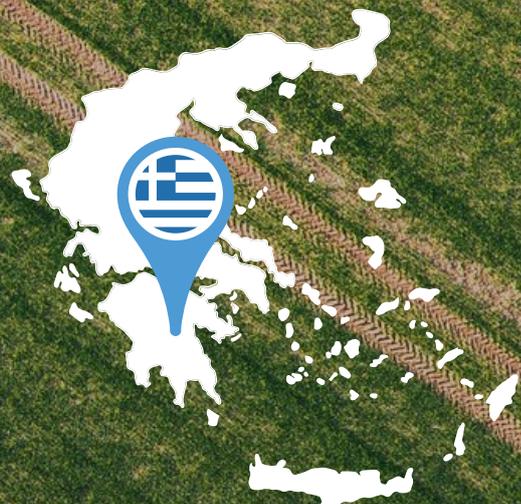




SHERPA
Rural Science-Society-Policy
Interfaces

MAP Position Paper

CLIMATE CHANGE AND ENVIRONMENTAL SUSTAINABILITY



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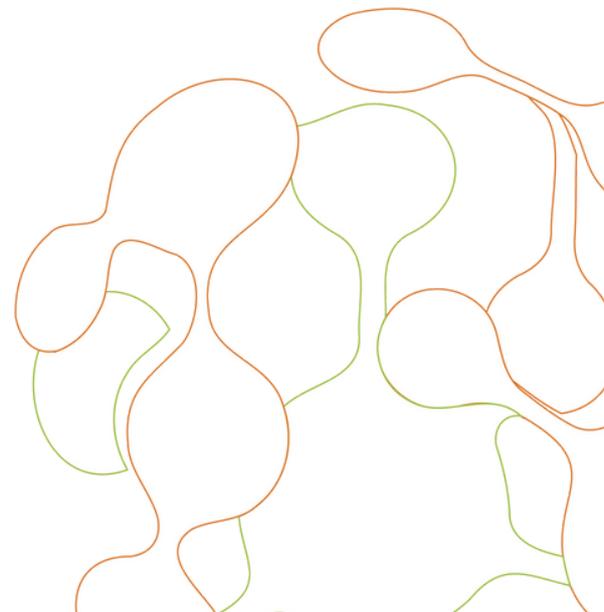
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<https://rural-interfaces.eu/maps/greece-south-aegean/>



Topic and headline messages

The discussions with the members of the South Aegean MAP revolved around agricultural production, tourism, renewable energy sources, digitalisation, and the provision of services and infrastructure by the region. The members of the South Aegean MAP referred to the climatic conditions in the region during the last few years and the problems they create in both their daily lives and professional activities. An important indicator of these changes is the reduction in honey production. Moreover, a point that has been highlighted relates to the investments needed to strengthen the local infrastructures and efficiently cope with overtourism. During the discussions, there have been mentions of the need to provide incentives (mainly financial ones) to companies aiming for climate neutrality, as well as towards the adoption of smart farming solutions. Concerted efforts at both the regional/national and EU level, as well as the focus on innovation, may help towards efficiently addressing the challenges that arise from climate change.

Problem being addressed and key questions

Despite the commitment of many countries in the context of the Paris Agreement to undertake climate-related actions and limit the increase of global temperature 'well below 2°C', the impact of climate change is prevalent across the world. The frequency and intensity of extreme weather phenomena will only increase, and thus a sound approach to climate risk means that adapting to this impact is as necessary as limiting emissions of greenhouse gases (GHGs). The effects of climate change are diverse and vary in regard to local geographic conditions, socio-economic characteristics and adaptive capacity. Local and regional authorities are critical to successfully respond to this impact. The current Position Paper outlines key issues, challenges, opportunities and recommendations in adapting to the impact of climate change for the region of South Aegean. It provides a summary of the effects of climate change based on recent literature and the discussions made with the members of the South Aegean Multi-Actor Platform (MAP). The questions addressed during the discussions were the following:

- 1) What transitions are required to achieve climate neutrality in the South Aegean region?
- 2) How can policy interventions enable or facilitate these transitions, considering the solutions needed at the local and national levels and the related implications for the wider policy framework (EU and global)?
- 3) What are the research needs and gaps?

1. Pathways to Tackling Climate Change in Rural Areas

1.1. Key scientific evidence

Several climatic parameters and effects relating to the countries around the Mediterranean basin have been reported by the European Environment Agency (ESA, 2017) including: (i) the increase of extreme high temperatures; (ii) a decrease in rainfalls and river flow; (iii) increased competition for water use; (iv) a significant decline in crop yields; (v) increased risks for livestock production; (vi) an increase in mortality rates due to heat waves; (vii) reduced capacity in energy production; (viii) increased energy consumption for cooling purposes during heat waves; and (x) time shifts in summer tourism. Moreover, climate change will trigger risks (e.g. droughts, forest fires and biodiversity loss) affecting negatively the environment and the most economic sectors.

According to simulations based on climatic models [1], the average annual temperature, both at the short- and medium-term, is expected to increase. Specifically, in Greece (Figure 1) the highest increase in average annual temperatures is estimated to take place during the period 2046-2065 (up to 2.6°C).

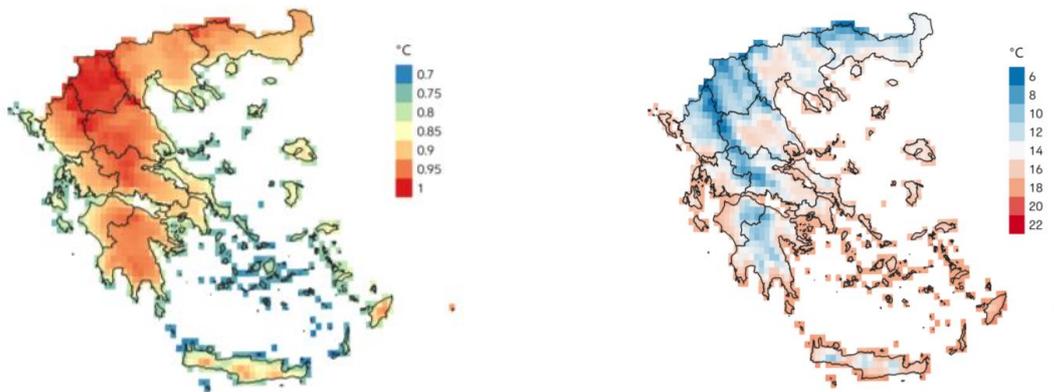


Figure 1. (a) Spatial distribution of the average annual temperature increase (°C) in the reference period 1971-2000; (b) expected differences in the spatial distribution of the average annual temperature increase (°C) during the period 2026-2045.

It is also estimated that the average annual temperature in the region of the South Aegean is expected to increase by 1.0 to 1.2°C in the period 2021-2050, and by 1.9 to 2.2°C in the period 2071-2100, in comparison to the period 1961-1990. There is also the extreme scenario that the temperature will raise by 1.5 °C during the period 2021-2050 and by 3.0 to 3.6°C in the period 2071-2100. In both cases, the rise in temperature is expected to be higher in the islands of the Dodecanese (especially Rhodes) and in the islands of the north part of the Cyclades complex. Livestock will also be adversely affected, especially during the summer season. The needs for water consumption will increase together with the levels of thermal discomfort of the farmed animals along with the risk of disease [2]. High temperatures can reduce the resilience of farmed animals and production [3].

1.2. Summary of position of the regional Multi-Actor Platform

1.2.1. Obstacles and enablers supporting success

There are both challenges and opportunities on the road to achieving climate neutrality in the region of the South Aegean. Within this context, the discussions with the South Aegean MAP members have revolved around agricultural production, tourism, renewable energy sources, digitalisation, as well as service provision and infrastructures. The extreme climatic conditions in the region during the last few years have created problems in both daily activities and production processes. Extended periods of drought and heat, shortage of water, as well as heavy rainfalls cause serious damage and create problems in the road network and power supply, and lead to the gradual desertification of the region. This results in time shifts in tourism,

harvesting and other economic activities. The risk of fire is high and it can ultimately lead to irreparable damages to production and the environment. At the same time, the stakeholders have expressed their concerns regarding the evident changes in the timing of seasons, which affect the agricultural production, change the biological cycle of crops and cause frequent "stressing" events. An important indicator is the reduction in honey production, which has an impact on the growth of certain plants critical for beekeeping, such as thyme. Another significant impact of climate change in the region is the reduction of drinking water reserves that can potentially lead to the abandonment of the primary sector. With regard to Renewable Energy Sources (RES), the major issue that was pointed out was the installation of wind turbines, their location and their proper operation. The local community expresses concerns about the installation of wind turbines, which are linked to potential harm to the natural environment, protected areas, animals and tourism.

During the discussions, there have also been references to opportunities that may arise from climate change. In particular, the South Aegean MAP members have emphasised the necessity for systematic and well-organised informative actions and education activities (starting from schools) focussing upon the changes and measures required to achieve climate neutrality. Personal responsibility is considered as important for understanding the importance of sustainability and contribution towards achieving climate neutrality. It was pointed out that strong political will and commitment is of utmost importance to change the conditions (and habits) that contribute to climate change. Local authorities need to be very active. Opportunities may also emerge from raising the awareness of citizens and producers on new regulations related to environmentally friendly solutions (e.g. how digitalisation can contribute to environmentally-friendly solutions by developing "smart" energy systems). Regarding the use of RES, what has been stressed is that the proper planning of the RES installation can help avoid the negative reactions from the side of the local community and gain benefits in terms of reduction in the emissions of GHGs.

1.2.2. Key research gaps

During the discussions, the necessity for further research was stressed. Specifically, the intensification of research in the use of sensors for crop monitoring was highlighted. Additionally, the importance of the implementation of long-term research by taking advantage of available financial frameworks was stressed.

1.2.3. Recommendations for the local/regional/national level and lessons learnt

To achieve the goal of climate neutrality, the members of the MAP have made recommendations able to be implemented at the local, regional and national levels. The extreme weather conditions that are prevalent in the last few years have made imperative the strengthening of the existing infrastructures and the increase of crop resilience. The provided recommendations relate to flood protection and the reduction of erosion problems, while deploying solutions capable of contributing to the enrichment of the aquifer. The Copernicus Climate Change Service (C3S) database may prove to be a valuable tool towards the prevention and confrontation of the effects of extreme weather. It is a database of great importance for updating and monitoring the meteorological conditions per region, which, however, needs to become accessible for all research, business, and economic/social/cultural activities. Smart farming can help optimise the production and management of the agricultural unit, but also improve the recording and proper utilisation of existing data. This way, the production process will be not only based on empirical methods but also on innovative technologies. Training practitioners on sustainable agricultural methods and making them aware of new regulations is a requisite for the achievement of technological transformation. Proper spatial planning and effective land use, along with the increase in individual awareness and mobilisation regarding climate change, are major issues to be addressed.

2. Enabling Environmental Sustainability

2.1. Key scientific evidence

Climate change is profoundly shaping a new context for tourism in Greece. The effects of the ubiquitous climate change are expected to significantly impact tourism in the medium- and long-term by exacerbating its chronic weaknesses as well as unveiling new growth opportunities. According to the World Tourism Organization (WTO) [4], 5% of GHGs worldwide are generated from touristic activities; mainly from transport

(4%), but also from accommodation (1%). Furthermore, it has been predicted that tourism in the region around the Mediterranean Sea will be significantly affected by climate change [4]. The climatic conditions in the touristic areas of Greece are expected to change dramatically within the time period 2021-2050. According to the findings of the pan-European PESETA program [5], the rise in the average temperature is expected to affect the tourist traffic as tourists may choose other destinations or stay in their home country. It is estimated that the Northern Mediterranean (Spain, Portugal, Greece) will encounter a 1% reduction in overnight stays, and an annual loss of €825 million in revenues, in the scenario of a 2.5°C increase in average temperatures. In the case of a temperature increase of 5°C, there will be revenue losses of nearly €5 billion per year. According to Eurostat [6], the South Aegean region ranks first, both at the national and European level, regarding 'overnight stays in hotel accommodation in relation to the size of the population (per 1 000 inhabitants)' by reaching the number of 69 777. The economy of the region depends heavily on tourism as 62% of its workforce is employed in this sector [7]. Currently, the Climate Change Impacts Study Committee (CCISC) of the Bank of Greece [8] is doing research in climate change adaptation strategy, starting with the tourism sector.

Climate change is evident worldwide and the region of South Aegean suffers from its effects as well. The air temperature has increased; however, the relative humidity is low, because of the sea, and thus the agricultural products can still grow normally. Every day, severe damages in agricultural production are witnessed as the result of climate change and extreme weather [9].

Regarding the digitalisation of the region, a number of recent studies have indicated that 69% of households in the region of South Aegean (and Crete) have access to internet services [11-13]. This rate increased in 2020, especially during the COVID-19 pandemic lockdowns. Apart from the rise in internet use, it has been noticed that the use of e-commerce services is high in the region. In 2018, nearly half of the total electronic transactions in Greece (45%) were conducted in the South Aegean region [13].

As is the case with many island regions in the world, the region of the South Aegean faces the problem of potable water shortage. Seawater desalination systems can provide a solution by producing potable water from seawater. Currently, there are more than 50 desalination units installed and operating in the region of South Aegean. Despite the fact that the quality of fresh water produced by the desalination units is excellent, the quality of water in the sink is not that good because of the old and poorly maintained water pipe network in use [10]. This fact causes a number of problems in cultivation.

2.2. Summary of position of the regional Multi-Actor Platform

2.2.1. Obstacles and enablers supporting success

During the discussions with the members of the South Aegean MAP, the issue of drought was highlighted. More specifically, it was reported that the island of Syros encounters serious water supply problems that lead to high energy consumption for the production of water or the collection of water from various sources and by various means (e.g. desalination, transport of water with tankers, drilling). It has also been stressed that large-scale investments related to sustainability may be difficult. Apart from the above, the growth of tourism in 2021 was rapid, exceeding the accommodation capacity of the islands of the South Aegean. Consequently, problems in infrastructure (e.g. the electricity network) arose. It was also pointed out that financial support is indeed provided for the development of touristic facilities, yet no support is available to strengthen the energy- and water-related infrastructures. The MAP members referred to the lack of adequately qualified human resources as an inhibitor of development and progress, a fact also relating to the migration of the local population. The discussions that were held have revealed some opportunities that may pave the way towards climate neutrality. Specifically, it was stressed that the measures to be taken should relate and be adapted to the particularities and economic activities of the region (e.g. livestock, agriculture, handicrafts, tourism). Emphasis was placed on the investments that need to be made in order to strengthen the infrastructures of the South Aegean's islands so that they can meet the increasing demands in regard to the supply of tourist accommodation and facilities. It is indeed necessary to exploit the natural resources of the region (e.g. energy from frequent strong winds), while at the same time reducing the migration rates of professionals and researchers.

2.2.2. Key research gaps

The discussions that took place helped draw conclusions regarding the desired future for 2050 and the vision of the members of the MAP for the South Aegean region. Their vision relates to mainstreaming protection measures to prevent and mitigate the adverse effects of climate change, especially on agricultural production.

2.2.3. Recommendations for the local/regional/national level and lessons learnt

What has become evident from the discussions with the members of the MAP is that the undertaking of specific actions is important to achieve climate neutrality. It has been stressed that changes are needed in the economic policy in the island areas, for example, in regard to taxation. Tax reliefs will be significant for companies operating in the primary sector and, in particular, to those entities that are climate neutral and have a zero (or low) environmental footprint. However, it should not be overlooked that, in recent years, there has been a considerable increase in the touristic traffic in the islands of the South Aegean. For this reason, the necessity to shift to 'green' (touristic) infrastructures, so as to offer visitors advanced eco-friendly experiences, has been highlighted. In this context, the members of the MAP envision a future including 'green' energy infrastructures, as well as accommodation and catering services that follow sustainable practices.

The consequences of drought are evident in both the primary sector and tourism, and thus there is a need to store rainwater. This can be achieved if existing establishments adopt and implement complete (third degree) water recycling systems. Another factor highlighted by the members of the MAP is the need to store water in order to avoid drilling. Furthermore, the contribution of digital technologies and the close cooperation of producers-consumers-researchers can be crucial in the direction of achieving climate neutrality.

3. Just Transitions to a Climate Neutral Continent by 2050

3.1. Key scientific evidence

The main sources of GHG emissions in Greece are shown in Figure 2. They relate to energy consumption (electricity, heating, transport; 71%), industrial processes (14%), agriculture (9%) and the processing of waste (6%). The contribution of Greece in CO₂ emissions, on a global scale, in 2019 was 0.18%.

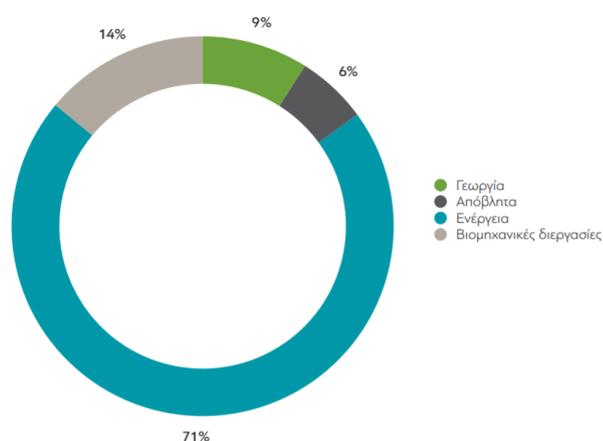


Figure 2. Sources of GHG emissions for Greece [15]

Figure 3 illustrates the contribution of Greece to CO₂ emissions per year, on a global scale, based on the analysis made by the Climate Change Impacts Study Committee of the National Bank of Greece [8]. The data used in that report cover a period of 30 years in regard to forecasting the present climatic

conditions (1961-1990), as well as two periods for future climatic conditions (medium term 2021-2050 and long term 2071-2100).



Figure 3. Contribution of Greece to global CO₂ emissions per year on a global scale

According to the aforementioned analysis, there has been a gradual increase in GHG emissions during the time period from 1990 to 2005 (Figure 4). A peak of GHG emissions has been recorded in 2005 and then, a rapid decrease followed in the time period from 2006 to 2016. Following 2016, there has been again an increase in 2017 and 2018. The main GHG emissions include carbon dioxide (CO₂) and methane (CH₄). A careful look at Figure 4 shows that the decrease observed in the period after 2005 is mainly due to the reduction of carbon dioxide emissions and secondarily to the reduction of emissions of other greenhouse gases.

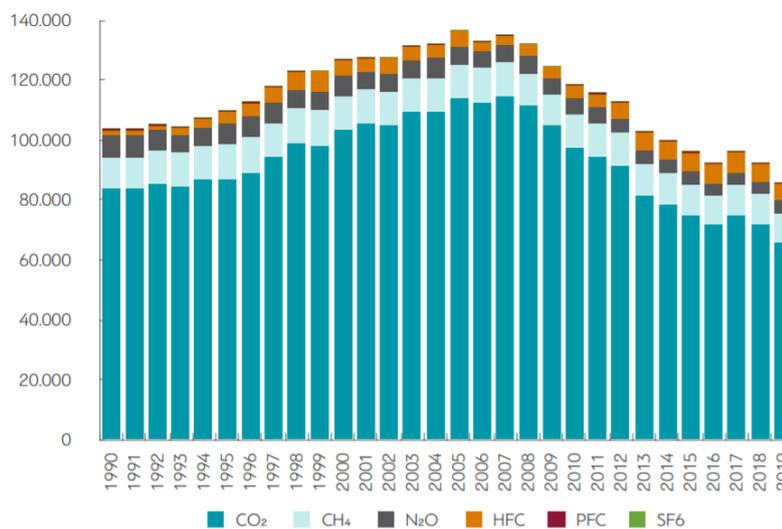


Figure 4. Total emissions (in kt) per GHG type/category

3.2. Summary of position of the regional Multi-Actor Platform

3.2.1. Obstacles and enablers supporting success

The Paris Agreement in 2016 set the goal of making Europe a climate-neutral continent by 2050. In practice, this means that the levels of GHG emissions will need to be zero by then. However, there are both obstacles and opportunities on the road to achieving climate neutrality. During the discussions with the members of the South Aegean MAP, the need to provide incentives (mainly financially) to companies aiming for climate neutrality was highlighted. In particular, there should be a registry of the companies/businesses having an

increased contribution to the production of GHGs, and a transition towards the direction of reducing emissions should be mobilised. In addition, companies need to understand how GHGs are produced, make a concerted effort to identify the practices they adopt that contribute the most to GHG production, and make the appropriate changes. Reducing GHG emissions necessitates the abolition of fossil fuel power plants (e.g. lignite) and the provision of incentives (from the government and the local authorities and in the form of the simplification of procedures) to businesses and producers towards proceeding to facility-related and practice-related energy upgrades. To achieve climate neutrality, agroecological activities can play an important role as they systematically deal with the preservation of ecosystem diversity. At the same time, digitalisation holds the potential to serve as a facilitator. The COVID-19 pandemic made apparent the need to shift to digitalisation-enabling solutions with teleworking being increased, and citizens becoming more familiar with digital technologies. Travelling has been significantly reduced, leading to a decrease of the environmental footprint of the transport sector.

3.2.2. Key research gaps

In order to achieve the Commission's ambition of making Europe the first climate-neutral continent, further research is needed. In particular, the members of the MAP referred to the need for research in the context of reconsidering the cultivated varieties and the agricultural products being produced. The adverse weather conditions create problems in production, and thus there is a need for new cultivation methods and more resilient varieties. Within this context, the contribution of smart farming solutions enabling crop optimisation and yield, as well as the promotion and adoption of environmentally-friendly agroecological methods, will be decisive.

3.2.3. Recommendations for the local/regional/national level and lessons learnt

The members of the MAP have come up with recommendations relating to both the local and national levels to tackle climate change and achieve climate neutrality. RES are undoubtedly a key factor in regard to the attainment of climate neutrality. For this reason, more investments need to be made towards a broader use and adoption of RES at both the individual and collective/business levels. To take steps in this direction, there needs to be concerted communication efforts from the side of the (local) public authorities. The need to design low-energy consuming production units (e.g. insulation of buildings to maintain temperatures and protect from extreme weather conditions) was also pointed out, while the energy upgrade of existing units has been highlighted. Integrated waste management systems should also be thought of. The Copernicus Climate Change Service (C3S) database can also be an important tool for the design of services informing citizens. The prospect of environment-friendly agrotouristic services was also discussed.

4. Interventions to Mitigate and Adapt to Climate Change and Enhance Environmental Sustainability

4.1. Key scientific evidence

The Climate Change Impacts Study Committee (CCISC) of the National Bank of Greece has divided Greece into climatic regions based on both climatic and geographical criteria (Figure 5). Based on that, the region of the South Aegean is divided into two climatic zones, namely the Cyclades (CY) and the Dodecanese (D). The South Aegean region presents a low level of expenditures in Research & Development compared to the country's average, as well as the EU's. More specifically, the South Aegean region has the second lowest performance among all regions in Greece in regard to the percentage of the national GDP spent on Research & Development. In 2011, the region spent only 0.15% of the GDP (€11.8 million), a percentage significantly lower than the national average of 0.67% (€1.4 billion). The University of the Aegean and the local research institutes, mainly ELKETHE (€10.8 million/€11.8 million) conduct 92% of the research activity in the region, while the business sector conducts only about 6% of the research (€0.659 million). These amounts indicate a significant decrease when comparing to 2005 (when the respective percentage was 9.6%). In 2011, the EU27 average was 63%, whereas in Greece it was only 35%. During the 2007-2013 period, the Tilos Park

together with five other companies participated in six research projects with a total budget of €994 750 (the private share amounted to €340 700 and the public funding was €654 050).

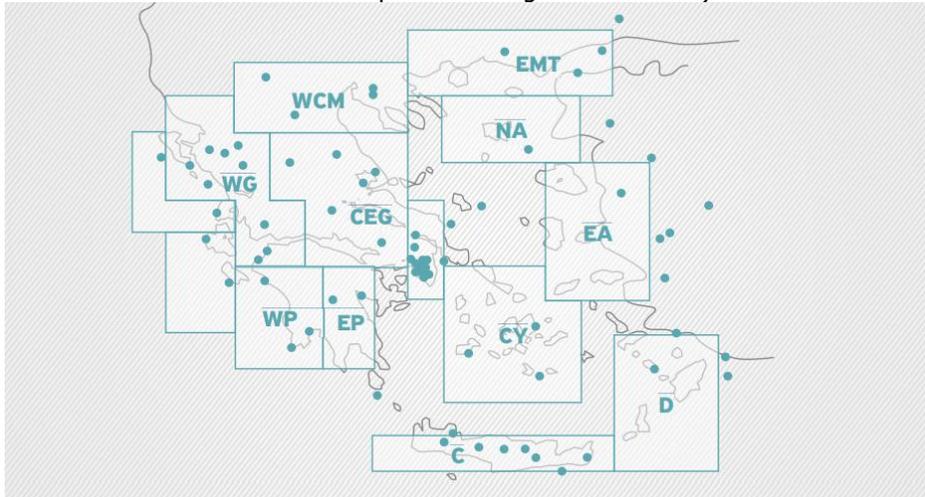


Figure 5. Climatic zones in Greece according to [8]

According to the South Aegean Region authority [16], 54% of the public funding for Research & Development projects was provided to IT- and telecommunication-related projects, 29% to projects related to agriculture, fisheries, livestock, food and biotechnology, 14% to projects for the development of added-value products, and only 3% to environmental protection projects.

4.2. Summary of position of the regional Multi-Actor Platform

4.2.1. Obstacles and enablers supporting success

Climate change has greatly affected the South Aegean islands and policies need to be put into motion for relieving the local population from their disastrous effects. As far as the agricultural sector is concerned, in the coming years, the climate change will completely alter the agronomist's/advisor's profession and the way in which farmers cultivate their land and grow their crops. Implementing interventions to mitigate climate change and achieve climate neutrality is linked both to challenges and significant opportunities. It has been emphasised that while the exploitation of solar energy is based on relatively simple technologies (i.e. solar water heater), its use is not widespread. This is due to the limited awareness of details related to installation and operating costs. It is worth mentioning that even companies do not make use of such technologies because of the limited awareness on how to find relevant funding opportunities. During the interviews it was pointed out that the measures and policy frameworks are not clear, thus leading to irregularities. Finally, great importance was given to the issue of individual responsibility.

There are also several opportunities, arising from the coordinated efforts of the national/regional public authorities and the European Commission, towards effectively tackling the challenge of climate change. The members of the MAP stressed the need of financial support to young entrepreneurs along with the minimisation of bureaucracy. Subsidies need to be provided and procedures get simplified. Emphasis has also been posed on education. Older people need also to be informed, as well as trained, in regard to new policies and opportunities that may arise from digitalisation. After all, age is no longer a restriction on engaging in the agri-food sector. Thus, education should be adapted to the respective cognitive and age level.

4.2.2. Key research gaps

Following the above ideas, the importance of paying the required attention to research, as well as making investments in both human and financial resources was highlighted. Research results need to become accessible to citizens, even those located in the most remote areas, and universities need to 'communicate' their role and disseminate the results of their research to the local communities.

4.2.3. Recommendations for the local/regional/national level and lessons learnt

Regarding the vision of a climate-neutral Europe, the members of the South Aegean MAP referred to the necessity to update and disseminate research information to the region and the local professional networks. In particular, this information should be accessible to all groups. Moreover, collective efforts should be taken at the local and the regional levels to prevent and tackle fire hazards, as well as droughts. Within the same context, the establishment of a Climate Crisis management ministry was proposed. In addition, tax reliefs could be an incentive for climate-neutral businesses in the primary sector. Finally, all MAP members pointed out the need for support from the local/regional public authorities.

Recommendations and Conclusions

The region of the South Aegean is confronted with various challenges when planning or implementing adaptation policies and measures, which can jeopardise the potential of establishing climate mitigation strategies and successfully managing risks. These challenges relate to insufficient commitment and will from the side of public authorities, insufficient administrative capacity and financial resources, as well as gaps in the knowledge that is available in regard to climate change and adaptation. Furthermore, the geographic particularities of the South Aegean makes it hard to take full advantage of its natural resources and expand its energy grid. Investing in RES is a good step towards climate neutrality as it promotes both sustainable growth and energy security, which may contribute to greater stability in the region. This will also help in the diversification of the regional economy, which is heavily reliant on tourism. During the discussions in the MAP, the need for increased cooperation between scientists, the local community, businesses and public authorities was also highlighted so as to help: (i) identify local climate changes; (ii) evaluate the impact of these changes; (iii) elaborate on tailored-made adaptation measures; and (iv) assess the relative costs and benefits of these measures and solutions.

Acknowledgements

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Annex 1: Key scientific evidence or activities cited by the Multi-Actor Platform

There were activities cited by the South Aegean MAP members, which have taken place on the islands of Kos and Serifos. In particular, Serifos has a visitable winery and helps citizens learn about vineyards, the process of winemaking and environmental-friendly vineyard cultivation, and wine-making practices. Kos was visited by students of the Aristotle University of Thessaloniki with the aim to participate in a workshop that would give them the opportunity to become engaged in hands-on activities relevant to one of their university courses. Emphasis was also placed on the future prospect of establishing a communication channel between the local stakeholders (i.e. on the island of Kos) and the scientific community.

Annex 2: Key scientific evidence or activities provided by the Multi-Actor Platform

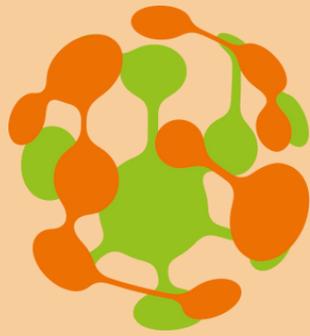
The meetings have been designed on the basis of the key scientific evidence available from desktop research, as well as the research findings provided by the South Aegean MAP members. Additional research sources that have been also used to support the MAP discussions were the following:

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Appendix

Table 1. Compilation of noteworthy projects / initiatives / tools / methods implemented

Name	Time of implementation	Contact & Internet address
TouristHub	2020-2023	https://touristhub-project.aegean.gr/
Project 293- Southern Aegean Interconnector	2008- 2025	https://tyndp.entsoe.eu/tyndp2018/projects/projects/293
DestiMED PLUS: Ecotourism in Mediterranean Destinations: From Monitoring and Planning to Promotion and Policy Support	2017-2020	https://interreg-med.eu/
Mouseion Topos	2018-2021	http://www.mouseion-topos.gr/en/home



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