CLIMATE CHANGE IMPACTS IN THREE REGIONS OF GREECE: INTERCONNECTIONS WITH REGIONAL PUBLIC PERCEPTIONS AND PLANNING POLICIES

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Abstract: The purpose of this work is to study and compare the impacts of climate change in three regions of Greece, in particular in Sterea Ellada, Thessaly and the Peloponnese. This crisis refers to the impacts of Climate Change, both current and expected, and concerns the social, economic and natural environment, the perceptions of people and the competent authorities, as well as the planning policies which either incorporate or not appropriate mitigation and adaptation measures. In the present work the authors test the fundamental hypothesis, that outdated regional plans and climatic blind regional policies are inadequate in coping with the challenges arising from new climatic environments which characterize new or more pronounced climatic and meteorological risks and vulnerabilities.

Keywords: Climate Change, Public Perceptions, Regional Planning Policies

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1. Introduction

Over the past decade, the parameters that make up our planet's climate have undergone significant changes. Since the 19th century, a rise in atmospheric temperature has begun and an important part of this increase has been attributed to the change in the composition of the atmosphere due to human activity. According to the forecasts of the Intergovernmental Panel on Climate Change (IPCC) this rise will continue in the 21st century in most regions of the world, with an increase expected to range between 1.8 – 4 °C (IPCC, 2007).

This rise is estimated to have a greater impact on the mainland and will help to increase the average sea level and incidences of extreme weather events (IPCC, 2013). Recent studies have shown that in the area of the Mediterranean region the intensity of hot invasions is expected to increase drastically and long duration of drought periods causes constant increase of the risk of forest fires (Giannakopoulos, 2009). These changes are expected to have a significant impact on primary, secondary and tertiary sectors (livestock, fisheries, tourism, natural disasters, urban environments, etc.) (Bank of Greece, 2011).

Climate Change (CC) is increasingly a matter of daily discussion, with international studies proving that it is considered by ordinary citizens to be an environmental problem that already exists (Tsakmakidou, 2013). In the following paragraphs, we present the climatic changes and the implications of CC in three regions of Greece, which are the subject of our study examining the socio-economic and natural environments of these regions, the perceptions of both people and the competent authorities, as well as mitigation and adaptation measures implemented or not by the competent authorities, (Bank of Greece, 2011).

The study of the impacts that CC is expected to cause is of paramount importance in terms of planning for sustainability of these three regions. The three regions under examination are very different from each other in terms of geomorphological, socio-economic and climatic conditions, leading us to some key questions:

- How are the impacts and risks of CC specified in and differentiated between the three regions and the climatic zones included in each case? Are these differences reflected to the response priorities of the competent authorities and organizations?
- What mitigation and adaptation measures are taken or considered by the competent institutions?
- Do planning policies incorporate appropriate CC mitigation and adaptation measures?
- What are the public perceptions of the three regions regarding CC? Is there any feedback to these perceptions on the part of competent institutions pushing forward adaptation and mitigation measures?

The above series of questions is certainly not exhaustive. Whatever the answers they will contribute to (a) better understanding of CC's geography, (b) understanding and mapping of the respectively perceptions of the public and responsible institutions and (c) identification of reflections of the above on regional CC adaptation and mitigation policies

The methodological approach is a process of successive steps as follows: first, consideration of the factors related to the different climatic zones in each region and anticipation of current and future climate changes; secondly, identification of the particularities of each region in terms of regional human and economic geography; thirdly, recognition and mapping of public and competent authorities' perceptions of climate change and fourthly actual climate policies and reflections to the actions of competent institutions. The basic sources supporting the work were climatic variables' statistical data, socio-economic primary and secondary data, reports on sectoral and regional distribution of climate change impacts in Greece, regional planning policy documents and public inquiry data.

2. The physical and socioeconomic geography of the Regions Sterea Ellada, Thessaly and Peloponnese - CC impacts and planning policies

Greece is a country featured by different climatic zones. This is due to interaction of weather systems with its complex topography, resulting in climatic characteristics that change within a few tens of kilometers. The study of the three regions of the country highlighted these differences.

Figure 1: Map of the administrative Regions of Greece, Date of Access: 12/4/21019, Source: Hellenic Oncology Foundation

2.1 Sterea Ellada

Sterea Ellada is located in the southern part of mainland, constituting the second largest Greek Region. It is located in an enhanced geographic location that makes it the hub and corridor of the mainland transportation, communication and energy networks of Central Greece (Ministry of Environment and Energy -MEE-, 2018).

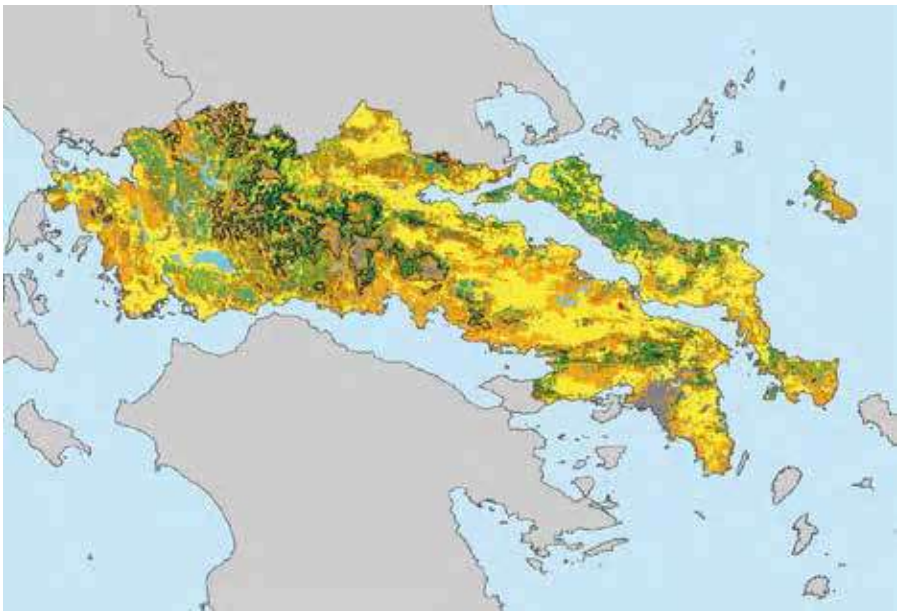


Figure 2: Map of the region of Sterea Ellada, Source: WWF Greece, 2012a

It is characterized by intense mountain volumes, a large number of lakes and several important wetlands and rivers. As a result, the high and steep mountains contribute to the formation of intense climate diversity, with the coasts generally having a smaller annual temperature range, the rainfall being more pronounced in the west often resulting in intense flood phenomena, and the central mountain complex being featured by cold climate with frosts and snows (Zografou et. al, 2012a).

In relation to climate changes, for the time being, desertification or drought phenomena have not been observed, although some areas (Fokida, Evia) are expected to be classified as high risk in the long term. Management and protection of water resources, which are a valuable source of water supply in the region, as well as prevention of natural disasters (fires, floods) with significant socio-economic impacts, are important challenges expected to increase by CC and calling for adaptation measures (Ministry of Environment, Energy and Climate Change -MEECC-, 2013).

The effects of CC are expected to be quite severe due to increasing incidences of extreme weather events and interactions between physical and social systems on one hand and the climate system on the other. According to the report of the Bank of Greece (2011) in the period 2021-2050 the very warm days (and nights) are expected to reach 20 and 40 in the period 2071-2100 in the lowlands and mainland of Sterea Ellada. In addition, the days of extreme rainfall in eastern Sterea Ellada are

expected to increase by 30%, while increases are expected in the periods of consecutive drought days where rainfall will be less than 1 mm per day.

According to the Regional Spatial Framework (RSF) of Sterea Ellada that was approved by a decision signed by the Minister of Environment and Energy (2018), one of the basic policy objectives is *"adaptation to the impact of CC and energy needs, with priority being given to planning development of Renewable Energy Sources (RES) and the restructuring of transportation systems".*

RSF (2018) provides for primary sector to become the basic tool for extrovert development, exploiting certain advantages of the region of Sterea Ellada for agriculture and livestock farming, forestry, fisheries and aquaculture. Particular attention is also put at the significant activity of mining. Secondary sector pursues an important role for the region in the field of energy and the promotion of designated origin and high quality food products with export orientation. Expansion and growth of the tertiary sector, particularly the tourism sector, is among the priorities of the RSF.

The RSF (2018) provides for the protection of the natural environment by means of basic principles for the management of protected areas and guidelines for tackling pollution and CC.

To ensure the protection of the primary sector, some of the specific directions given are:

• *"Preservation of agricultural land.*

• *Rational management of irrigation infrastructure and land reclamation projects.*

• *Rational management of pastureland.*

• *Organization of fishing facilities.*

• *Interconnection of local nutritional products with tourism".*

Regarding the protection of water resources, which are a valuable source of water supply for cities and a major input to agricultural production, since 2013 MEECC has promoted management studies per water basin, which are expected to prove particularly useful for the treatment of upcoming drought periods due to CC. According to the RSF (2018) priority is also prevention of natural disasters, such as fires, floods, landslides, etc., having significant socio-economic impacts on settlements and technical infrastructure. Adaptation to CC requires further specialization as it is expected to affect adversely and distinctly several of the region's productive and residential sectors, such as tourism, housing, agriculture, livestock farming, fishing etc. (MEECC, 2013).

2.2 Thessaly

The region of Thessaly is located in a privileged geographic position at the center of the Greek territory and bordering with the region of Sterea Ellada.

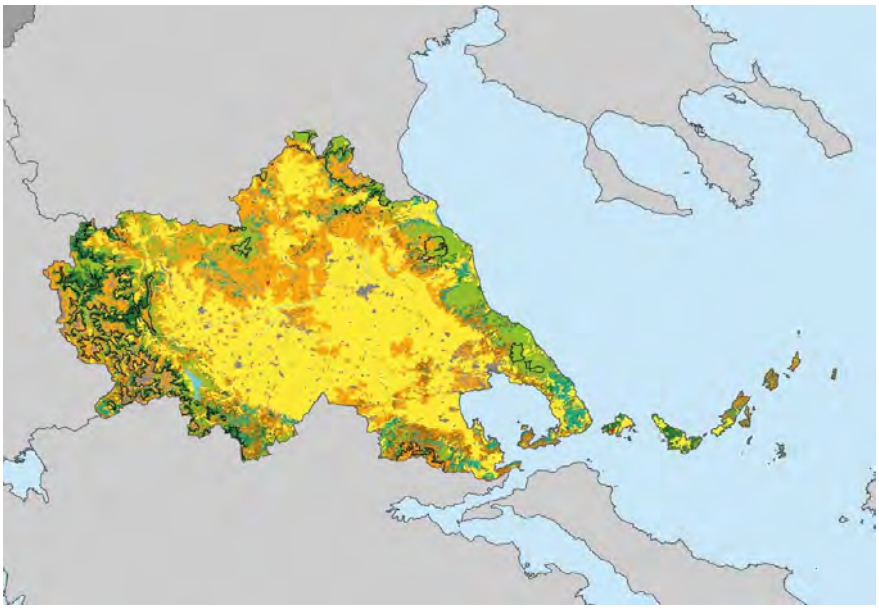


Figure 3: Map of Thessaly region, Source: WWF Greece, 2012b.

It is featured by the Thessalian plain, which is the largest plain of the country. The plain is enclosed by large mountainous volumes, of which the highest is mount Olympus. Its longest river is Pinios, which is fed by several tributaries and its largest natural lake was Carla which was drained in 1962 causing serious problems to both the natural and the social systems in the region. There are also artificial lakes in the region as well as several wetlands. The climate is characterized as Mediterranean, with hot summers and cold winters and rainfall presenting great spatial variability (Zografou, et. al, 2012b).

The impacts of CC are expected to significantly affect the region with greater changes in the climate to be anticipated in the plains and mainland, where change in the number of days with maximum temperature figures up to 20 in the period 2021-2050 and up to 40 in 2071-2100 (Bank of Greece, 2011). According to a study by the Ministry of Environment (1997) there will be a reduction of cotton production in the area up to 29% due to mean temperature increase in the period 2071-2100 in. However, according to IPCC (2007), moderate warming will likely increase crop yields in the temperate zone while according to the Bank of Greece Report (2011) there will be a change in the days of night glaciers in the region, with a reduction between 10 and 15 days in the years 2021-2050 and 25 days in the period 2071-2100, describing this parameter as very important for rural areas, especially those with sensitive crops such as citrus fruits.

By decision signed by the Minister of MEE in 2018, the RSF of Thessaly was approved with the aim of preventing and adapting to climate change, by increasing energy efficiency and promoting RES and co-generation in all sectors (MEE, 2018). Basic aims are to promote the sustainable, balanced and integrated development in accordance with the natural, social and economic particularities; to preserve biodiversity; prevent pollution and improve the quality of life; restrict the dispersed structure and siting of tourism activity infrastructure and maintain significant power plants (Hydroelectric stations of Plastiras and Smokovo Ponds).

According to the RSF (2018), the Thessalian plain is and must retain its role as the most important agricultural area in the country. Sustainable management of this natural resource is of particular importance at both the regional and national level. In order to fulfill this objective, it is necessary to:

- *"Declare agricultural land in terms of its productivity.*

  Eliminate building development out of statutory plans exclude uses and activities related to and compatible with agriculture.

- *Implement measures foreseen by water planning of the basins of Thessaly;*

- *Protect and promote the branded/local quality products;*

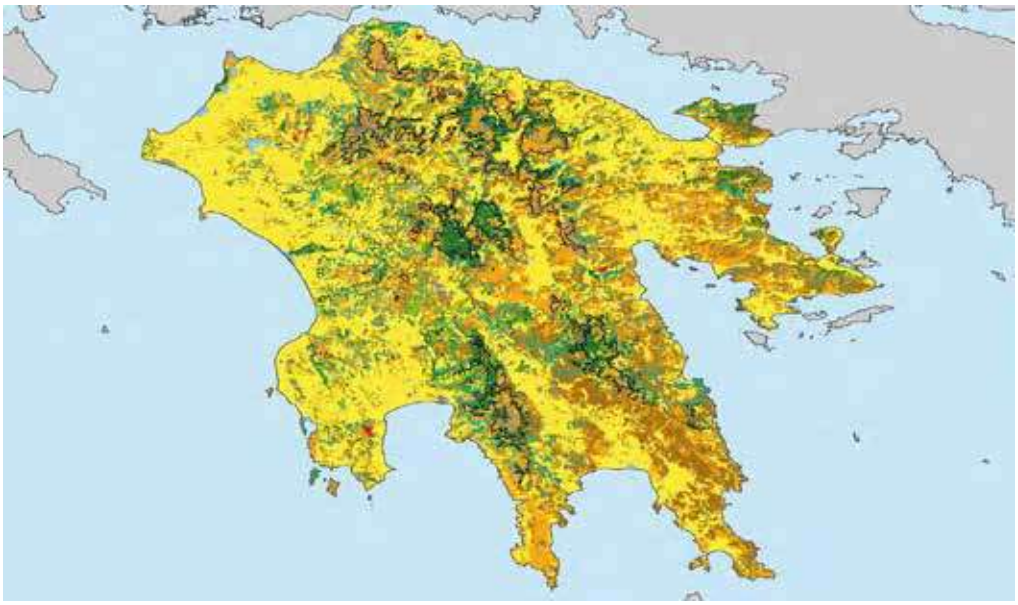
- *Support the production of "organic" products (including livestock)".*

Livestock farming is an important factor in the development of the agricultural sector of the Thessaly region and it is considered as a first priority policy sector, alongside other compatible uses in the designated zones. Aquaculture plays also a key role in the delta of Pinios, while RES occupies an important position in the development of the area including small hydroelectric works photovoltaic installations and the mining.

Three horizontal guidelines are foreseen by the RSF (2018) for CC mitigation and adaptation in the region of Thessaly: (a) *"Reinforcing the application of the best available practices and technologies to increase energy efficiency";* (b) *"Promotion of RES and co-generation of energy in all sectors"* and (c) *"Reduction of energy consumption in accordance with national commitments arising from international and European policies for CC"* (MEE, 2018).

2.3 Peloponnese

The region of Peloponnese includes the largest peninsula of Greece and its relief is mainly mountainous and steep. The largest plains meet at the seaside, but also in the valleys of the rivers of the region.



. Figure 4: Map of Peloponnese region Source: WWF Greece, 2012c.

The climate of the Region is characterized as Mediterranean with prolonged droughts during the summer months and mild rainy winters. However, climate differentiation between western, central and eastern Peloponnese is quite noticeable. In the coastal and lowland areas of Western Peloponnese a Mediterranean Sea climate pertains with heavy rainfall. Centrally, the climate is characterized as mountainous, cold, with frosts and snows during the winter months (Zografou et. al, 2012c) and an average annual temperature about 10º C (Bank of Greece, 2011), while in the east rainfall is limited and the climate is characterized as semi-arid (Zografou et. al, 2012c). Rainfall and air temperature are the most important climatic elements of a place. On the coasts of the Peloponnese region, humidity of the air approximates that of sea climates, while the average annual amount of rain received by the mountain ranges reaches 1,600 mm. (Bank of Greece, 2011).

CC is expected to influence the region considerably, as in the years 2021-2050, the number of extremely hot days and nights are expected to reach 20, in southern Peloponnese, while in the years 2071-2100 to reach 40. At the same time, the expected reduction of frost days is 10-15 days for the period 2021-2050 and 25 days for the period 2071-2100 (Bank of Greece, 2011).

Regarding CC and its impact, it is estimated that several parts of the region will be affected, due to the rise of sea levels and parallel salinization of aquifers (MEECC, 2013). According to the report of the Bank of Greece (2011), vulnerability of the coastal regions of northern Peloponnese is expected to increase because the sea level is estimated to rise, until 2100, from 0.3 to 1.5 mm/year as a result of northern winds. In turn it will threaten port and athletic facilities, erode beaches and increase floods and the salinity of rivers, bays and groundwater (Stavropoulou, 2017).

In the region of Peloponnese, there are several areas of sensitive coastal ecosystems, which will undergo geographical changes due to sea level changes which are estimated in turn to affect the extensive alluvial coasts of Western Peloponnese and the alluvial fields of the Messinian, Laconian and Argolic Gulfs (Tripitsidis, 2010). In Figure 5 illustrated in red are the coastal areas estimated to be affected by one meter sea level rise.

Figure 5: Map of Greece indicating coastal moderate and high vulnerability to the rise of sea level, Source: Bank of Greece (2011).

The effects of the rise in temperature, especially in the urban centers of the region, the tourism destinations and the primary sector (livestock, fishing, agriculture, etc.) are also important. As far as desertification is concerned, several coastal areas are at risk (Argolikos, Laconian Gulf) and some already suffer from aquifer salinization, while areas at high risk of erosion may be found eastwards (MEECC, 2013).

A significant number of environmental studies have been developed for the region and protection zones have been established for both mountainous areas of Parnonas and Erymanthos-Chelmos. In other mountainous areas the protection zones are expected to be institutionalized. As for the water supply of the area, the region is mainly served by boreholes, water tanks and desalination units. During the summer months, there are problems of water adequacy, due to the inadequate water supply network and the always increasing demand in various tourist areas, such as Messinia and Laconia (MEECC, 2013).

As it becomes apparent, there is a pressing necessity for revision of the outdated Regional Framework for Spatial Planning and Sustainable Development (RFSSD) of Peloponnese. Since more than 15 years have gone by its institutionalization a series of substantive and significant new conditions and necessities have appeared: (a) utilization of solar and wind potential, (b) satisfaction of growing tourism demand, (c) protection and sustainability of natural resources, (d) new irrigation projects etc.

3. Public Perceptions

Over the last few decades, CC has become one of the world's most serious problems, already causing and expected to cause more huge impacts in the future, in both social and economic terms. After multiple research projects, the scientific community has acknowledged the challenges of CC and, to some extent, has been mobilized to meet these challenges. However, the communities' and people's perceptions play a crucial role in coping with these challenges. Appropriate education and continuous information dissemination on CC issues can help individuals and societies to understand the serious impacts out of the interaction of the natural with anthropogenic environment and gain knowledge and practical skills for adaptation and mitigation actions. However, before organizing appropriate information campaigns and education programs, we should first obtain knowledge about people's current understanding and perceptions of CC.

According to surveys and polls that have been conducted from time to time, it seems that the majority of people in Greece consider that CC is due to anthropogenic factors while a small percentage of people consider either that it does not exist or it is due to natural causes.

In November 2015, on the occasion of the United Nations Conference, the European Commission carried out an investigation in EU countries. According to the findings Greeks support the need for collective action for CC. Almost nine out of ten respondents in Greece believe that CC is a "very serious" problem, while about six out of ten say that the national governments are responsible for dealing with CC in the European Union (EU). When asked if they have taken any personal action to combat CC in the last 6 months, only four out of ten responded positively. However, when they were presented with a list of practical measures (e.g. effort to reduce rubbish) the percentage of positive answers increased up to 89%, thus proving that many respondents did not associate certain environmentally friendly actions with CC mitigation or adaptation (European Commission, 2015).

The research was repeated in March 2017, with the results showing that 8 out of 10 Greeks considered that CC was a serious problem, while half of the respondents argued that they had taken personal action to combat it. Two thirds of the respondents reported that they were trying to reduce waste and separate them regularly for recycling. A percentage of 14% of respondents have, as they replied, installed solar panels at home, while 20% regularly use environmentally friendly alternatives for their movements and buy locally produced and seasonal food, whenever this is possible, at a rate of 35% (European Commission, 2017).

In June 2017, on the occasion of the World Environment Day, the polling company "Aboutpeople" on behalf of electronic newspaper "Athens Voice", conducted a poll regarding the view of the Greeks on CC, in a sample of 731 people over the age of 18. According to this poll, 78.2% believe that CC is mainly due to human factors, and 17.2% that it is mainly due to natural causes, while 3.9% believe that it does not exist (A.V. Team, 2017).

In November 2018, the European Investment Bank, in view of the international climate Summit, published a public opinion survey on CC carried out by the polling company YouGov in a sample of 25,000 citizens. According to this research, the middle social class in Greece is more concerned about climate change (96%) than the lowest (90%) and higher (78%) classes. The same research shows

young people more concerned (94%) than the elderly (85%) and women more concerned (94%) than men (89%) (Voutsadakis, 2018).

In our three areas of study, various initiatives have been undertaken from time to time to inform and raise public awareness about CC.

3.1. Sterea Ellada

As far as the region of Sterea Ellada is concerned, public information is primarily undertaken by the local media, through published articles highlighting the dangers of CC and respective consequences on health of the region's residents, as well as on the regional and national economy. They inform people about relevant to CC actions, lectures, workshops and conferences that take place in the region, urging them to take action for adaptation and mitigation, while disseminating wider information about actions of EU citizens.

In November 2015, on the occasion of the meeting on CC in Paris with the presence of 150 leaders from around the world, a demonstration was held in the city of Lamia against any policy degrading and polluting the environment. This was indeed a mass meeting of protesters who gathered to send their own message against climate aggravating activities and forms of development (LamiaReport, 2015).

In addition, on the occasion of the World Wetland Day, in January 2019, a group of cCitizens carried out an informative intervention in the city of Chalkida for the rescue of Kolovrechti. This activistic initiative aimed to remind the inhabitants of the region of the importance of protection of the environment and the necessity to preserve the remaining natural wetlands in Greece, thus contributing to the planet's climate balance (Pantiora, 2019).

Since the beginning of 2019 the Municipality of Lamia, has organized a series of actions to raise awareness and inform citizens about CC, with the slogan: "Let's Do It Lamia 2019". The initiatives aimed at raising concern and protect the natural environment and reinforcing the spirit of voluntarism besides. This was attempted through promotion of the volunteering school week (with the assent of the Ministry of Education and Religious Affairs), where each school organizes its own actions and cooperate with the municipality for supportive assistance. The overall objective has been to inform and sensitize pupils and students at all levels (Municipality of Lamia, 2019).

3.2. Thessaly

In Thessaly, mainly the local media has taken over the task of informing and sensitizing citizens by posting scientific articles raising citizens' awareness and motivating them to act individually and collectively to combat CC. In November 2015, the ~~"G~~lobal Climate Action" was held on the beach of the city of Volos enabling citizens to send a strong message to the governments' representatives attending the climate conference in Paris, including claims as ~~"t~~urning to green energy" (e-thessalia.gr, 2015).

In June 2017, the 1st Panhellenic Congress on CC was held in the city of Karditsa, where many local people participated and were informed about the significant impact of CC on the environment and humans. Almost two years later, in March 2019, on the occasion of World Forest Day, the Association of Forest Guards of Central Greece, invited all citizens of Thessaly το ask for a new forestry policy providing for a new single forest protection body (Association of Forest Guards of Central Greece, 2019).

Finally, in April 2019, the gymnasium of Platykampos, acted and marched against CC in the city of Larissa, in the context of the event "School open to society", sending the message that it is the responsibility of the young people to act for the sake of the climate with slogans such as: "Save the Earth" (OnLarissa, 2019).

3.3. Peloponnese

As with the previous two regions, the local media mainly have undertaken the task of informing and sensitizing the people of the region of Peloponnese about CC. However, in this region the local mass media hardly mention the negative impact that CC is expected to bring to the region. Citizens are informed mainly through scientific reports, conferences and lectures on the overall impact of CC, without particular reference to the specific locally expected negative impacts. The reason maybe related to political orientation of those controlling the local media or simply to lack of knowledge.

In January 2008, a public event was held in Patra. It was organized by the MESOGEIOS SOS network in collaboration with the environmental education offices of primary and secondary education and the Association of Environmental Organizations of the wider region. During the event the response of the public was particularly warm, and the discussions indicated that CC concerns considerably the residents of the region, who seemed to realize the need of mobilization (MESOGEIOS SOS Network, 2008).

In November 2015, a group of citizens, in view of an environmental protection event, made an internet call inviting the public to claim for the transition to 100% clean energy, thus protecting the future for the next generations and demanding an agreement from world leaders that would release clean energy for all (Tempo24, 2015).

4. Results and Discussion

The three regions presented, although very close to one another differ considerably in terms of their natural, geomorphological and climatic characteristics; also in terms of their socio-economic profile differ to a quite large extent. the three regions illustrate perfectly the strong spatial dimension of CC and its impacts on the diverse human activities affecting consequently spatial policies and regional development (Kartalis et.al., 2017). According to Davoudi (2009), there is a two-way relationship between CC and spatial planning, since spatial planning has the potential to mitigate the effects of CC, while CC may lead to a revision of the basic norms, objectives and directions of spatial planning.

According to research and statistical analyses, CC spatial variations, cause diverse and different pressures on the natural and anthropogenic environment, where the challenges that are posed to many sectors of the economy differ from one region to another (European Environment Agency 2005, 2008, 2012). Indicative cases of such sectors are tourism, energy production, agriculture, fisheries, etc. (European Commission, 2009).

In recent years, the regions have taken a number of initiatives to adapt to CC. Below are three tables comparing the three regions in terms of: (a) physico-geographical and climatic features and challenges; (b) the predominant economic activity and income sectors and (c) the impacts of CC on urban, tourist, agricultural and forestry areas.

Table 1: Physico-geographical and climatic features and challenges of three regions in Greece: Sterea Ellada, Thessaly and Peloponnese.

	Sterea Ellada	**Thessaly**	**Peloponnese**
Physical Geography	• Intense Mountain Volumes • Large number of ponds • Wetlands • Rivers	• Extensive Plain accommodating agricultural development • Intense Mountain Volumes • Rivers • Lakes	• Mountains • Plains • Valleys • Beaches • Rivers
Climate	• Mediterranean • Hot Summers • Mild Continental Winters • Frequent snowfalls in mountainous areas	• Continental • Cold winters • Hot Summers	• Mediterranean • Mild and warm on the coast • Cold in centrally located mountainous areas
Natural Hazards	• Desertification • Drought • Forest Fires • Floods • Frost	• Desertification (due to intensive agriculture) • Drought • Floods • Frost	• Floods • Rainfall • Forest Fires • Earthquakes
Climatic Challenges	• Increase of the number of hot days and nights • Increase of the number of days with extreme	• Hot days increase • Reduction of the days of night Frost • Rainfall reduction	• Hot days increase • Reduction of the number of days of night Frost • Rainfall reduction

	rainfall • Freezing during consecutive drought days		

Source: author's elaborations

Table 2: Predominant economic activity and income sectors in three regions of Greece: Sterea Ellada, Thessaly and Peloponnese.

	Sterea Ellada	**Thessaly**	**Peloponnese**
Areas of Activity and Employment rates	• Agriculture (20,90%) • Livestock Farming (20,90%) • Fishing	• Agriculture (14,26%) • Livestock Farming (14,26 %) • Sea Fishing • Aquaculture	• Agriculture (13,47%) • Livestock Farming (13,47%)
Areas of Income	• Primary Sector • Energy sector • Tourism • Research and innovation	• Primary Sector • Tourism • The field of mineral wealth, energy and industry • Research and innovation	• Primary Sector • Exports of primary sector products • Tourism • Research and innovation

Source: author's elaborations and Greek statistical authority (2009).

Table 3: The impacts of CC on urban, tourist, agricultural and forestry areas

	Sterea Ellada	**Thessaly**	**Peloponnese**
Impacts:			
Urban Areas	• Extreme Precipitation • Floods • Droughts • Heat waves • Frosts • Extreme Rainfall • Fires • Rising sea level • Atmospheric pollution	• Heat waves • Atmospheric pollution • On Tourism • On Economy • On Public health • On Energy demand	• Extreme Precipitation • Floods • Heat waves • Fires • Rising sea level • Atmospheric pollution • On Tourism • On Economy • On Public health • On Energy demand • On Availability and

	• On Tourism • On Economy • On Population health • On Energy demand • On Availability and supply of water		supply of water
Tourist Areas	• On Winter Tourism • On Demand Energy	• On Winter Tourism • On Summer Tourism • On Energy demand	• On Winter Tourism • On Summer Tourism • On Availability and supply of water • On Energy demand
Agricultural Areas	• Extreme Rainfall • Droughts • Floods • Heat waves • Frosts • Rising sea level • Fires • On Availability and provision	• Heat waves • Droughts • Rainfall reduction • On Availability and supply of water • On Productivity Cultivation	• Droughts • Floods • Heat waves • Rising sea level • Fires • On Availability and supply of water
Forest Areas	• Droughts • Fires		• Rainfall reduction • Fires

Source: author's elaborations

It becomes evident that he effects of CC are expected to affect at quite a large extent primary sectors of all three regions, as well as in the secondary and tertiary. Significant changes have been recorded and are anticipated also in various climatic parameters, such as temperature, rainfall, snowfall, sea level, etc., while heat waves, extreme weather phenomena (including extreme precipitation) and droughts are expected to increase. Most of these impacts are negative as they are expected to affect the agri-food sector of these regions by increasing cooling costs during the summer months and reducing tourism due to extreme temperatures and shortages in water supply availability. All of the above are a priority in drawing up plans for adaptation to CC with linkages with sectoral and spatial policies (Kartalis et. al., 2017).

The region of Sterea Ellada is expected to suffer mainly in the primary sector where it bases most of its economy while the energy sector follows. The region of Peloponnese is expected to suffer the largest impact, since it will affect all regional sectors to a large extent. The region of Thessaly will be affected also, but in some cases of the primary sector it will benefit besides, for instance due to the anticipated increase in the production of citrus products.

Our research also revealed the perceptions of the people about CC, that relate to their individual actions regarding CC mitigation and adaptation with an emphasis on issues regarding consumption of energy and the use of environmentally damaging products. After analyses of statistical and poll data, it was found that the Greek middle class consider the problem of CC and acts to tackle it, in a higher percentage, than the higher and lower social classes.

Conclusions

The Mediterranean has been recognized internationally as a vulnerable area to the impacts of CC (Bank of Greece, 2011). This study presents the impact of CC in three regions of Greece, Sterea Ellada, Thessaly and Peloponnese, with climatic conditions appearing to change in urban and non-urban areas. According to the methodology used, potential impacts of CC and the exposure and sensitivity of each region and sub-regions have been addressed. According to the findings of a series of climatic simulations and the IPCC reports (2007, 2013), by the end of the 21st century the temperature in Greece will increase significantly, while the height of precipitation is expected to continue decreasing, with a parallel significant increase in the number of events of temperature extremes and extreme rainfall values (Bank of Greece, 2011). Because of these conditions, the dry areas will become even drier due to the reduction of water resources, the productivity of forests will decrease, and the number of forest fires will increase. Forestry and agriculture have at times shown their susceptibility in the increasing trends of heat waves, droughts and floods, while coastal wetlands are vulnerable to the long-term rise of the sea level. The most acute negative impacts are expected in the western Peloponnese and the lower in Thessaly and southern Peloponnese (Kartalis et. al., 2017).

According to the results of the present study, the impact of CC on the three study regions, especially in the sectors of agriculture, tourism, energy, livestock and public health will generally be negative, without, however, bringing equal results in all three regions. In some cases, CC can produce positive results, for example Thessaly may experience an increase in agricultural production due to the reduction of frost nights.

The planning and sustainable development spatial frameworks institutionalized in 2003 include only with a few references to CC with a visible deficit in the spatial specialization of the counter-actions concerned.

As found in this study, informing people in three regions is being conducted by local media with limited school penetration and limited information by the state, both at educational and operational level. As reflected through the research of "Public Issue" in 2008, Greeks consider that the CC exists primarily in the agricultural sector and not in the urban areas, leading us to the conclusion that information through the local mass media is inadequate, as local media may be biased with the CC or lack the necessary knowledge.

In spatial frameworks, it was found that CC appears at the target level, but not at the operational level, while absent from the urban space and planning. In the field of spatial legislation, CC is practically absent, but there are often references to energy issues, but through the technical prism of the energy infrastructure, not CC. The same applies to urban planning legislation (Kartalis et. al., 2017).

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