentrations are critically low, rendering the environment inhospitable to most aquatic organisms [40]. At present, the ecological condition of the Gulf is classified as poor [41]. Furthermore, it has been demonstrated that the widespread decline in fish production is due to the combined effects of increasing fishing pressure and the ongoing environmental degradation of coastal ecosystems—most notably, the spatial and temporal expansion of the anoxic zone. All of this is occurring within a highly sensitive and ecologically significant area that has been designated as a National Park and benefits from substantial institutional protection.

Human activities have contributed significantly both to the shaping of the Gulf's landscape and to its current environmental condition. In the name of development, a series of public and private projects were carried out in the area. However, several of these actions were implemented without proper planning, in an uncoordinated manner, and without consideration for sustainability or the protection of the Gulf's rare ecosystems. The pressures currently exerted on the Amvrakikos Gulf can be broadly categorized into three main groups: pollution; disruption of the hydrological balance—both of the Louros and Arachthos Rivers and of the Gulf itself; and a range of anthropogenic activities, either legal or illegal, occurring in the wider region (within both the Gulf and its surrounding coastal zone).

Indicative factors contributing to environmental degradation include urban expansion, agricultural intensification, mismanagement of water bodies discharging into the Gulf, and the implementation of various infrastructure projects (e.g., port works, road construction, drainage systems, land reclamation), all of which contribute to the fragmentation and degradation of the natural landscape, intensifying ecosystem disturbance. In addition, several activities occurring outside the legal framework further deteriorate the environment. These include unauthorized road construction and illegal infilling of wetland areas, encroachments along riverbanks, operation of illegal landfills, unregulated sand extraction and dumping of construction debris, livestock units operating without functional wastewater treatment systems, overgrazing, illegal logging of

riparian forests, and improper disposal of agrochemical substances such as pesticides and fertilizers. Moreover, unregulated and excessive hunting and fishing activities degrade and alter the composition of local fauna by disrupting the food web and ecological balance of the Gulf's habitats.

4 Context of interaction

In 1872, the first regime for the protection of a sensitive ecosystem prioritized humans over the protected entity itself, while environmental protection was initially excluded from the policy framework of the former European Economic Community (EEC), which, in its founding act—the Treaty of Rome in 1957—set as its sole objective the economic cooperation among its member states. Environmental protection was recognized for the first time as an objective of the European Union only in 1972, during the Paris Summit, as it gradually became clear that economic development could not be pursued independently of environmental policy, nor without a clear social and ecological orientation. Until then, political and economic systems, often in conflict with ecological principles, regarded environmental resources as inexhaustible.

In this context, the Amvrakikos Gulf has historically been perceived as an inexhaustible source of economic wealth. However, its ecological distinctiveness—particularly the vulnerability of its wetland complex—only began to receive systematic attention in the 1980s, primarily triggered by the observed decline in catch. The environmental degradation of the Gulf resulted from unregulated anthropogenic activities such as pollution and the overexploitation of its ecosystem resources. Environmental protection was formally established as an autonomous field of action within the European Community in 1986. In 1987, in an effort to address and resolve the then-ongoing environmental crisis, the United Nations' World Commission on Environment and Development introduced the concept of sustainable development, which became associated with the imposition of stricter environmental protection standards. It was not until 1997 that the Community addressed environmental protection independently of economic growth, while the principle of sustainable development was officially articulated and later ratified by Greece in 1999.

The revisions of the Greek Constitution in 1986 and 2001 incorporated the principle of sustainability as a legal norm, from which obligations, commitments, and restrictions arise for the legislative power, public policies, and private activities. Law 1650/1986, in conjunction with its amending Laws 3937/2011 and 4685/2020, set the national framework for the protection of the environment and biodiversity. These laws defined, among other things, the categories of protected areas and the procedures for their designation. The amendments introduced by the 2020 environmental law concerning already protected areas under Articles 18–21 of Law 1650/1986 primarily aimed to align Greece with EU directives regarding the biodiversity protection of environmentally sensitive zones. The law clarified procedures for the inclusion (or exclusion) of areas in the Natura 2000 network. Specifically, Law 4685/2020 sought to streamline the issuance of Presidential Decrees under Article 21 of Law 1650/1986 by requiring the preparation of a Special Environmental Study (SES) as a prerequisite, along with a

Management Plan (MP). These instruments are intended to define the permitted land uses within the designated protection zones on a case-by-case basis. However, this process is largely not implemented in practice.

The protective measures that have been implemented were often perceived by the local population, to some extent, as impediments to regional development. Crucially, when ecosystem conservation efforts are decoupled from the productive functions of the landscape, they tend to result in superficial, short-term preservation initiatives. Concurrently, local economic development strategies often revolve around the formulation of growth plans which, within the constraints of the prevailing regulatory framework, amount to fragmented and poorly coordinated interventions. Such approaches have long-term adverse implications for both the natural environment and human systems. Therefore, the environmental degradation of the Amvrakikos Gulf can be interpreted as a gap in local development planning, as the relevant local authorities had, until recently, failed to recognize the Gulf's significance as a local development factor. Simultaneously, the lack of public awareness led residents to view the natural environment as a hindrance rather than a contributor to the development process.

Although the criteria for designation and the principles governing the protection of National Parks throughout the country were established in 1986 (Law 1650), the Amvrakikos Gulf was not officially designated as a National Park until 2008. Over time, several weaknesses have been identified within the relevant Greek legislative framework. The first of these weaknesses concerns the absence of management plans. In 1986, the Greek regulatory framework stipulated the establishment of administrative and operational regulations for the management units, as well as the preparation of management plans (MPs) for the protected areas in question, following the completion of a Special Environmental Study (SES). Since then, only one SES was carried out in 2004, as a prerequisite for the designation of the Amvrakikos Gulf as a National Park in 2008. Although the legislation provides that MPs should be periodically revised and updated through new SESs, in accordance with extensive and qualitative changes observed within protected zones—so as to substantiate the significance of the protected object and the necessity of the proposed conservation measures—a new SES was not commissioned by the Ministry of Environment and Energy (YPEN) until 2019. Furthermore, longitudinal analysis of the regulatory framework governing permissible land uses within protection zones indicates a gradual intensification of allowable projects and activities, the implementation of which may be authorized within these areas, albeit subject to specific conditions and requirements. Additionally, over time, provisions have been introduced allowing for exceptions and derogations from protective regulations for certain projects and activities within protected areas, which may contribute to the degradation of the associated ecosystems.

The management units were initially designed to be governed by administrative boards comprising, among others, representatives of the respective first and second level local government authorities as well as productive organizations active within the area of the protected site. However, according to the 2020 Environmental Law, the newly established Board of the Natural Environment and Climate Change Agency no longer includes representation from either local authorities or local productive stakeholders. This shift reflects the adoption of a centralized governance model for sensitive

areas, through the abolition of the institutional autonomy previously granted to the Protected Areas Management Units (PAMUs), effectively marginalizing local self-government.

Pursuant to recent environmental legislation, Protected Areas Management Bodies (PAMBs) are mandated, among other responsibilities, to generate revenue through the imposition of fines in cases where violations of protection measures are identified, and to conclude programmatic agreements with competent authorities for the surveillance and enforcement within their jurisdiction. However, the exercise of these competencies is effectively hindered due to fragmented and/or conflicting legal frameworks that do not provide the necessary institutional clarity and support for their implementation. Moreover, although the legislator has, albeit subjectively, defined threshold values aimed at preventing the exceedance of the ecosystem carrying capacity for elements of biodiversity and ecosystem resources, the relevant regulatory provisions are not universally applied, as a significant portion of society does not comply with them. Nevertheless, even these exceptions are sufficient to cause environmental degradation, due to the inherent vulnerability and sensitivity of protected ecosystems.

Within the ever-changing environment they inhabit, coastal settlements are required to monitor changes, protect themselves, adapt, and survive. In essence, they are called upon to pursue resilience—safeguarding their citizens, their activities, and the adjacent ecosystems. An essential ally in this effort can be an integrated planning approach, which should aim to promote the sustainable management of coastal areas by leveraging the natural features and character of coastal zones. At the level of the European Union (EU), the integrated management of coastal zones in the Mediterranean Sea region (as defined in Article 1 of the Convention) constitutes an integral component of the EU's Integrated Maritime Policy, which was endorsed by the European Council in Lisbon in December 2007. In this context, the Protocol on Integrated Coastal Zone Management (ICZM) in the Mediterranean, or the ICZM Protocol, which constitutes the seventh Protocol of the Barcelona Convention, is recognized as an international legal instrument for the sustainable management, use, and development of coastal zones, with the aim of preserving coastal ecosystems, landscapes, and natural resources. The Protocol promotes a participatory and collaborative framework between the public and private sectors, including civil society and various economic stakeholders, through more coordinated and integrated approaches that take into account the transboundary nature of the environmental issues to be addressed [42]. Member States are required to develop action plans and to incorporate into their national strategies, among other things, the protection and sustainable use of coastal zones, the safeguarding of the characteristics of specific coastal ecosystems, the recognition of the natural and cultural value of coastal landscapes, and the preservation of local natural resources from certain economic activities. For this reason, effective governance and the participation of relevant stakeholders must be ensured, along with the implementation of awareness-raising, training, education, and research activities.

The Amvrakikos Gulf has the potential to enhance the dynamics of Preveza through both primary sector activities and tourism. This interaction, however, must be characterized by mutual respect—particularly from the contemporary urban center, which constitutes the dominant partner within this interdependent nexus. The productive

activities developed by residents within the AWNP must be aligned with the preservation of nature and landscape. Preveza has the capacity to coexist harmoniously with the Amvrakikos Gulf. Their interaction can yield mutual benefits. However, the city must demonstrate genuine respect for and actively protect this sensitive ecosystem. The city stands to gain considerably more from a healthy and balanced relationship. To achieve this, regulatory provisions and measures should be established for all activities before they pose a threat. Pressures should be addressed holistically rather than individually, adopting small solutions for large-scale problems. Moreover, in Greece, it may not be necessary to establish new laws, but rather to improve existing ones by eliminating conflicting provisions within the current legislation and ensuring strict adherence to the existing legal framework. At the same time, effective supervision and enforcement of the terms and regulations set forth in the environmental protection regulatory framework must be implemented, while the development of environmental awareness among residents is an essential and possibly primary prerequisite.

5 Conclusion

In Greece, legislative initiatives aimed at addressing the protection and conservation of ecologically sensitive areas appear to have fallen short of achieving both the required level of environmental safeguarding and the effective promotion of their significance in advancing sustainable development. The underlying causes are multifaceted, including inadequate regulatory frameworks, administrative shortcomings, lack of coordination—and potentially, lack of interdisciplinary approaches—limited public participation, weak environmental monitoring, and insufficient financial resources to implement the measures arising from the terms and restrictions imposed by protective regimes. It is a fact that, despite the existence of legal tools, binding commitments, and clearly defined obligations for environmental protection available to the competent authorities, scientific evidence and observations do not indicate a reduction in environmental pressures. Many of the regulatory provisions related to environmental protection have been revised periodically, ostensibly to enhance protection through the modernization of environmental legislation. However, due to the procrastination of central authorities and the lack of an integrated legislative approach to the issue, the work of Management Units has been hindered—reducing them to mere observers and recorders of adverse events affecting the protected areas, rather than active agents of conservation. Consequently they did not provide significant assistance in the conservation—and certainly not in the improvement—of the protected ecosystems. Moreover, relevant laws and regulatory provisions are often enacted after significant delays, and their implementation may not take effect until long after their formal adoption.

In countries with a multi-tiered system of governance the local level is the one most directly connected to the challenges and opportunities of the coastal zone. Local authorities have a vested interest in, and are significantly affected by, the ecological integrity and economic viability of coastal areas. They are also among the primary entities impacted by insufficient development and environmental degradation, as many coastal stakeholders are embedded within the structure of local governance. Therefore, it is

imperative that local authorities are fully engaged and systematically integrated into the framework of integrated coastal zone management. A key prerequisite for success is the acceptance of the management plan by the local population, which may require compensatory investments to offset potential short-term income losses resulting from restrictions on the unrestricted exercise of certain economic activities. Additionally, the establishment of a management body is essential—one that includes, on the one hand, representatives of the state apparatus responsible for biodiversity-related issues and members of the scientific community, and on the other, primarily local stakeholders and representatives who articulate the local development vision in alignment with the protection and conservation of the area's distinct ecosystems.

Among all global ecosystems, wetlands present some of the most contentious, complex, and politically sensitive contemporary environmental challenges. Their future appears to be predominantly influenced by the trajectories of economic, social, and political development, as well as by the resolution of conflicts emerging from the administrative and legislative framework. However, their ecosystem services hold significant value for society, which can be expressed in economic terms. Consequently, the preservation of wetland biodiversity elements, combined with the sustainable development of interacting urban systems, should be the primary goal of managing any relevant dipole, ensuring that local communities are not marginalized and their economic prosperity is not jeopardized. There is an urgent need for the implementation of cohesive and integrated management frameworks, moving away from isolated and disconnected services and actions. An integrated approach should focus on innovation and targeted actions towards desired development, while simultaneously enhancing the resilience of all factors that need to be protected, namely the environment, the economy, and society.

References

1. Moutzouris, K.I.: Coastal Zone Management in Greece within the Framework of Directive 2000/60/EC. In: Conference: Directive 2000/60/EC – Alignment with the Greek Reality. NTUA, Athens (2001). (in Greek)
2. Committee for the Study of Climate Change Impacts (CSCCI): The environmental, economic, and social impacts of climate change in Greece. Bank of Greece, Athens (2011). (in Greek)
3. Development Assistance Committee (DAC): Sustainable use of wetlands. Guidelines on aid and environment. OECD (1996).
4. Fytoka, E., Tompoulidou, M., Hatziiordanou, L., Apostolakis, A.: Wetlands in Mainland Greece: Number, Area, and Spatial Distribution. Goulandris Natural History Museum – Greek Biotope/Wetland Centre, Thermi (2020). (in Greek)
5. Myers, S.C., Clarkson, B.R., Reeves, P.N., Clarkson, B.D.: Wetland management in New Zealand: Are current approaches and policies sustaining wetland ecosystems in agricultural landscapes? Ecological Engineering, 56, 107-120 (2013)
6. International Union for Conservation of Nature (IUCN): Annual Report 2019. https://portals.iucn.org/library/sites/library/files/documents/2020-025-En.pdf, last accessed 2025/5/12.
7. Coad, L., Burgess, N., Fish, L., Ravillious, C., Corrigan, C., Pavese, H., Granziera, A., Besançon, Ch.: Progress towards the Convention on Biological Diversity terrestrial 2010

and marine 2012 targets for protected area coverage. Parks: the international journal for protected area managers 17(2), 35-42 (2010)
8. Velegrakis, A.: THALES Research Proposal: Assessing the Impacts of Sea Level Rise on Insular Coastal Zones in the Aegean Sea. University of the Aegean, School of Environmental Studies, Department of Marine Sciences (2010). (in Greek)
9. Klabatsea, I.: Local development of small islands with intense specialization in tourism: Cost and benefits in the framework of sustainable development. WIT Transactions on Ecology and the Environment, 98, 205-214 (2006)
10. Commission of the European Communities (EEC): Communication from the European Commission to the Council and the European Parliament on Integrated Coastal Zone Management: A Strategy for Europe. COM (2000) 547 Final. Brussels (2000)
11. Kenanidou, Ch.: Management of Marine Flooding Risks in the Coastal Zone. Master's Thesis. Aristotle University of Thessaloniki, Department of Civil Engineering. Thessaloniki (2017). (in Greek)
12. Washburn, D., Sindhu, U.: Helping CIOs Understand "Smart City" Initiatives. Forrester Research (2010)
13. Oppenheimer, M., Glavovic, B.C., Hinkel, J., van de Wal, R., Magnan, et al.: Sea level rise and implications for low-lying islands, coasts and communities (Chapter). In: Oppenheimer, M., Glavovic, B.C., Ghosh, T., Special Report on the Ocean and Cryosphere in a Changing Climate, 321-445. Cambridge University Press, Cambridge, UK and New York, NY, USA (2019)
14. Powell, E.J., Tyrell, M.C., Milliken, A., Tirpak, J.M., Staudinger M.D.: A review of coastal management approaches to support the integration of ecological and human community planning for climate change. Journal of Coastal Conservation, 23, 1-18 (2019)
15. Todd, P.A., Heery, E.C., Loke, L.H.L., Thurstan, R.H., Kotze, D.J., Swan, C.: Towards an urban marine ecology: Characterizing the drivers, patterns and processes of marine ecosystems in coastal cities. Oikos, 128(9), 1215-1242 (2019)
16. Borchert, S.M., Osland, M.J., Enwright, N.M., Griffith, K.T.: Coastal wetland adaptation to sea level rise: Quantifying potential for landward migration and coastal squeeze. Journal of Applied Ecology, 55, 2876-2887 (2018)
17. Nguyen, N., Friess, D., Todd, P., Mazor, T., Lovelock, et al.: Maximising resilience to sea-level rise in urban coastal ecosystems through systematic conservation planning. Landscape and Urban Planning, 221(104374), 1-12 (2022)
18. Koutrakis, M.: Selected Issues in Environmental Management: The Case of Greek Wetlands. Goulandris Natural History Museum – Greek Biotope/Wetland Centre, Thermi (1996). (in Greek)
19. Millennium Ecosystem Assessment: Ecosystems and human well-being: wetlands and water synthesis. A Report of the Millennium Ecosystem Assessment. World Resources Institute, Washington, DC (2005)
20. Woodward, R.T., Wui, Y-S.: The economic value of wetland services: a meta-analysis. Ecological Economics, 37, 257-270 (2001)
21. Barbier, E.D., Acreman, M., Knowler, D.: Economic valuation of wetlands: A guide for policy makers and planners. Ramsar Convention Bureau, Gland, Switzerland (1997)
22. Gerakis, P.A.: Wetlands. Goulandris Natural History Museum – Greek Biotope/Wetland Centre, Thermi (1993). (in Greek)
23. Tzatzaki, V.: Adapting the legal framework of natural marine resources management to climate disruption: The case of Greece. Arctic Review on Law and Politics, 9, 359-376 (2018)

24. European Commission (EC): The European Green Deal. COM (2019) 640 Final. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels (2019)
25. Davidson, N.C.: How much wetland has the world lost? Long-term and recent trends in global wetland area. Mar. Freshw. Res. 65(10), 934-941 (2014)
26. Tiner, R.W.: Watershed-based Wetland Planning and Evaluation: A Collection of Papers from the Wetland Millennium Event. August 6–12, 2000; Quebec City, Canada. Association of State Wetland Managers, Inc., Berne, NY (2002)
27. Reis, V., Hermoso, V., Hamilton, S.K., Ward, D., Fluet-Chouinard, E., et al.: A global assessment of inland wetland conservation status. Bioscience 67(6), 523-533 (2017)
28. White, E.E., Ury, E.A., Bernhardt, E.S., Yang, X.: Climate change driving widespread loss of coastal forested wetlands throughout the North American coastal plain. Ecosystems 25(4), 812-827 (2022)
29. Ballut-Dajud, G.A., Sandoval Herazo, L.C., Fernandez-Lambert, G., Marín-Muniz, J.L., Lopez Mendez, M.C., Betanzo-Torres E.A.: Factors affecting wetland loss: a review. Land 11(3), 434 (2022)
30. Seifollahi-Aghmiuni, S., Kalantari, Z., Egidi, G., Gaburova, L., Salvati, L.: Urbanisation-driven land degradation and socioeconomic challenges in peri-urban areas: insights from Southern Europe. Ambio 51(6), 1446-1458 (2022)
31. Niu, Z., Zhang, H., Wang, X., Yao, W., Zhou, et al.: Mapping wetland changes in China between 1978 and 2008. Chinese Science Bulletin 57(22), 2813-2823 (2012)
32. Duan, H., Yu, X., Xia, S., Zhang, G.: Waterbird habitat loss: fringes of the Yellow and Bohai seas along the East Asian–Australasian Flyway. LDD 32(15), 4174-4182 (2021)
33. Geneletti, D., Scolozzi, R., Esmail, B.A.: Assessing ecosystem services and biodiversity tradeoffs across agricultural landscapes in a mountain region. International Journal of Biodiversity Science, Ecosystem Services & Management 14(1), 188-208 (2018)
34. Greek Biotope/Wetland Centre and Attica Region: Climate Change Vulnerability Assessment of Wetlands in the Attica Region and Strategic Action Plan. Goulandris Natural History Museum – Greek Biotope/Wetland Centre, Athens (2014). (in Greek)
35. Karras, G, Manos, G., Ifanti, P., Mparouhas, P., Patakioutas, G., et al.: The Hypoxic Zone of the Amvrakikos Gulf: Mapping, Impacts, and Management. Subproject 5 – Reports B and C: Qualitative and Quantitative Analysis of the Drainage Canal Inputs to the Amvrakikos Gulf and Their Contribution to the Development of the Hypoxic Zone. Technological Educational Institute (TEI) of Epirus, Arta (2017). (in Greek)
36. Payments and Control Agency for Community Support Schemes and Guarantees: Aggregate Data of Single Exploitation Applications: Database related to the evolution of plant and animal capital for the period 2011-2021. OPEKEPE, Athens (2023). (in Greek)
37. Tzoumas, V.: Coastal residential complexes in the vicinity of protected ecosystems. Interactions in the Preveza - Amvrakikos gulf dipole. Master's Thesis. NTUA, School of Architecture. Athens (2023). (in Greek)
38. Institute of the Greek Tourism Confederation (INSETE Intelligence): Region of Epirus: Annual Report on Competitiveness and Structural Adjustment in the Tourism Sector for the Year 2020. December 2021. Athens (2021). (in Greek)
39. Amvrakikos Gulf – Lefkada Management Unit (ALMU): Amvrakikos, a Rich and Generous Nature. Preveza (2020). (in Greek)

40. Hellenic Centre for Marine Research (HCMR): Oceanographic study of Amvrakikos Gulf. Ministry of Environment, Physical Planning and Public Works, Athens (1989). (in Greek)
41. Albanis, T.: Pollution problems of Amvrakikos Gulf. University of Ioannina, Department of Chemistry, Ioannina (n.d.). (in Greek)
42. The Council of the EU: Council Decision of 4 December 2008 on the signing, on behalf of the European Community, of the Protocol on Integrated Coastal Zone Management in the Mediterranean to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (2009/89/EK). Official Journal of the European Union (2009)