







# Enhancing Heritage Management for Sustainable Development in Insular Areas Through Digital Documentation: The Case Study of the Historic Center of the Megisti Island (Kastellorizo)

Aspasia E. Fafouti<sup>1</sup> , Anastasia Vythoulka<sup>1</sup> , Ekaterini T. Delegou<sup>1</sup> ,  
Agapitos Xanthis<sup>2</sup>, Antonios Giannikouris<sup>2</sup>, Nikolaos Kampanis<sup>3</sup>,  
Georgios Alexandrakis<sup>3</sup>, and Antonia Moropoulou<sup>1,4</sup> 

<sup>1</sup> Lab of Materials Science and Engineering, National Technical University of Athens, Athens, Greece

amoropul@central.ntua.gr

<sup>2</sup> Technical Chamber of Greece-Department of Dodecanese, Athens, Greece

<sup>3</sup> Institute of Applied and Computational Mathematics Foundation for Research and Technology - Hellas (ITE), Athens, Greece

<sup>4</sup> Member of the Executive Committee – Technical Chamber of Greece, Athens, Greece

**Abstract.** Protection and promotion of cultural and environmental heritage could be a key factor of an area's integrated sustainable development plan, while presenting social, environmental, cultural, and economic benefits. In remote areas, sustainable development usually depends on external economies, such as tourism. This study focuses on the Megisti Complex and the historic center of Kastellorizo, aiming to propose an applicable, innovative approach for their sustainable development. Through analysis and documentation of the cultural and environmental assets of the area, a data base of important information was created. Integrated heritage management is one of the main challenges in areas such as Kastellorizo. Involving a diverse set of stakeholders, including users, owners, experts, public agencies, and the private sector was crucial to achieve a holistic approach based in interdisciplinarity. The study's proposals are based on ensuring appropriate infrastructure to enhance the quality of life in local communities and promoting Cultural, Responsible Tourism. Additionally, the study emphasizes on the role of local communities that are considered as the leading stakeholders in the planning, development, and operation of these procedures. The main purpose of this study, focused on Kastellorizo, is to enhance the island's cultural and environmental assets through strategic sustainable planning and the use of Information and Communications Technologies (ICTs). The final goal is to promote the island's international recognition as a significant national border of great geopolitical importance with a unique Aegean cultural identity.

**Keywords:** Sustainable Heritage Management · Island Development · Digital Documentation · Kastellorizo

# 1 Introduction

## 1.1 Cultural Heritage as a Driver of Sustainable Development to Mitigate Insularity

Sustainability, which first brought to the attention of the international community at the United Nations (UN) Stockholm Conference on the Human Environment in 1972 [1], continues to serve as a fundamental basis for international development and collaboration. In the literature, the most widely recognized definition of sustainable development is that proposed by Rutland, which posits that “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [2]. In recent years, the 17 Sustainable Development Goals (SDGs) of 2030 Agenda for Sustainable Development, that first adopted in September 2015 by all United Nations Member States, have 169 specific targets that nations are striving to achieve by 2030 [3, 4]. These specific objectives focus on regional and global stability, ensuring the health and prosperity of the planet, fair and resilient societies, and prosperous economies [5].

Sustainability is widely regarded as possessing three interrelated dimensions, which referred to as the environmental, economic, and social pillars [6]. However, in his work “The Fourth Pillar of Sustainability,” [7] Hawkes argues that culture must be recognized as the fourth pillar of sustainable development, alongside the economy, society, and environment. According to literature, advancement in the integration of culture in sustainable development can be accomplished through the cultivation of the cultural sector, including heritage, creativity, cultural industries, cultural tourism, and crafts, as well as through the allocation of appropriate consideration for culture within all policies, particularly regarding education, economics, science, communication, environment, social cohesion, and international cooperation [8].

Islands, with their well-defined limits and discernible flow patterns, provide ideal “laboratories” for the assessment of sustainability [9, 10]. Based on the “Europe 2000+: Cooperation for spatial planning in Europe” report by the European Commission [11], the specificities of island regions must be recognized and addressed through differentiated development measures. The priorities for these regions include:

- Improving and modernizing road and maritime transportation systems.
- Enhancing passenger and freight transport infrastructure (airports and ports).
- Diversifying the production base.
- Developing human resources.
- Promoting the natural and cultural heritage.
- Facilitating interregional cooperation within the EU.

Moreover, the European Parliament’s report on the preservation of European natural and architectural heritage in rural and island regions highlights the necessity of dedicating special attention to the safeguarding and improvement of the natural and cultural heritage in Europe’s island areas [12]. The principles that must be considered in implementing intervention measures in both rural and island areas are:

- a sustainable balance between population and the environment
- the integrated approach of traditional rural areas
- the participation of local populations in the formulation and implementation of policies and the alignment of their views with central planning.
- Continuous dialogue with civil society organizations and voluntary organizations active in the field of cultural heritage.

Recognizing the significant impact of culture on the sustainable development of islands [13], as highlighted by existing literature, the developing plans for the management and preservation of cultural heritage in insular communities can be linked to the promotion, protection, and enhancement through cultural tourism, cultural reserves, and environmental conservation [14]. It is also imperative to acknowledge the significance of empowering the local communities' involvement in the formulation and execution of islands' sustainable development strategies, as they possess the most intimate knowledge of their community's requirements and priorities [15, 16].

## 1.2 ICTs in Cultural Heritage Management

In recent years, the management and promotion of cultural heritage has become increasingly challenging due to the multiple evolving parameters that need to be considered for effective action planning [17]. According to A. Giannakidis [18], digital tools can be divided into two categories for the use of local communities and cultural organizations: Digital Documentation and Digital Communication. Digital Documentation tools are essential for scientific interpretation, conservation, digitization, and management of cultural heritage, such as a database or a Geographical Information System (GIS).

Digital Communication tools are crucial for disseminating cultural heritage and increasing public access to it. In any case, these digital tools can significantly aid cultural heritage protection bodies and aid in the sustainable management of cultural resources [19, 20]. According to literature, Information, and communication technologies (ICTs) play a critical role in cultural heritage management of isolated islands [21]. ICTs provide a range of tools and platforms that can help address some of the challenges posed by insularity in these regions [22, 23]. Some of the ways that ICTs can contribute to cultural heritage management in isolated island contexts are [24–33]:

- Creating digital records and documentation of cultural heritage sites, which can be used to preserve and protect these sites in the long term.
- Increasing the accessibility of cultural heritage sites, both physically and digitally, by providing virtual tours, online databases, and other interactive resources that can be accessed by a wider audience.
- Educating and raising awareness about the cultural heritage of isolated islands, by providing information and resources to local communities and other stakeholders.
- Facilitating networking and collaboration among cultural heritage stakeholders, including researchers, practitioners, and local communities.

Monitoring and evaluating the impact of cultural heritage management initiatives, by providing real-time data and insights into the state of cultural heritage sites and the effectiveness of conservation and management strategies.

Also, academic research has extensively documented the intricate relationship between tourism and technology, highlighting their interdependence [34, 35]. The growth and widespread use of ICT has had a profound impact on the tourism industry, with far-reaching implications of achieving sustainability, fostering better partnerships with stakeholders, and engaging in meaningful dialogue with the community [36]. Although, the literature highlights the need for further investigation into the potential of using Information and Communication Technology (ICT) to reduce the negative effects of tourism and enhance its positive impact, particularly in conjunction with the promotion and preservation of natural and cultural heritage [37]. In this study, using ICT applications to create data bases, will help the development management of an insular area. ICT applications can also be used for data integration and mapping to provide management organizations and local authorities with a clearer picture of conditions at the destination for better decision-making [38].

## 2 Materials and Methods

The case study of the historic center of Megisti (Kastellorizo) was examined according to the methodology as follows:

- Axis I: Analysis, documentation, modeling, and management of the Cultural and Environmental assets.
- Axis II: Utilization of innovative ICT applications
- Axes III: Design and creation of new products for touristic local development
- Axis IV: Circular economy and social cohesion.

The methodology employed in the analysis of Kastellorizo was based on a comprehensive bibliographic review of relevant data pertaining to the island's natural environment, historical background, architectural and cultural heritage, and social organization. This holistic approach was necessary to thoroughly comprehend the interactions between these factors and their impact on the sustainable development of Kastellorizo. The bibliographic review aimed to provide a detailed and holistic assessment of the island, capturing the full range of its physical, cultural, and social attributes. An active engagement with local entities, such as the Municipality of Megisti as well as with members of the community and relevant stakeholders, was requisite for the purposes of conducting an in-depth analysis. The information collected was combined with the findings of the bibliographic review to describe an accurate representation of the current state of Kastellorizo. The results of this procedure -organized into data sheets, along with the local community's aspirations for sustainable development and the preservation of cultural and environmental assets of Kastellorizo, led to the proposals for the sustainable tourism and energy efficiency initiatives on the island.

### 3 Results and Discussion

#### 3.1 Analysis of the Study Area – The Case Study of the Historic Center of Megisti Island (Kastellorizo)

Megisti (Kastellorizo) is a Greek island of the Dodecanese Island complex in the south-eastern Aegean Sea (Fig. 1a & 1b.). Megisti is the largest island (area 9, 1 sq.km. Coastline 19,5 km.) of a cluster called Megisti or Kastellorizo complex and includes 13 islets. The most well-known of them are the islets Ro and Strongyli. Strongyli is the easternmost tip of Greek territory and was the easternmost tip of the European Union until Cyprus joined. Located just 1.25 nautical miles from the southwest coast of Asia Minor of Turkey, 72 nautical miles from Rhodes and 328 nautical miles from the port of Piraeus, [39] Megisti constitutes a significant national border of great geopolitical importance and possesses a unique Aegean cultural identity.

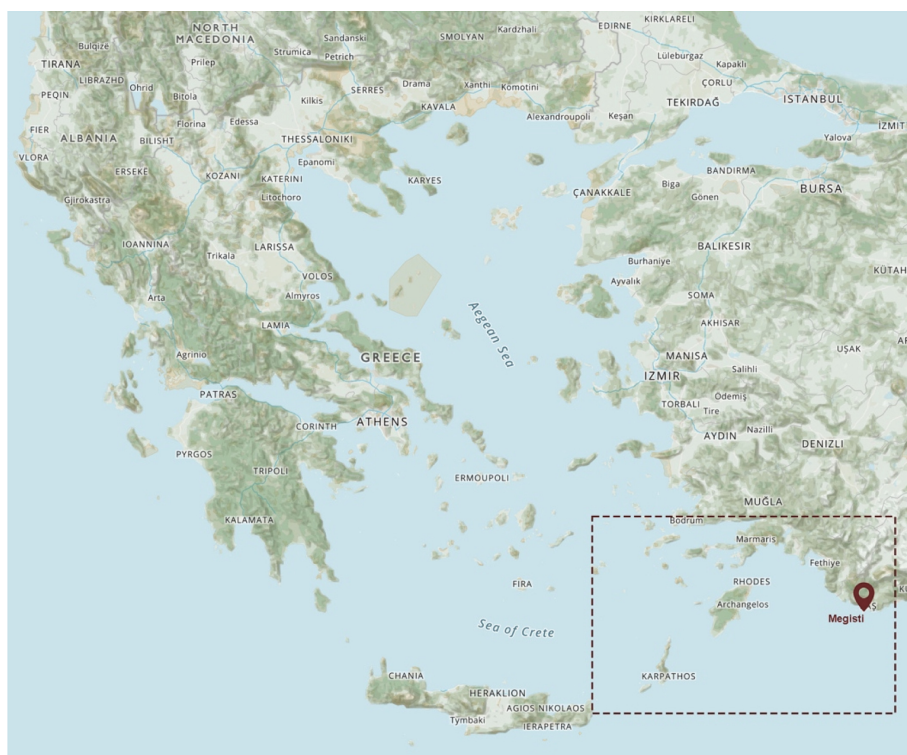
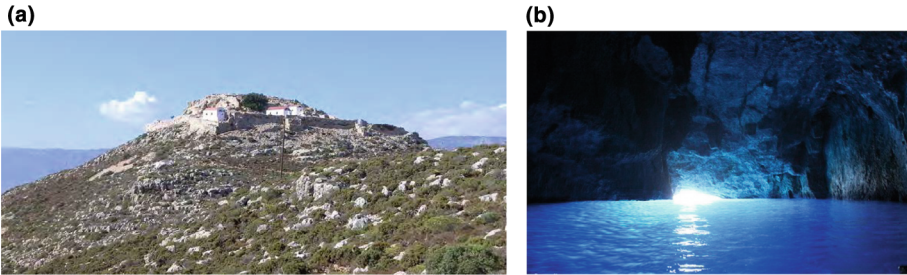


Fig. 1. a. Megisti in the map of Greece

Megisti is connected to the mainland through ferry services from Piraeus and more frequently from Rhodes. The Port Station of Megisti, which is part of the Port Fund of Southern Dodecanese, covers port and sea activities and has Customs services. Despite its small size, Megisti has an airport –4 km from the port- with connections to Athens

and Rhodes, with more frequent flights during the summer and can be reached via the island's only asphalt road. Public transportation on the island includes taxi and summer-only bus services, with boats also available for reaching the caves and beaches of the complex's islets.

The island of Megisti is characterized by its predominantly rocky terrain, with the highest point being Vigla at an elevation of 273 m. The island is notable for the presence of Paleokastro (Fig. 2a), the ancient acropolis that was inhabited until the early 20th century and is located on the highest point of the island, Vigla [40].



**Fig. 2. a. and b.** Paliokastro-the ancient Acropolis of Megisti & Blue Cave

The island's morphological features include a steep coastline that creates a plateau in the largest part of the island, seasonal small reservoirs, and the absence of sandy beaches, as well as a few sea caves, including the Blue Cave, Parastas Hole, Katrantzis cave, Arnaoutis cave, and Colones cave. The Blue Cave (Fig. 2b), located in the southern part of the island, is a particularly notable feature, with a length of 75 m and a height of 35 m, and is widely recognized as an international landmark. The only sandy beach on the island is in the Mandraki (Fig. 3a) district of the settlement [41].



**Fig. 3. a. and b.** Mandraki & Historic center of Megisti

Archaeological evidence suggests that Kastellorizo was inhabited as early as the Neolithic period, and during the Mycenaean and Minoan eras, it was considered a “merchant” of Crete, with commercial relations with the Minoans. The port served as an

intermediary station in transactions with Cyprus. During the Byzantine era, Kastellorizo, along with the other islands near Rhodes, belonged to the provincial insular, and later became part of the Kibyrraeots. During World War II, Kastellorizo was a crucial military base and was used as a supply station by the British after the capitulation of Italy in 1943. However, on October 17, German fighters began bombing the island, leading to widespread destruction, and forcing its inhabitants to evacuate. The bombings ended with the fire on July 6, 1944. Kastellorizo officially became part of Greece in 1948.[42] In the first half of the 20th century, political instability and successive occupations by European states prompted mass immigration from Kastellorizo. Most of the permanent population immigrated to Australia, where they established a thriving Greek community. Today, the population of Megisti reaches 492 inhabitants according to the 2011 census of ELSTAT.

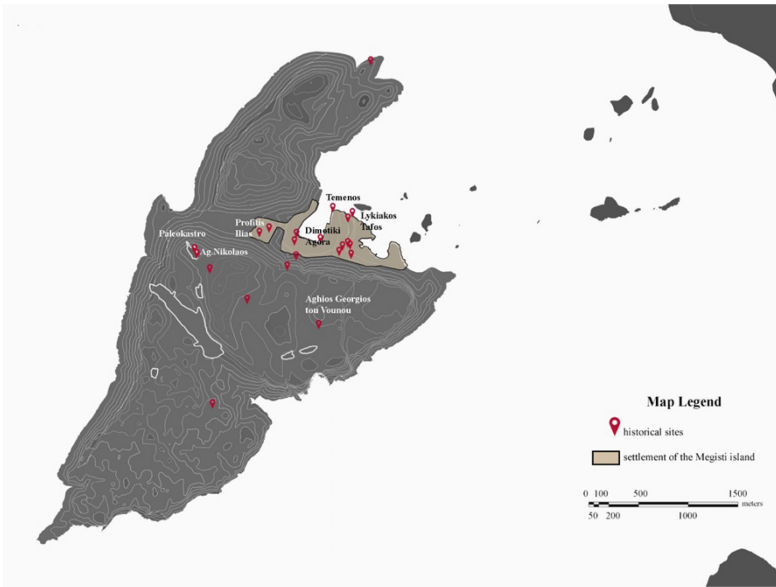
The settlement of Megisti has an amphitheatrical layout and its history -as aforementioned- is reflected in its current form. The urban gaps from the bombings of the war are distinctive, and the houses have neoclassical elements (Fig. 3b.) due to the area's 19th century economic development. The street plan is irregular, and roads were developed based on property lines rather than a plan, following the port's relief and form. The plateaus of the settlement are of interest. Megisti's settlement (Fig. 4) is characterized as a pre-existing settlement as of 1923 according to Greek legislation, and is considered traditional, with a 1,000-m protection zone established to preserve its character. The whole island is declared as an archaeological site and as an area in need of special protection under the Presidential Decree 10-5-2002, which defines the restrictions and special building conditions in the off-plan and out-of-settlement areas of the island.



**Fig. 4.** The Historic center of Megisti (National Cadastre)

The cultural reserve of Megisti (Fig. 5) includes ancient monuments such as the Lycian tomb, the castle of Agios Nikolaos, the Paleokastro, and the acropolis on Mount Vigla. Significant Christian monuments include St. George of the Well, St. Mercury, St. George the Sandrape, St. George of the Mountain, and the Holy Church of Constantine

and Helen. More recent monuments include the municipal market building, the Santrapia urban school, and the old mosque with the historical collection of Kastellorizo.



**Fig. 5.** Megisti complex's cultural reserve

As far as infrastructure concerned, the island has a Kindergarten and a school for primary education, and a Gymnasium for secondary education. A regional clinic with telemedicine and laboratory capabilities also serves the island.

Megisti is an arid island with no springs, so drinking water is transported from Rhodes through an aquifer and stored in a 1000 sq. m tank in Profitis Ilias. The island has a desalination plant in Mandraki that produces 60 sq. m of water per hour. A small portion of the desalinated water is stored in the Prophet Elias tank for drinking, while the rest is used for other purposes. Moreover, the island has a small reservoir with a capacity of 82,500 cubic meters located at Kolia, intended to collect rainwater from the airport and surrounding watersheds for the island's water supply needs. The few crops on the island, mainly family vegetable gardens, have minimal irrigation needs. The reservoir project was completed in 2001, but it has never been filled due to sealing issues. The island's energy infrastructure is mainly the electricity grid, which is supplied by a PPC autonomous station. Renewable energy sources, such as solar energy for domestic water heating, are limited.

Due to the arid and rocky terrain of the island, there is limited development in the primary sector. The only agricultural activity is mainly limited to fodder cultivation for hay, family vegetable gardens, and olive groves for family consumption [43]. There are 14 professional fishermen on the island with 11 small-sized fishing vessels, but the inhabitants' involvement in fishing is limited. Past attempts to establish a tuna farm failed. There is no fishing shelter on the island and both professional and amateur boats



use the central commercial port. In the secondary sector, besides a bakery, there are no processing units or craft enterprises related to primary sector products. The tertiary sector is the most developed production sector on Megisti Island, with a thriving tourism industry. The island gained worldwide recognition due to the Oscar-winning Italian film “Mediterraneo” shot there in 1991 [44] and the spectacular total solar eclipse in 2006, attracting visitors from around the world. The annual Kastellorizo documentary festival “Beyond Borders” (Fig. 6) is also a significant contributor to the island’s prominence and takes place on the Aegean border between West and East. The festival celebrates culture and cinematography and is accompanied by parallel cultural activities, such as art and photography exhibitions, training programs, and workshops, attracting both the local and international community [45].

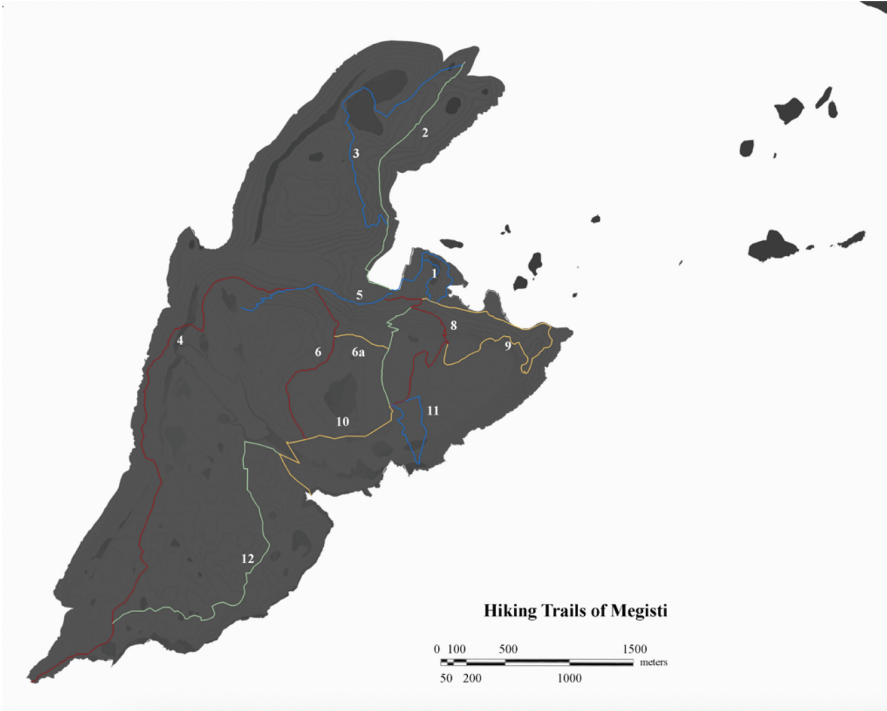


**Fig. 6.** “Beyond borders”-The international Documentary Film Festival of Megisti

### 3.2 Sustainable Development Initiatives in the Historic Center of Megisti

Within the framework of the National Development Program (NDP), the regional development program (RDP) for the southern Aegean 2021–2025 is being prepared. The South Aegean Region is the planning authority and the Special Service for the Management of the Operational Program (OP) of the Aegean Region is the implementing body. The RDP focuses on the insular character and geographical isolation of the region and has five pillars: Smart Development, Green Development, Social Development, Infrastructure Development, and Extroversion. Effective administration support is essential for the success of the mentioned development goals [46].

Moreover, the Ministry of Environment and Energy, the Natural Environment and Climate Change Organization, and the Municipality of Megisti signed a memorandum to fund a study on the comprehensive network mapping (Fig. 7) of 30 km of hiking trails (1.the route of the settlement; 2. Megisti-Plakes- Agios Stefanos; 3. Megisti-Mounta-Kastreli-Agios Stefanos; 4. Moni Agias Triadas- Cape Pountentis; 5. Megisti – Palaiokastro; 6. Moni Agias Triadas-Agios Ioannis-Connectio with French Trail; 6A. Connecting Leg of Routes 6,7,8; 7.Megisti- Moni Aghios Georgios tou Vounou; 8. Megisti-Avlonia-Moni Aghios Georgios tou Vounou; 9. Megisti – Cape Niftis – Avlonia; 10. The French Trail; 11. View Trail; 12; Charoupias’ Trail) [47].



**Fig. 7.** Megisti’s proposed trails (according to the study of the Ministry of Environment and Energy, the Natural Environment and Climate Change Organization, and the Municipality of Megisti)

These initiatives are crucial and could lead to Megisti’s sustainable development through actions that utilize the cultural and environmental reserve. The trails will serve as a bridge towards green development and preserve the environmental identity of the island. In addition,

### 3.3 Utilizing Megisti’s Cultural and Environmental Heritage for Sustainable Development: Proposals for the Island

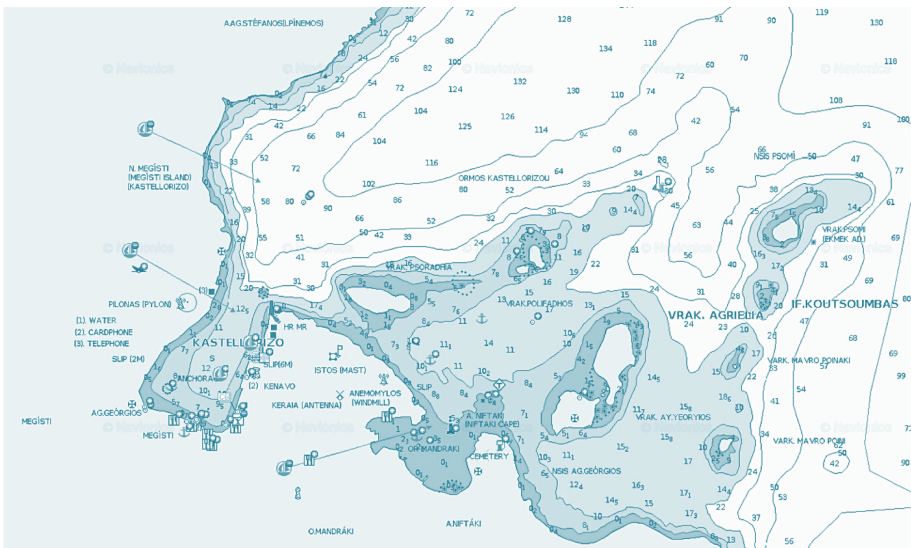
A cooperative effort was undertaken with the Technical Chamber of Dodecanese and local government to address the challenges faced by the Megisti island. Proposals were formed after engaging with local stakeholders and integrating their aspirations into the proposed sustainable development policy. During study area analysis, the cultural reserve of Megisti was documented in sheets that identify the key elements of each monument, including its name, administrative affiliation, location, type, architectural style, construction period, historical background, current and original use, protection status, conservation status, building materials, damage, restoration efforts, photographs or drawings, its spatial location, and its financing. Additionally, all the trails, natural heritage, and the analyzed information were organized in data bases using ICTs applications, to make efficient decisions on the sustainable management of Megisti island.

The proposed system aims to promote the cultural heritage and natural environment of the island within the context of sustainable development and circular economy. The major challenges faced by the island include limited infrastructure, such as transport, connectivity, and communication, and limited access to basic services like healthcare and education. To address these challenges, interventions are divided into four categories: improving living conditions, upgrading the environment and daily life in deprived areas, attracting alternative and sustainable tourism models, and safeguarding the island's geographical integrity.

### *Enhancement of Infrastructure*

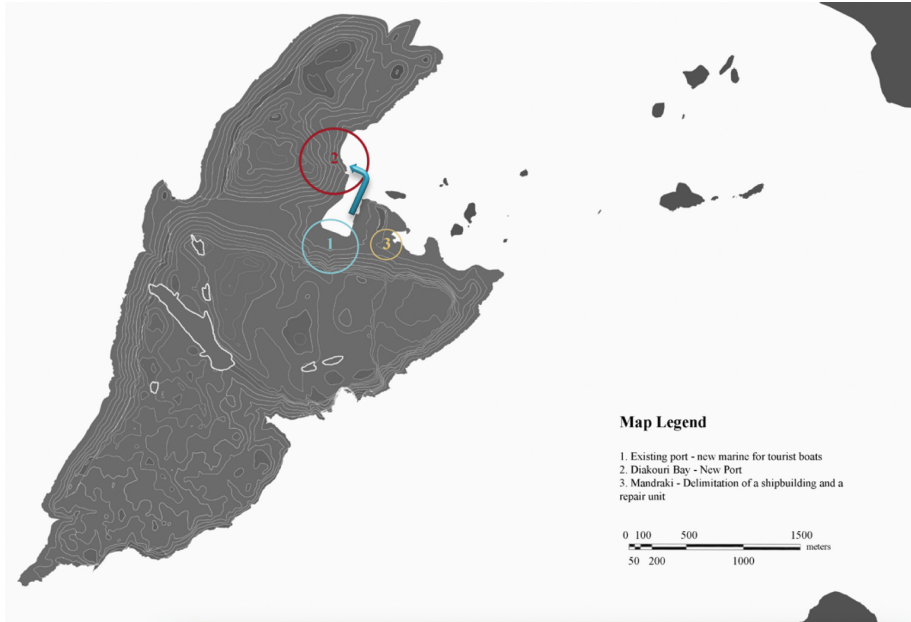
In the Megisti area, proposals for the development and promotion of the cultural and environmental reserve necessitate appropriate infrastructure. This includes completing and extending the ring road to reach Diakouri and Plakes, securing and protecting the recently implemented desalination project with road access to the settlement, and establishing road connectivity between the historic center and Mandraki. To promote sustainable and green development, the island's public transportation system is proposed to be upgraded with electric municipal buses. This will not only protect the settlement but also enhance the living conditions for the permanent population.

In the context of infrastructure, the proposal for the redeployment of port facilities is crucial for the historic center of Megisti to become a destination for visitors and protect its historical form. According to the Foundation for Research and Technology – Hellas (FORTH), the current port has limited capabilities with a narrow opening of 158 m and a vertical distance to the entrance of 365 m. Additionally, the depths in the old port are less than 20 m., making it challenging for larger ships to dock (Fig. 8).



**Fig. 8.** Port isobaths

Additionally, the infrastructure of the existing port platform needs restoration to prevent failures from increasing traffic. For the above reasons, but also after contacting the local authorities, the following port rearrangement is proposed as follows (Fig. 9).



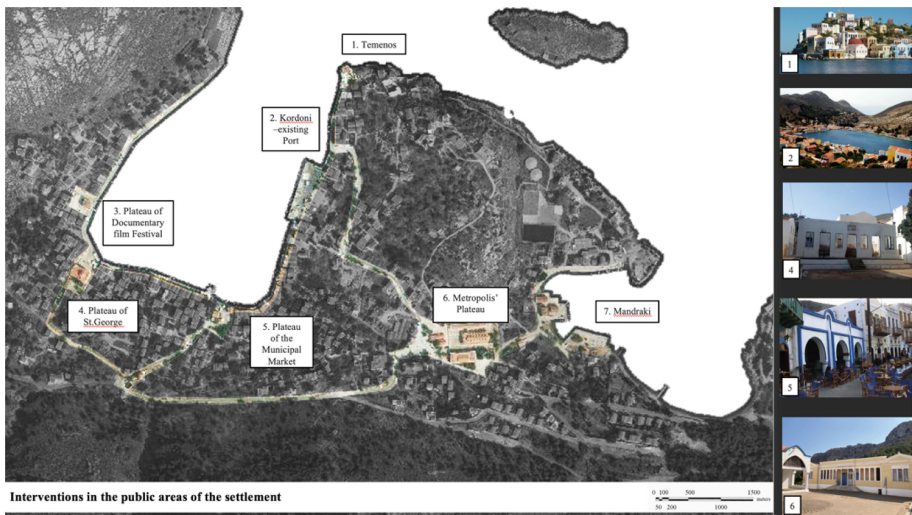
**Fig. 9.** Map of Megisti-Proposed rearrangement of port facilities

A new port is proposed in “Diakouri Bay” to accommodate commercial and military activities, as well as larger cruise and commercial ships. This necessitates the expansion of the ring road as previously recommended. The current port can be used for tourist purposes, accommodating small and medium-sized boats, allowing visitors to have direct contact with the settlement. In the degraded area of Mandraki, where the local community wants the creation of a beach and upgrading of the coastal front, it is suggested to retain part of the fish auction with the provision of modern facilities. Along with the proposed infrastructure, crucial projects for the development of the island and the improvement of life’s quality of its residents include the repair and restoration of the Kolia Mountain reservoir. Its operation must be secured to promptly address any issues. Furthermore, the installation of photovoltaics to utilize renewable energy sources (RES) in the form of recent desalination plants will help reduce electricity costs and per capita expenditure on electricity and water.

#### *Interventions in the Settlement*

The proposal aims to improve and preserve public spaces in the settlement through renovations, starting with the redevelopment of the Kordoni of the Port. The project has been submitted to the Ministry of Infrastructure, Transport and Networks, but further studies are necessary to confirm the compatibility of the settlement’s aesthetics (such as

benches, lighting, garbage bins, and public configurations) with the architecture, and to restore the structural stability of the port's quay to prevent coastal failures. A connection of the settlement's plateaus is proposed (Fig. 10) to highlight its history and create an attractive route for visitors beyond the seaside. The configuration of public spaces as part of a comprehensive redevelopment plan of the settlement would further emphasize the interventions of the historical building stock. The selected plateaus, including the Plateau of Aghios Georgios tou Pigadiou, the Museum plateau, the Documentary Film Festival plateau, the Mandraki Pier, and the Municipal Market, are key points of social activity in the settlement.



**Fig. 10.** Map of Interventions in the historic center of Megisti

The plateau of the Metropolis holds the island's most important public buildings, including the metropolitan church of Constantine & Helen, the Church of Agios Nikolaos, and the Church of St. George of Lucca. The Sandrapeia School, a miniature of the University of Athens, and the Girls' School are also noteworthy. The pebbled floor of the square is of special aesthetic interest and should be highlighted.

In the degraded area of Mandraki, which served as the second port of Kastellorizo until the 19th century as a ship repair zone, a proposal for its compatible revival and restoration on the left side of the bay is proposed. The area, located near the Metropolis plateau, could host a naval technology exhibition, including outdoor exhibitions and cultural events during the summer months, either outdoors at the pier of Mandraki or indoors at the Girls' School. The creation of a tourist shelter near the pier is also proposed, without affecting existing or proposed functions of the area. In response to the residents' request for a developed coastal front and accessible beach, a beach can be created on the right side of the bay near the cemetery area. Finally, a critical issue for the region of the island complex is the resolution of the settlement's borders and the proclamation of a General Urban Plan.

### *Cultural and Sea Routes in the Island Complex of Megisti*

The study of trails, as aforementioned, plays a crucial role in enhancing the promotion of cultural and environmental heritage. The study provides a comprehensive analysis of the technical and qualitative aspects of twelve trails, spanning a total length of thirty kilometers. The proposed network of trails can incorporate markers of declared monuments through the utilization of QR Codes and smart applications. The information is organized in an integrated database and can be used to facilitate the visitors. Furthermore, at the Municipal Market square, visitors can access a QR Code through an app to obtain information on the trails, including length, degree of difficulty, estimated time, and points of cultural and environmental interest. This enables the creation of a digital navigation map.

It is also noted that promoting sea routes is crucial for the entire Megisti Island complex. Given the rich coastal and underwater environment, as well as the unique caves, sea routes offer the potential to expand tourist activities and visits, while also contributing to the recognition of the national space in all islands within the complex.

### *Promoting Conference Tourism*

As a national and European border, Kastellorizo presents a unique opportunity for promotion as a destination for conferences and alternative forms of tourism. The island boasts important natural and cultural resources, making it suitable for combining with marine and hiking tourism. Given its geopolitical significance and size, Kastellorizo is well-positioned to host significant conferences and speeches, generating increased interest from visitors and international attention. This projection can be achieved through the effective engagement of delegates who are well-respected and financially well-off individuals, without incurring significant expenses.

The promotion of Kastellorizo as a destination for conferences and alternative tourism offers the potential to extend the tourist season beyond the summer months and bring economic benefits to the local population through high tourist spending. The establishment of conference facilities and visitor services is essential for the effective organization of conferences and can lead to the creation of new employment opportunities. The improvement of the island's infrastructure and connectivity with the mainland is a prerequisite. The traditional Stamatiou School building, which is owned by the Municipality of Megistis and was originally established in 1903 as a kindergarten, is proposed as the primary conference venue. The building, located on the plateau of Aghios Georgios tou Pigadiou, was converted into a Cultural Center in 1999, but was unfortunately destroyed in a fire in 2016. In 2018, the Stavros Niarchos Foundation donated for the study of restoration and reuse of the Cultural Center in Kastellorizo.

## **4 Conclusions**

Megisti Island possesses a unique potential to serve as a model for sustainable development design, practices, and innovation in insular areas. The integration of digital documentation and ICTs, along with the involvement of international educational and research institutions, holds great promise for the protection and promotion of the island's environmental and cultural heritage, and the development of new tourism models. The ongoing investment and growth in tourism, despite the challenges posed by the pandemic,

further underscores the dynamic nature of the tourism sector in insular regions. The main objective of the proposals formulated was the creation of sustainable tourist activities that respect the environmental and cultural resources and the establishment of conditions necessary for new job creation and potentially attracting a permanent population.

The crucial role of ICT applications in documentation was one of the key conclusions drawn, with the creation of efficient databases serving as a crucial tool for local governments in making decisions towards sustainable development.

The success of sustainable development on an island is closely linked to the well-being of its residents. The participation of local communities and leadership in discussions about the sustainable development of Megisti was therefore deemed vital. The proposals prioritize the involvement and awareness of the island's residents in preserving their cultural heritage and emphasize the importance of empowering the local community and supporting cultural initiatives as the foundation of any efforts to promote the island.

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## References

1. Nurse, K.: Culture as the fourth pillar of sustainable development. *J. Small States Econ. Rev. Basic Stat.* **11**, 24–40 (2006). [https://scholar.google.com/citations?view\\_op=view\\_citation&hl=en&user=UNmsD1gAAAAJ&citation\\_for\\_view=UNmsD1gAAAAJ:u-x6o8ySG0sC](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=UNmsD1gAAAAJ&citation_for_view=UNmsD1gAAAAJ:u-x6o8ySG0sC)
2. Brundtland, G.H.: *Our Common Future: Report of the World Commission on Environment and Development*. Geneva, UN-Dokument A/42/427 (1987)
3. The 17 Sustainable Development Goals, United Nations page. <https://sdgs.un.org/goals>. Accessed 14 Jan 2023
4. International Institute for Sustainable Development. <https://www.iisd.org/>
5. EUR-Lex, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Next steps for a sustainable European future European action for sustainability. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2016%3A739%3AFIN>. Accessed 28 Jan 2023
6. Purvis, B., Mao, Y., Robinson, D.: Three pillars of sustainability: in search of conceptual origins. *Sustain. Sci.* **14**(3), 681–695 (2019). <https://doi.org/10.1007/s11625-018-0627-5>
7. Hawkins, J.: The fourth pillar of Sustainability: culture's essential role in public planning, pp. 48–55, *Humanities.com* (2001). [https://books.google.gr/books?id=NHIT12xmw3EC&pg=PR4&hl=el&source=gbs\\_selected\\_pages&cad=2#v=onepage&q&f=false](https://books.google.gr/books?id=NHIT12xmw3EC&pg=PR4&hl=el&source=gbs_selected_pages&cad=2#v=onepage&q&f=false)
8. Astara, O.H.: Culture as the fourth pillar of sustainable development. *J. Sustainable Dev. Cult. Tradit.* **1a, 2a**, 93–102 (2014). <http://sdct-journal.com/index.php/2015-10-18-22-23-19/2014-volume-2-a/351-culture-as-the-fourth-pillar-of-sustainable>
9. McElroy, J.L., de Albuquerque, K.: Tourism penetration index for the small-Island Caribbean. *Ann. Tour. Res.* **28**, 145–168 (1992). <https://www.sciencedirect.com/science/article/abs/pii/S0160738397000686?via%3Dihub>
10. Spilanis, I., Kizos, T., Koulouri, M., Kondyli, J., Vakoufaris, H., Gatsis, I.: Monitoring sustainability in insular areas. *Ecol. Indicators* **9**(1), 179–187 (2009). <https://doi.org/10.1016/j.ecolind.2008.03.003>

11. CORDIS. <https://cordis.europa.eu/article/id/4496-europe-2000-cooperation-for-european-territorial-development>. Accessed 27 Nov 2022
12. Legislative Observatory, European Parliament. [https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?lang=en&reference=2006/2050\(INI\)](https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?lang=en&reference=2006/2050(INI)). Accessed 24 Dec 2022
13. Castanho, R.A., Behradfar, A., Vulevic, A., Naranjo Gómez, J.: Analyzing transportation sustainability in the Canary Islands archipelago. *Infrastructures* **5**, 58 (2020). <https://doi.org/10.3390/infrastructures5070058>
14. Nocca, F.: The role of cultural heritage in sustainable development: multidimensional indicators as decision-making tool. *Sustainability* **9**, 1882 (2017). <https://doi.org/10.3390/su9101882>
15. Rodriguez Diaz, M., Espino Rodriguez, T.F.: Determining the sustainability factors and performances of a tourism destination from the stakeholders' perspective. *Sustainability* **8**, 951 (2016). <https://doi.org/10.3390/su8090951>
16. Sheldon, P.J.: The challenges to sustainability in island tourism. School of Travel Industry Management, University of Hawai'i. Occasional Paper 2005-01, October 2005. <https://lib.ici.mod.org/record/11965>
17. UNESCO. [https://www.unesco.org/en/cultural-heritage-7-successes-unescos-preservation-work?TSPD\\_101\\_R0=080713870fab200041af9e6a5d592767b34ce000b85385e6e24caade8a11be317af320d775cfd57108a6dfe522143000c8e6536df7bbbf8b3763f14a792dd6154470955d01cf5a48655fd8a05b51dc2459272c93f6c86b1ebc05d141213c5166](https://www.unesco.org/en/cultural-heritage-7-successes-unescos-preservation-work?TSPD_101_R0=080713870fab200041af9e6a5d592767b34ce000b85385e6e24caade8a11be317af320d775cfd57108a6dfe522143000c8e6536df7bbbf8b3763f14a792dd6154470955d01cf5a48655fd8a05b51dc2459272c93f6c86b1ebc05d141213c5166). Accessed 2022
18. Poullos, I., et al.: *Cultural Management, Local Community and Sustainable Development* [Undergraduate textbook]. Kallipos, Open Academic Editions (2015). <https://hdl.handle.net/11419/2392>. Accessed 06 Dec 2022
19. Mudge, M., Ashley, M., Schroer, C.: A digital future for cultural heritage. In: XXI International CIPA Symposium, Athens, vol. 10. no. 1, p. 222 (2007). <https://www.isprs.org/PROCEEDINGS/XXXVI/5-C53/papers/FP104.pdf>
20. Arnold, D., Kaminski, J.: Cultural heritage tourism and the digital future. *Contemporary Issues in Cultural Heritage Tourism*, pp. 289–310. Routledge (2013). <https://www.taylorfrancis.com/chapters/edit/10.4324/9780203583685-31/cultural-heritage-tourism-digital-future-david-arnold-jaime-kaminski>
21. Koutsi, D., Stratigea, A.: Sustainable and resilient management of underwater cultural heritage (UCH) in remote Mediterranean islands: a methodological framework. *Heritage* **4**, 3469–3496 (2021). <https://doi.org/10.3390/heritage4040192>
22. Stratigea, A., Kyriakides, E., Nicolaidis, C.: *Smart Cities in the Mediterranean*, pp. 47–49. Springer, Cham (2017). <https://doi.org/10.1007/978-3-319-54558-5>
23. Online book “Strengthening ICT and knowledge management capacity in support of the sustainable development of multi-island Caribbean” SIDS. [https://repositorio.cepal.org/bitstream/handle/11362/45064/1/S1901146\\_en.pdf](https://repositorio.cepal.org/bitstream/handle/11362/45064/1/S1901146_en.pdf). Accessed 03 Feb 2023
24. Interreg Europe. <https://www.interregurope.eu/news-and-events/news/use-of-ict-in-protection-of-natural-and-cultural-heritage>. Accessed 02 Feb 2023
25. Guccio, C., Martorana, M.F., Mazza, I., Rizzo, I.: Technology and public access to cultural heritage: the Italian experience on ICT for public historical archives. In: Borowiecki, K., Forbes, N., Fresa, A. (eds.) *Cultural Heritage in a Changing World*. Springer, Cham (2016). [https://doi.org/10.1007/978-3-319-29544-2\\_4](https://doi.org/10.1007/978-3-319-29544-2_4)
26. Pouloupoulos, V., Wallace, M.: Digital technologies, and the role of data in cultural heritage: the past, the present, and the future. *Big Data Cognit. Comput.* **2022**, *6*, 73 (2022). <https://doi.org/10.3390/bdcc6030073> Author, F., Author, S., Author, T.: Book title. 2nd edn. Publisher, Location (1999)



27. Brizard, T., Derde, W., Silberman, N.: Basic Guidelines for Cultural Heritage Professionals in the Use of Information Technologies. How can ICT support Cultural heritage? Tamara Brizard, Willem Derde, Neil Silberman & The Interactive Institute AB (2007). <https://www.enamcenter.org/files/documents/Know-how%20book%20on%20Cultural%20Heritage%20and%20ICT.pdf>
28. Liang, X., Lu, Y., Martin, J.: A review of the role of social media for the cultural heritage sustainability. *Sustainability* **13**, 1055 (2021). <https://doi.org/10.3390/su13031055>
29. Oikonomopoulou, E., Delegou, E., Sayas, J., Moropoulou, A.: An innovative approach to the protection of cultural heritage: the case of cultural routes in Chios Island, Greece. *J. Archaeol. Sci. Rep.* **14**, 742–757 (2017). <https://www.sciencedirect.com/science/article/abs/pii/S2352409X16305922>
30. Masini, N., Soldovieri, F.: Cultural heritage sites and sustainable management strategies. In: Masini, N., Soldovieri, F. (eds.) *Sensing the Past. Geotechnologies and the Environment*, vol. 16. Springer, Cham (2017). [https://doi.org/10.1007/978-3-319-50518-3\\_1](https://doi.org/10.1007/978-3-319-50518-3_1)
31. Moropoulou, A., Delegou, E.T.: Integrated Environmental Management for the Preservation of Historic Cities. Conference and Brokerage Event the Construction Aspects of Built Heritage Protection. European Construction Technology Platform, Dubrovnik, Croatia (2006)
32. Oikonomopoulou, E., Kioussi, A., Delegou, E.T., Tsilimantou, E., Moropoulou, A.: Innovative methods for the protection of cultural heritage. application on cultural and natural heritage site paths. *Scienza e Beni Culturali Vol. XXIII*. Publ. Arcadia Ricerche Editore, Padova, pp. 335–346 (2010)
33. Delegou, E.T., Tsilimantou, E., Oikonomopoulou, E., Kioussi, A., Sayas, J., Moropoulou, A.: Strategic planning of materials and conservation interventions for the damage rehabilitation of the Sarantapicho Acropolis and the Erimokastro Acropolis in Rhodes. In: Proceedings of the 8th International Symposium on the Conservation of Monuments in the Mediterranean Basin, Patras, Greece. Droj, G., 2010. Cultural heritage conservation by GIS (2010). <http://www.geo.info.hu/gisopen/gisopen2010/eloadasok/pdf/droj.pdf>. Accessed 28 June 2012
34. Navío-Marco, J., Ruiz-Gómez, L.M., Sevilla-Sevilla, C.: Progress in information technology and tourism management: 30 years on and 20 years after the internet-Revisiting Buhalis and Law’s landmark study about eTourism. *Tour. Manag.* **69**, 460–470 (2018). <https://www.sciencedirect.com/science/article/abs/pii/S0261517718301134?via%3Dihub>
35. Ali, A., Frew, J.A.: ICT and sustainable tourism development: an innovative perspective. *J. Hosp. Tour. Technol.* **5**(1), 2–16 (2014). <https://doi.org/10.1108/JHTT-12-2012-0034>
36. Cole, S.: Information and empowerment: the keys to achieving sustainable tourism. *J. Sustain. Tour.* **14**, 629–644 (2006)
37. Ruggier, G., Calo, P.: ICT and tourism impacts in Islands. *Ecocycles* **4**(2), 4–11 (2018). <https://doi.org/10.19040/ecocycles.v4i2.102>
38. European Union. <https://europa.eu/capacity4dev/eu-working-group-land-issues/documents/geographic-information-systems-gis-spatial-dimension-development-cooperation>. Accessed 15 Jan 2023
39. Kastellorizo online. <https://www.kastellorizo.online/en/services/information/>. Accessed 03 Jan 2022
40. Alfa cert. <https://certs-it.com/listing/kastellorizo/>. Accessed 03 June 2022
41. Ragkousis M., Abdelali M.: New alien Mediterranean biodiversity records (October 2020). *Mediterr. Mar. Sci.* **21**(3), 631–652 (2020). <https://doi.org/10.12681/mms.23673>
42. Greece-Is. <https://www.greece-is.com/the-long-history-of-kastellorizo-from-ancient-empires-to-modern-wars/>. Accessed 05 June 2022
43. Energy Transition of the island of Kastellorizo, Study of the Institute of Energy Of Southeast Europe (IENE). <https://www.iene.eu/articlefiles/kastellorizo%20executive%20final%20eng.pdf>. Accessed 07 Aug 2022

44. Online Article about Kastellorizo by Archyde. <https://www.archyde.com/in-kastellorizo-the-island-of-the-film-mediterranean-winds-of-war-between-turkey-and-greece/>. Accessed 06 June 2022
45. Beyond Borders festival homepage. <https://beyondborders.gr/en/>. Accessed 03 June 2022
46. South Aegean Regional Programme 2021–2027 homepage. <https://pepna.gr/el/perifereiako-programma-notioy-aigaioy-2021-2027>. Accessed 30 Jan 2022
47. Official site of the Ministry of Energy. <https://ypen.gov.gr/sto-kastellorizo-gia-ta-monopatia-o-yfypourgos-perivallontos-kai-energeias-giorgos-amyras/>. Accessed 03 June 2022