THE ENVIRONMENTAL PROFILE OF CHIOS ISLAND

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Abstract
The present study examines the environmental physiognomy of Chios with the intention of representing the island's unique natural characteristics and the major challenges. Based on primary and secondary sources, the research combines a literature review of the environmental characteristics with a qualitative SWOT analysis. The findings indicate a distinctive geographical location, biodiversity and cultural heritage as key strengths, with the cultivation of mastic, recognized by UNESCO, being a central element. The weaknesses include resource limitations and inadequate infrastructure. Opportunities occur in the areas of renewable energy, ecotourism and the circular economy, while threats include frequent forest fires, overfishing, and geopolitical pressures due to Chios' sensitive location on the border that need to be addressed. The research highlights significant research gaps, especially in environmental monitoring, emphasizing the need for evidence-based policies. Nonetheless, the available information provides a useful basis for constructing an environmental overview of Chios. In conclusion, interesting findings are drawn about the integrated picture of the environmental physiognomy of Chios and possible challenges that need to be faced for the protection and preservation of the unique environmental character of this island.

Keywords: Environmental physiognomy, Chios, SWOT analysis, sustainability, mastic, environmental policies

Introduction

Understanding the environmental profile of a region is crucial for capturing its identity and adopting suitable sustainable management strategies. Environmental physiognomy is particularly important for determining the identity of a region. The term physiognomy is used to describe the characteristics that distinguish a region and it is reflected in a wide range of characteristics and features relating either to the natural environment, such as the topography and natural formations, as well as elements of cultural and historical significance. (Stefanou, 2000) This study focuses solely on environmental characteristics and challenges. The aim is to identify and describe them and then investigate their internal strengths and weaknesses and external opportunities and threats. The analysis is based on an extensive review of both primary and secondary sources including reports from governmental and regional reports, academic literature and documents from environmental organizations.

Environmental Features of Chios

Chios is the fifth largest island in Greece, located in the North Aegean Region and is a part of the regional unit along with Oinousses, Psara and Antipsara. It is divided administratively into three municipalities, those of Oinousses, Chios and Psara. The largest of these is the municipality of Chios, which covers the entire island of Chios and has the largest population. Its capital, Chora, where the largest port is based, lies on the island's central-eastern coast, opposite the Erythrea peninsula of Turkey, just 3.5 nautical miles away. (Giannoulopoulos &

Lappas, 2010) The island covers an area of approximately 842 km² and has a population of 51,694 according to the 2021 census. (Hellenic Statistical Authority, 2024)

This distinctive island, situated opposite the coast of Turkey and characterized by a Mediterranean climate, features a highly varied relief, comprising mountainous and semi-mountainous areas, particularly in its northern and central regions. The highest peak is Mount Pelinaios (1,297 m), followed by Mount Oros (1,126 m) to the south, Koklia (770 m), Provatás (807 m), Lepro (650 m) and lower mountains such as Aipos (448 m). South of Chora lies the island's largest plain, while smaller lowland areas are found in the southeastern and southern parts, interspersed among low hills. In the western part of the island, four caves dating back more than 150 million years have been identified. Today, only two are open to the public: Agio Galas Cave, and the Cave of Olympoi, while the others, including Lithio Cave remain accessible only to speleologists. Agio Gala Cave is a part of an underground river system and exhibits complex limestone formations and Neolithic artifacts (c. 5500 BCE) that are not housed in the Archaeological Museum of Chios. The cave of Olympoi is the only cave developed for tourism with a 52 m. deep vertical shaft with rich stalactite and stalagmite formations, dating from the Upper Jurassic, which continue to grow. Its stable microclimate (around 18°C, with >95% humidity) and impressive carbonate formations allow safe guided access while preserving the cave's delicate interior structures. (Municipality of Chios, 2020)

Of particular geological interest is the now inactive volcano of Psaronas in southeastern Chios. Dating to approximately 16 million years ago, it is considered a local landmark as it has shaped the local coastal morphology since its lava is responsible for the black pebbles and stones along the beaches of Emporios, including the well-known Mavra Volia beach, named after them. (Tsagkarakis & Katsikis, 2007)

The island's unique morphology is shaped by its complex tectonic and lithological structure, the latter evident in its hydrographic network, particularly in the absence of large streams and lakes. The few rivers of Chios are short in length, the largest being the Chalikia (Potamiá) and the Mallaggiotis, while blue surfaces are limited to them. (Region of North Aegean, n.d.). According to WWF Greece, Chios hosts about 0.03% of the country's natural and artificial wetlands. Its coastline is moderately indented with bays, beaches, capes, and a large open gulf on the western side, giving the island a crescent-like shape. Among the most popular are Mavra Volia with its volcanic black pebbles, Komi, Daskalopetra, Glaroi and Agia Markella. (Katsadorakis & Paragamian, 2007)

Chios belongs primarily to the thermo-Mediterranean vegetation zone, except for its central part, which belongs to the meso-Mediterranean zone. In humid areas, species of maquis vegetation appear, such as wild olive, holm oak, mastic, myrtle, laurel, oleander and arbutus. In less humid areas, there are low xerophytic shrubs, usually aromatic, medicinal, and aromatic plants, such as oregano, thyme, lavender, sage, galangal, and amaranth. The plain south of Chora is very important for the biodiversity of the area, where a special variety of wild mushrooms grows among the citrus trees. Chios also hosts remarkable floral diversity, including 76 of Europe's 250 orchid species, which thrive across habitats ranging from coastal areas and wetlands to agricultural land and mountain slopes. Mount Pelinaio is also home to the rare and protected Fritillaria pelinaea, while the island supports four tulip species (Tulipa aegenensis, T. undulatifolia, T. clusiana, and T. praecox), which locals call lalades. (Municipality of Chios, 2020)

The most renowned protected species is the Pistacia lentiscus var. chia, from which mastic is produced. This evergreen shrub grows exclusively on the southern side of the island, in the Mastihohoria Villages. Beyond its agricultural value, mastic embodies deep cultural, social, and economic significance for the locals. It is worth noting that in 2014, mastic cultivation in Chios recognized the collective, family-based labor practices and intergenerational knowledge transmission that sustain it, was inscribed on UNESCO's

Representative List of the Intangible Cultural Heritage of Humanity. The entire cultivation process involves everyone through gender specific roles: men handle the fertilization and pruning, while women prepare the soil, collect, and clean the resin, with older and experienced members preserving and transmitting the techniques. These practices are not only labor-intensive but also constitute a communal event, reinforcing networks of solidarity and cultural memory. (UNESCO, 2016) As Leontidou-Moutafi (2004) highlights, the values attributed to mastic through production and marketing practices connect the product to its place of origin, shaping both symbolic and economic realities, while historical disputes over control of mastic reveal the importance of culture, economy, and representation. (Galani-Moutafi, 2004)

Regarding fauna, Chios is a refuge for a few endemic species and many migratory species. The island partridge is most commonly found on the mountainous side of the island, and the Chios sheep is a productive and high-quality domestic animal.

The list of wild fauna in the area also includes mammals such as foxes, martens, hares, and hedgehogs, a few species of rodents, amphibians and a few reptiles. As an island location, it would be remiss not to mention the diverse marine fauna, which includes a plethora of species. Notably, a small population of no more than 9 monk seals, Monachus monachus, inhabits the island's northwestern coast and nearby Psara. (Municipality of Chios, 2020)

The European Ecological Network of Natura 2000 areas has included two areas of Chios under the categories of Special Protection Areas (SPAs) and Sites of Community Importance (SCIs). In the first category (SPAs) for birdlife, as defined in the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council) "for the conservation of wild birds", the area with the code GR4130003, which concerns part of northern Chios and includes the Pelinaios mountain range, is home to 45 species of birds. The second site, coded GR4130001, is categorized under the Habitats Directive and covers north Chios, Oinousses and the coastal marine zone, which includes approximately 18% of the marine area is home to 3 species of reptiles and 8 species of flora, such as Pinus brutia forests, extensive phrygana, evergreen broadleaf shrublands, and plane trees. Its marine ecosystems are equally important, featuring Posidonia oceanica meadows and reef formations that contribute significantly to Mediterranean biodiversity. (European Environment Agency, 2025)

Environmental Challenges & Resource Management Issues of Chios

Fires pose the most serious threat to the ecosystem and forest areas, especially those caused by humans, either through negligence or arson, rather than natural causes like lightning. Chios is no exception, especially its northern part, which is rich in pine forests and, combined with the strong north winds that occur during the summer months, is extremely prone to fires. The worst case was recorded in August 2012, when 20% of the island's area was affected and approximately 147,000 acres were burned, of which 40,000 were agricultural land. As a result of successive fires, the forest ecosystem has been degraded, with possible soil erosion further burdening the ecosystem. (Adaktylou et al., 2020) In particular, signs of desertification are evident in northern Chios, where the rocky subsoil is gradually being exposed and the growth of flora is declining. (Athanasiou et al., 2022) More recently, Chios was again severely affected by a wildfire that broke out on 22 June 2025, burning more than 10,000 acres, although no official post-fire report has yet been published.

Being an island, there is talk of protecting marine fauna primarily from practices such as overfishing, which leads to the destruction of breeding grounds and the obstruction of fish migration routes, and amateur and illegal fishing, illegal fishing, which make it difficult for small fish that are not considered marketable to escape. Finally, with regard to problems related to flora and fauna, it is worth noting that as there are no intensive agricultural or

livestock farming practices in the area, Chios does not suffer from the environmental impacts that accompany them. (Municipality of Chios, 2020)

As mentioned above, there are no significant water resources across the entire surface of the island, and they are limited to small springs, streams, and groundwater. Their quantity is considered insufficient to meet the existing needs of the island's inhabitants, where they can be exploited, as in many areas, their quality is low. (Municipality of Chios, 2020) As far as waste management in Chios is concerned, despite the progress made over the last decade, the problems of uncontrolled disposal continue to exist, with significant impacts on the environment, especially the marine ecosystem. These are expected to be targeted through the local solid management plan of the municipality. However, to this day, no scientific studies are available on the topic.

Chios has a high rate of private car ownership, with 407 cars per 1,000 people and a population density of 427 people/km2. These figures make it the third region with the highest car ownership in the country (Tsouros Ioannis, 2020). In practice, this leads to significant problems that make everyday life difficult for residents, particularly in the city of Chios, including environmental degradation caused by emissions. The road network, already burdened by vehicles, is further exacerbated by the high mobility of the city, as it is a commercial center, It is home to the island's main economic and administrative organizations, part of the University of the Aegean facilities, and key stops for urban and intercity public transport, and connects the port with Chios State Airport "Omiros." The current structure of the road network has been shaped by the evolutionary course of construction without an organized plan. (Municipality of Chios, 2020). It is worth noting that in a questionnaire survey conducted on the physiognomy of the city of Chios at Harokopio University for the postgraduate program in Sustainable Development, respondents cited the lack of modern road network infrastructure as the city's biggest problem.

Methodology

The methodological framework of this study consists of two main components: a literature-based environmental profile and a qualitative SWOT analysis. The first part of the research involves a systematic review and synthesis of existing literature and official reports related to the environmental characteristics of Chios Island. Here, the aim is to analyze the factors, identify the problems and challenges of the island and examine methods for managing contemporary environmental challenges that need to be addressed, such as successive fires. The second part of the study focuses on a qualitative SWOT analysis, examining the environmental strengths, weaknesses, opportunities, and threats of Chios to optimize its resource utilization. The SWOT method is particularly useful for small-scale, localized studies, where complex systems interact at social, economic and ecological levels.

SWOT Analysis

The following sections analyze the strengths, weaknesses, opportunities, and threats facing Chios. In this particular case, it is used to assess the current situation to make the appropriate decisions and formulate the optimal strategy for managing and exploiting its natural resources. It should be noted that strengths and weaknesses stem from internal factors, while opportunities and threats are related to external factors.

Strengths

Starting with its geographical location, Chios occupies a pivotal position in the Eastern Aegean, adjacent to the Greek-Turkish naval borders. That proximity provides fast and direct access to national and international transport routes via its port and airport, which is an essential asset for trade, tourism and also geopolitical significance. The utilisation of the European and national funds for an infrastructure upgrade can strengthen the island's role as a transport hub and an economic gateway.

It is also rich in natural beauty and, due to its diverse topography, combines mountainous landscapes with coastal areas while supporting a varied ecosystem, including the rare mastic tree. Its cultivation, recognized by UNESCO as a unique product of cultural heritage, links the tradition with nature and creates opportunities to strengthen the island's cultural identity, image and economic resilience. In addition, there are areas of particular environmental and ecological interest that are included in the NATURA 2000 network in the northern and central parts of the island. This ecosystemic wealth supports the potential for sustainable ecotourism, conservation and local rural economies.

Weaknesses

As mentioned, the geomorphology of Chios has led to a poor hydrographic network, with a lack of large rivers and lakes, while the few rivers on the island are short, resulting in Chios being largely dependent on mainland Greece to meet its water needs. Another significant weakness is the city's congested and inadequate road network, while access to remote and mountainous areas remains limited. The island faces environmental pressures, such as frequent and intense fires in pine forests and scrubland, which are exacerbated by dry summer periods and strong winds. At the same time, overfishing and generally inadequate management of marine ecosystems are threatening biodiversity, including protected species such as the Mediterranean monk seal.

In addition, the lack of modern urban infrastructure and traffic congestion in the city center may add to the reduction of the quality of life for residents and the experience for visitors. It is crucial to mention that limited scientific documentation in areas such as air pollution, water and waste management makes it difficult to design efficient protection and development policies.

Opportunities

Regarding the potential opportunities for Chios, it is essential to make proper use of existing waste management infrastructure to ensure optimal coordination and implementation of a comprehensive plan while adding circular economy principles. In this regard, the contribution of European and national institutions is important so that the infrastructure can respond to the number of residents and tourists and effectively adapt to the changing needs of the island. Concerning the island's economic opportunities, the development of international and national naval and air transport networks would be beneficial in order to boost economic activity and labor mobility. A typical example that needs to be strengthened is the local entrepreneurship of the Chios Mastic Producers Association and the citrus fruit growers of Kampos. Chios can harness solar and wind energy to reduce its dependence on fossil fuels and enhance its energy independence. The development of alternative energy sources and pilot projects involving the local community can improve grid stability and promote sustainable energy practices.

Threats

The analysis concludes that there is a high risk of fires, which intensifies during the summer months, especially on days with strong north winds, a frequent phenomenon on the island. In addition, in the field of environmental protection, it is necessary to take measures to combat overfishing and preserve marine biodiversity. An additional threat that must be addressed regardless of the season and conditions is the island's dependence on the country's international relations due to its geographical location.

In conclusion, based on the current situation and the above analysis, Chios is a place with many advantages and potential which, if used correctly, can strengthen its position in Greece. Furthermore, by taking the appropriate measures to reduce or even eliminate its weaknesses, in combination with addressing threats, it can become a sustainable island in the Aegean.

Conclusions & Policy Implications

Chios is an island with a unique geographic location, rich natural environment and significant cultural heritage, factors that enhance its potential for sustainable development. The SWOT analysis highlighted the key assets, such as its strategic location in the European borders, the value of the mastic and the protected ecosystems. However, major weaknesses were also identified, the most important being the limited availability of water resources, the inadequate road network and the limited data regarding air pollution, water and waste management indicators. At the same time, the opportunities that came up may be utilized such as, the promotion of agricultural goods, the development of circular practices and ecotourism and the harness of renewable energy resources. Finally, threats found to be intense: frequent forest fires, overfishing and geopolitical pressures due to Chios proximity to a sensitive border zone. The research pointed out the significant research gaps, for instance the lack of systemic data on air pollution, waste and marine ecosystems. The need for further research is required in order to develop evidence-based policies and effectively implement sustainable development strategies. Admittedly, a part of this effort can also be promoted at a local level through academic initiatives, municipality programs and closer cooperation among local authorities and academic and research institutions and environmental organizations.

To sum up, the case of Chios combines rich natural and cultural resources with significant challenges in management and their protection. Building on its potential, coupled with targeted policy framework and investments in infrastructure, research and education may contribute to shaping a resilient and sustainable model for the island.

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