ARPHA Proceedings

Proceedings CAUSummit 2024, 0154-0163
doi: 10.3897/ap.7.e0154

World Summit: Civil Engineering-Architecture-Urban Planning Congress

Climate Change and the Effect of Natural Disasters on the Tourism of Architectural, Cultural Heritage Sites: The Case of Broader Area of Thessaly, Greece

Georgia Cheirchanteri[1,a)]

[1] *University of West Attica, Industrial Design and Production Engineering, Faculty of Engineering, Ancient Olive Grove Campus, 250 Thivon and P.Ralli, 12241 Egaleo, Athens, Greece*

[a)] Corresponding author: geoxeirr@gmail.com

Abstract. Climate changes as gradual changes in temperature, atmospheric humidity, rainfall and wind intensity, as well as rising sea levels together with the occurrence of extreme weather events, is already affecting cultural heritage sites worldwide. Although these areas have always been and will continue to be subject to interactions with their environment, climate change is an additional potential threat, exacerbating expected decay rates and/or contributing to new decay changes. Additionally, the occurrence of natural disasters, because of climate change, threaten the people life by causing the damages on the properties, and the societies encounter the significant cultural and socio-economic problems. Natural disasters may occur naturally and by human impacts for example forest fires that the main causes are generally human's stolidity. The natural disaster management is especially important by means of tactical and management decisions, and also the operational activities in various phases of the disasters for society's resilience. It is a fact that the protection of cultural heritage from the consequences of natural disasters due to climate change is gaining more and more ground on the international agenda. Furthermore, the G20 summit and the European Commission are constantly paying more attention to the importance of the past for the changes of the future. However, many areas affected by natural disasters are tourist destinations where the architectural cultural heritage and the natural environment are attractions for tourism. The aim of this article is to investigate the socio-economic results of the natural disasters on tourism in areas of architectural cultural heritage. Floods are the second most frequent disaster in Greece after forest fires. The most recent example is the flood in the wider area of Thessaly, in September 2023, which will also be a case study of this announcement. Many traditional settlements of Pelion, which were famous tourist destinations for their architecture and natural environment, suffered severe damage from the flood, as well as some of the reconstructed and reused industrial buildings of the 19th century in Volos, mud seeped in, covering the basement surfaces at a height of about 3 meters. At the same time, dealing with them with measures such as the mapping of flooded areas using new technological means will be discussed, which will demonstrate the necessity of managing a disaster through records that will provide usable data, so that prevention and mitigation measures can be designed and implemented based on advanced technical tools.

Keywords: Climate change, natural disasters, touristic destnations, architectural cultural heritage, natural environment

Published by CAUSummit and peer-reviewed under the responsibility of "World Summit: Civil Engineering-Architecture-Urban Planning Congress - CAUSummit-2024".

INTRODUCTION

Large-scale and intense natural disasters have been occurring with increased frequency in recent years, which can be caused by processes occurring in nature, with or without human presence. More and more extreme weather events as a consequence of climate change, frequent floods, high-intensity earthquakes followed by tsunamis, landslides and other catastrophic consequences are prime examples of these natural disasters.

This constantly and constantly accelerating manifestation of phenomena in the earth's atmosphere and surface tends, although it seems paradoxical, to find some balances in the environment. Balances that have been disturbed not only by exogenous and endogenous factors but also to some extent by ever-increasing human interventions, such as air pollution and the consequent change in climate conditions [1].

Organized societies in the modern era are called to face the direct and indirect consequences of every natural disaster. This problem is particularly difficult and becomes even more difficult especially when the disasters take place in a metropolitan environment. The catastrophic floods of 1966 in Florence, the great Kobe earthquake in 1995 or even the Athens earthquake in 1999, Hurricane Katrina in New Orleans in 2005, are examples of such catastrophic phenomena. The study of each case leads to the derivation of many conclusions from the facts themselves and their results, not only in relation to technical and scientific issues, but also in regards to the particularly difficult and demanding task of managing a catastrophic phenomenon for all the phases of its cycle: for the phase of prevention, preparedness, response, restoration and reconstruction after the disaster.

A people's cultural heritage, both tangible and intangible, can be affected by catastrophic natural phenomena. Fires, floods and earthquakes are the main factors of its destruction and loss. In the context of achieving sustainable development, the need to protect and save the world's cultural heritage is considered imperative. Mitigating and dealing with natural hazards in cultural monuments and sites has, in recent decades, increasingly attracted the interest of the global community.

Cultural heritage, both tangible (historical cities, archaeological sites, monuments, museums, etc.) and intangible (traditions, rituals, knowledge, arts, etc.) are components not only of culture but also of the whole of humanity, in which case the latter has a duty to protect them. Cultural heritage monuments can suffer the devastating consequences of the uncontrolled combination of seemingly insignificant elements. The loss of cultural heritage does not only constitute the loss of important sources of tradition, identity and knowledge, but also implies the deterioration of socio-economic resources for the societies recovery and development [2]- [3]-[4].

Many of the disasters that have occurred at cultural heritage monuments could have been mitigated or even avoided if appropriate preventive measures had been taken. It is important to recognize and assess the risks that pose a threat to monuments in order to prevent or even mitigate them, but also in general to manage them in order to protect their exhibits and more importantly, human resources [3].

The aim of this paper is to highlight the value of cultural heritage by emphasizing in general the need and importance of its management and protection, especially from natural hazards. The goal is to inform and raise awareness about natural disasters and their impact on tourism in areas of architectural cultural heritage. The effects of natural disasters on cultural heritage sites are investigated and presented, and the case of the recent flooding of the wider area of Thessaly, in September 2023, is particularly studied. Many traditional settlements of Pelion, which were famous tourist destinations for their architecture and natural environment, suffered severe damage from the flood, as well as some of the reconstructed and reused industrial buildings of the 19th century in Volos, mud seeped in, covering the basement surfaces at a height of about half a meter.

The preservation and protection of cultural heritage requires attention and special measures must be taken to minimize damage to the goods. The development of a disaster response plan is a coordinated process that provides guidance on responsibilities for preparedness, prevention, response and recovery processes aimed at the integrated management of natural disasters in the wider cultural heritage sector.

ARCHITECTURAL CULTURAL HERITAGE TOURISM: AN ALTERNATIVE KIND OF TOURISM

The contribution of the tourist activity to a region economy is considered to be particularly important. It has been proven that tourism, under certain conditions, is a development lever. This is attributed to the special tourism feature development, primarily, at a regional and local level, causing positive economic effects on the productive base of the regional economy.

The concept of sustainability, in recent years, especially regarding to tourism, began to be discussed more widely, as well as being the subject of study by many researchers. "Sustainability" is defined as the rational use of natural resources for the man's benefit, without their degradation or destruction in order to maintain the ability for next generations to meet their own needs in the future. In the context of sustainability concept, special mention is made of specific and alternative kinds of tourism since the traditional type, which has flourished so much in recent decades, seems to be abandoned in favour of some other kinds of tourism, which satisfy modern man needs or simply desires. The decline of mass tourism leads to the creation of special Kinds of tourism programs depending on the people interests. So, the alternative kinds of tourism are as many as the corresponding tourist needs.

Furthermore, these specific kinds of tourism are more efficient, more compatible with the environment and their goal is to improve the touristic "package" offered with particular sensitivity to the visitor-tourists preferences and interests. Additionally, the specific kinds of tourism, which will be the axis of the future tourist development of every region, are characterized by the existence of a special and dominant demand motive (e.g. conferences, ecology, culture) and by corresponding special infrastructure development in the tourist areas which aim to serve tourists of every specific kinds of tourism. Concerning the alternative kinds of tourism, are characterized by the existence of a dominant special motivation which is linked to specific topics such as: nature worship, adventure travel, sports, sightseeing, environment, getting to know the local tradition.

One of these kinds of "alternative tourism" is architectural cultural heritage tourism. This term characterizes people who visit a place based on the architectural cultural heritage stock of each region. The importance and universality recognition of architectural cultural heritage marks an extremely important development of cultural policy in its global dimension. This development can be included in the wider context of "cultural internationalism", which particularly characterizes the post-war period.

After all, cultural tourism is not limited to admiring only the antiquities or modern monuments of a region, but also extends to understanding the way of region people's behaviour or thinking, as well as their direct contact with their habits, customs and traditions.

Threats and Dangers of Architectural Cultural Heritage Monuments

From 1994 to 2004, the World Heritage Committee, in collaboration with the World Heritage Service, carried out evaluative surveys on the threats facing cultural heritage worldwide, as well as the rate of their occurrence. The main threats are demographic boom, uncontrolled commercial activity, intense anthropogenic activity, oversized projects, animal husbandry, exploitation of natural resources, social and cultural changes, mass tourism, lack of management plans and assessment of cultural value, in illicit trafficking, war conflicts, climatic conditions, extraterrestrial material fallout, nuclear energy and natural disasters [5].

Demographic boom, uncontrolled commercial activity and agricultural development are putting intense pressures on cultural heritage. The extraction of natural resources, such as oil, natural gas, water and the reckless exploitation of forest lands combined with the infrastructures required bring about their degradation, creating contrasts in land uses that lead to social conflicts. The lack of spatial planning management and control mechanisms combined with demographic developments and population movements lead to social conflicts that disturb the environmental conditions of a region's cultural resources and exert increased pressure on existing infrastructures [6].

The use and management of a cultural monument is determined by society and its environmental space. The lack of management plans is a key factor in creating conditions of instability in the monuments. This phenomenon is particularly found in the cultural heritage of Africa. Inactive protection agencies and insufficient staff enable the illegal trafficking of cultural heritage elements and uncontrolled antiquities [5].

The rise of the mass tourism phenomenon has resulted in the expansion of the built environment over the natural, leading to a vicious cycle of environmental and climate impacts. Due to the high inflows of tourists, the pressures that develop on the cultural resources disrupt the environmental balances (pollution of natural resources, spatial rearrangements, social changes, alteration of cultural identity, etc.) making it necessary to manage dangerous phenomena [7].

Climate change is a multidimensional factor, as it has a catalytic effect on changes in weather conditions, on the geographical configuration of a place and on its economic development, bringing about demographic and social changes. The built environment and its evolution is directly affected by these sectors, making the role of climate change a catalyst in the sustainability of the historical landscape and, by extension, the cultural identity of a community. The control of climate changes requires the development of preventive measures to protect cultural heritage, the development of plans for dealing with risks and recovery after natural disasters. Their monitoring is done

through the use of specific indicators of a system's sensitivity, the effects, the adaptive capacity and vulnerability to the negative effects of climate change, which are located in destructive natural phenomena, creating an inextricable relationship between the two concepts [8].

It is a fact that climate change creates natural phenomena such as storms, cyclones, droughts, heat waves and floods, while the category of geophysical phenomena includes, for example, earthquakes, landslides, lake retreats, volcanic eruptions and accompanying events such as tsunamis. Of course, regarding the protection of cultural monuments, it should be mentioned that deterioration is not only caused by extreme natural phenomena, but also gradually by their chronic exposure to atmospheric and climatic factors (atmospheric pollutants in gaseous or particulate form, humidity, temperature differences, hail, etc.).

Natural phenomena frequency in urban centers, where there are the largest concentrations of population, is directly affected by human activity. Hurricane Harvey in 2017, is a typical example, which was the result of climate change due to intense human activity and the change in environmental temperature, bringing the state of Texas devastating consequences.

Cultural Heritage Resilience and Sustainability

The ability of a system to accept, assimilate and resist possible changes without changing its structure constitutes the term resilience [9]. The international literature refers to systems located in the natural environment, specifying the resilience of the ecosystem and natural resources, in the social environment, referring to the ability of a social group to recover immediately, in economic resilience and in the built environment, referring to building units or historical ensembles [10].

Cultural heritage, as it is part of an ecosystem, is inextricably linked to its environment and to society. The stability of a cultural system is susceptible to environmental, social, economic, political changes, the pressures and conflicts of which may become more unfavorable due to residential growth and technological development.

Therefore, although heritage is often seen through its cultural interpretation, sustainable development brings the concepts of heritage to another dimension, as it establishes full relations with economic, environmental and social sectors. As far as the material cultural heritage, and more specifically the architectural heritage, these relationships become even stronger, as the monuments erosion is not only a result of the materials aging or the environmental actions. Factors such as global and local pollution, climate change, poverty, religion, tourism, trade, ideologies, war, are now at the forefront of the search for new approaches, thoughts and perspectives on heritage [11].

Addressing the challenges must be done effectively so as to cover the needs of a system for future generations without affecting the immediate environment, thereby recommending the definition of sustainability. Failure to respond immediately to pressures and negligence increases the degree of vulnerability. In the context of understanding the dynamics between the evolutionary path of a system and the human factor, the concept of the adaptability cycle is defined. According to the cycle of adaptability for a system (in this particular case cultural) the phases of development, maintenance, collapse and reconstruction are recognized, at which point it should adapt and be characterized by flexibility within a constantly changing landscape.

The ability to anticipate these changes, to prevent their effects even unilaterally and to recover by assimilating the effects efficiently and in a timely manner, ensures its future protection and its maintenance over time [12]. The resilience of a cultural system is one of the elements that constitute its sustainability. The basic principles of sustainability are the strengthening of the quality characteristics of the environment, the promotion of social and genealogical equality, economic activation, the creation of an optimal standard of living and the strengthening of resilience against crises. Achieving the sustainability of a (natural, social, built, cultural) environment requires intelligence, inclusive openness, accessibility and resilience in times of crisis.

NATURAL DISASTERS: A CLIMATE CHANGE RESULT

In recent years, the effects of disasters in various regions of the world have been increasing. Along with their complexity, they cause great concern in developed and developing countries. These catastrophic events are mostly hydrological, meteorological, geological or climatological, such as floods, earthquakes, fires. In the coming decades, it is expected that climate change will lead to more frequent and extreme weather conditions approaching wider areas, with losses both in human and material terms [1]- [4]. However, many areas affected by natural disasters are tourist destinations where the architectural cultural heritage and the natural environment are attractions for tourism.

The already intense natural phenomena are getting worse due to the intense anthropogenic activity that brings significant changes to the climate. In particular, human interventions on an extensive scale that cause significant burdens on natural resources, high population concentrations in high-risk areas, climate changes, the failure to take protection measures and decisions in time combined with political ignorance, the lack of specialized personnel and informational programs, constitute factors that intensify the destructive effects of natural phenomena.

A natural disaster is a natural event of unusual magnitude; which people cannot control or do not expect. Human weakness in the face of natural disasters is exacerbated by the lack of an appropriate emergency management system or lack of planning, leading to structural, economic and human losses. Natural hazards (e.g. a flood, a fire, an earthquake, a landslide, a volcanic eruption, etc.) threaten human lives but also cultural goods.

A natural hazard can be developed into a natural disaster when it causes the injury and death of people, the destruction of settlements, properties, cultural goods, monuments, etc. It should be noted that apart from the direct and obvious effects of natural hazards (such as when a building is destroyed by an earthquake), there are usually indirect effects as well. And while the latter may be less obvious, they're usually the most damaging, adding years to a community's recovery period after a disaster.

Therefore, it is very important to know everyone about natural hazards, and this is because human activities are increasing their magnitude and severity as well as their frequency of occurrence. Understanding when, how, where and why natural disasters occur is the primary step in limiting their impact on human lives.

FIGURE 1. Daniel’s storm, nature disasters result in the wider area of Thessaly, September 2023.

Natural Disasters and Cultural Heritage

Natural disasters result from the manifestation of potential natural hazards, that is, natural phenomena capable of causing them. Cultural heritage can be threatened by various and varied damaging factors, as natural disasters which are the most important. Archaeological findings, objects of art and historical value whether or not kept in museums, as well as monuments with their architectural and decorative elements, are threatened by various destructive natural phenomena. The main natural phenomena that threaten cultural heritage are floods, earthquakes, fires as well as related phenomena such as landslides, tsunamis and storms. Extreme natural phenomena occur in modern urban centers with increased frequency and with greater human, economic and material losses. This happens mainly due to the built environment density and the population sizes increase on the one hand, as well as the protective measures absence or degradation to simple instructions on the other. The risk and, therefore, the size of the disaster, which

is also the final result, depends on the size and intensity of the natural phenomenon, on the system vulnerability in which the phenomenon manifests itself and on the exposed element value to the risk [13].

The manifestation of intense natural phenomena within an ecosystem is, in any case, a normal development of the life cycle on earth. However, the existing natural environment has been altered, by the development of man-made structures either in organized communities or in the form of urban centers, which has as a consequence its unfavorable operation during the natural phenomena encroachment. Today, the cost to the global economy is over $60 billion annually. Of these, approximately 1/3 corresponds to the expenses for the prediction, prevention and prevention of

disasters. While approximately the remaining 2/3 correspond to damages from disasters that are directly caused as well as their restoration. Annually, the world average of the number of deaths varies from year to year at 250,000, while the dead from major disasters amount to 140,000 [13].

The effects of natural phenomena, which are varied and multifaceted, they are divided into direct and indirect, affecting various aspects of life. The first, refer to the events and losses during the occurrence of the natural phenomenon, and are measurable quantities. On the contrary, the second ones are perceived after some time from the catastrophic event to the wider environment, and are non-measurable quantities. Direct impacts on cultural heritage are identified in evidence morphology of historic buildings or complexes, as irreversible damages are caused altering them entirely.

The indirect effects of natural disasters are found more in the wider environment. Their size depends on the size of the natural disasters and the level of the monuments importance placed in a state of danger. More specifically, the indirect effects are found in the physical and structural environment and in the existing infrastructures as well. The cultural landscape is under alteration, the degree of which depends on the intensity of the phenomenon. Demographic changes and population losses. which are important in a community, leading to social degradation. The everyday life of residence shows transitions. The economy of the affected area is deteriorating, determining the evolutionary course of the respective community. Conflicts of use land are intense, especially in crises where organization is absent. The value of the land shows reduction, while the land itself is abandoned in several cases. The standard of living population is degraded, in which case it is necessary to repair the damage immediately and in a universal level.

While, as reported by the World Heritage Center (WHC) of the Educational United Nations Scientific and Cultural Organization (UNESCO), the risks of disasters in cultural heritage monuments are related to vulnerability to various potential risks [14]. In Greece, the occurrence of natural disasters is particularly high. This is due to intense geological rearrangements but also to climate change, a modern phenomenon, which is inextricably linked mainly to floods and heavy rainfall. While among natural disasters, regarding this country, fires are the ones that occur with the greatest frequency.

However, the second most frequent natural disaster, after forest fires of course, are floods. Most floods are the result of a) the total amount and distribution of rainfall, b) permeability of the soil or rock (ie the ability of a rock to allow water to penetrate and circulate within it) and c) topography. Some floods can be caused by the melting of snow and ice during the spring season or in rare cases by the failure of a dam. Also, the use of land in small drainage basins can significantly affect the flood [1]. Also, in general, the size of the flood directly depends on the intensity and amount of rainfall. Catastrophic floods, which are even rarer, are in most cases caused by intense and large storms, while the smaller floods or flows that occur more often are created by storms that are less intense [1].

Urban floods are those floods that occur in an urban environment. They can become more destructive because of human intervention land use, which has increased their size and frequency, especially in poorly drained basins. The frequency of flooding is a function of the percentage of impervious surface (pavements, roofs, cement) and the area with a drainage network. Sewers are considered important in an area because they allow rapid surface runoff of impervious surfaces into streambeds. Flooding and urbanization create a huge number of changes in the precipitation-surface runoff relationship, with the largest changes corresponding to large storms [1].

(a) (b)

FIGURE 2. Traditional settlements in Pelion region: Before (a) and after (b) Daniel's storm disasters.

Flooding effects can be either direct, caused by the flood itself (such as death, injury as well as damage and destruction caused by the velocity of currents and sediments to homes, buildings, roads, bridges, means of transport, in communication systems), or indirect, caused by the malfunctioning or decentralization of systems and services related to it (such as short-term river pollution, hunger, disease and displacement of residents, as well as sometimes fires from cut gas lines or from short circuits) [1].

CASE STUDY: NATURAL DISASTERS IN THE WIDER AREA OF THESSALY IN GREECE

The wider area of Thessaly, which located in Central Greece, gathers a multitude of monuments from antiquity, Byzantine times and of course newer monuments from the 18th to the beginning of the 20th century. Lowland Thessaly has a rich cultural heritage of great historical value, created by its indigenous and exclusively Greek-speaking inhabitants. Some of the most famous monuments of the area are Meteora with the status of World Heritage Monuments (1988), the famous Pelion for its architectural cultural heritage and Lake Plastira. Therefore, the wider area of Thessaly is also an attraction pole for tourists who are more interested in alternative tourism, since the area offers them religious, agricultural and architectural heritage tourism.

Especially the region of Pelion in Magnesia, is characterized for its folk art and architecture, due to its uniqueness and particularity in the Greek area. The 24 villages of Pelion were developed during the late Turkish occupation, the period when Pelion experienced great economic and cultural development. Thus, in the period of the 18th century until the beginning of the 19th, more and more houses and mansions are built, which, combining elements of the urban architecture of that era with the fortification preservation, create this unique Pelion local building tradition, which is still preserved to this day. However, it is not only the mansions that give their mark to the area, but also the multitude of church monuments, fountains, paved squares, bridges and cobblestones, which make up one of the most traditional settlements in Greece. It is no coincidence, that many of the villages of Pelion such as Vyzitsa, Pinakates and Makrinitsa have been declared protected settlements of absolute protection ‘Figure 2 (a)’.

Also, Pelion gathers many visitors, both in the winter and summer months. In winter it is preferred by those who wish to enjoy the beautiful mountain and fresh air, snow, skiing, spending time in nature, while in summer visitors enjoy the beautiful beaches of Pelion for swimming, rackets, water sports, hiking, etc. Pelion remains beautiful during all months of the year and is suitable for any kind of activity, as well as for alternative tourism or agro-tourism, having the appropriate infrastructure to host a large volume of visitors. Also, Pelion has a large number of trails that are ideal for walking, horse riding and cycling of mild form tourism. The paths-cobblestones including the railway Volos - Mileon, were until the 50s the only axis of communication between the villages and Volos. Nevertheless, many of the old trails are kept in very good condition thanks to the local communities care, giving the visitor the opportunity to explore the mountain up close and safely.

Daniel Storm in the Wider Area of Thessaly

Daniel storm was an extreme weather phenomenon with heavy rains and thunderstorms that first hit Greece, Bulgaria and Turkey and then moved towards Libya, also causing heavy rainfall, resulting in massive property damage and the death of at least 11,500 people, after two dams rupture, while tens of thousands of people in Libya were missing. Daniel storm began on September 4, 2023 from the Ionian Sea, centered on the wider area of Thessaly ‘Figure 1’, causing massive destruction and accounting approximately 17 deaths. According to the experts, the Daniel storm was an extremely extreme phenomenon, where the area of Volos in the region of Magnesia received 150 million tons of water and mud in just one day. The website Meteo.gr, reported that the area of Pelion had received 750 millimeters of rain from midnight on September 4th to 3 o’clock in the following day afternoon, when the average annual rainfall in Athens was about 400 millimeters.

On September 6, the Krausidonas river, which originates in Pelion, overflowed its banks in Volos city and destroyed a bridge and a nursing home, while sweeping away cars, buses, trees and other heavy objects in its wake. On September 7, the main highway between Athens and Thessaloniki was closed and train services between the two cities were suspended. In Larissa, after the rains ended on September 8, the water continued to rise, as the Pinios River overflowed its banks, reaching a level of 9.5 meters, compared to the normal level of 4 meters. On the same day, the continuous heavy rainfall that occurred in Karditsa and Trikala during the morning hours resulted in the rivers overflowing, as many villages being submerged under the water and dozens of residents being trapped. Also, in the Valley of Tempi, the height of the Pinios river water reached about 18 meters.

The major devastation caused in the Thessaly region by Daniel storm, has still left major wounds in various infrastructures in the region. A characteristic example is the Tempi bridge located in Agia Paraskevi church on the Pinios river banks, built in 1960, which was destroyed by floods and Pinios rushing water 'Figure 3'. In particular, a large metal part of the bridge deck was detached from the rushing water and swept away for at least 3 kilometers, at the height of the first Tempi tunnel, near the Pinios river mouth. Even today, access to the small church of Agia Paraskevi remains impossible.

(a) (b)

FIGURE 3. Tempi bridge located in Agia Paraskevi church on the Pinios river banks: Before (a) and after (b) Daniel's storm flood disasters.

However, in addition to the Pelion infrastructure and architectural cultural heritage damage due to the Daniel storm, the floods also damaged modern cultural heritage monuments in the city of Volos such as the renovated industrial building, former Nikolaos & Spyridonos Tsalapatas Brick Pottery Factory, which was functioning as a Brick and Ceramic Factory Museum 'Figure 4'. The building complex aimed to highlight the historical identity of Volos and its contribution to the industrial heritage rescue and promotion, as well. But after Daniel's storm advance, the building was covered with water and tons of mud almost up to its roof, rendering it non-functional and unvisitable.

(a) (b)

FIGURE 4. Brick and Ceramic Factory Museum, the former Nikolaos & Spyridonos Tsalapatas Brick Pottery Factory: Before (a) and after (b) Daniel's storm flood disasters.

Daniel's storm economic effects had a very significant impact in the immediate period following the Thessaly economy and by extension the national economy, mainly in the primary sector, as the Thessalian plain produces 38% of cotton domestic production and 52% of industrial tomato. Also, fruit and nut production percentage (pears, apples, chestnuts, walnuts) is many times over 50% of domestic production. Concerning meat production, Thessaly produces more than 18% in cattle, as well as occupying a very high position in pig farming and livestock farming.

It is noted that Daniel storm in Thessaly region had serious effects on the hotels operation, where Magnesia area having suffered the greatest damage. In total, 189,000 overnights were canceled with the estimated revenue losses due

to overnights and events cancellations amounting to €22.4 million. In addition to the direct loss of revenue, the cash return advances are estimated at €1.03 million. Generally, there was a very serious damage to state infrastructure, such as the road network which has been cut off in many places of Pelion popular villages, the water supply network both in the urban complex of Volos city and South Pelion, and as a result the businesses operation was impossible.

Concerning the region of Pelion tourism 'Figure 2', September is a month of high tourist demand. In addition to the losses suffered by businesses, there was a huge loss of revenue due to the cancellations. In addition, alternative tourism programs in the Pelion area, such as trekking, walking, etc., could not be carried out since the paths and the mountain morphology were destroyed, while at the same time villages and smaller ports which supplied people to Pelion have been cut off. Traditional settlements and popular villages for tourists, even though beaches disappeared or were cut off. For example, Makrynitsa, one of the most famous settlements of Pelion, did not have access during the autumn-winter tourist season begging.

NATURAL DISASTER MANAGEMENT

According to the International Federation of Red Cross and Red Crescent Societies (IFRC), disaster management is defined as the organization and management of responsibilities and resources to address the humanitarian aspects of emergency situations, aiming to reduce the disasters impact. Natural disasters management is of vital importance so that man can protect himself and also deal with the damages resulting from natural disasters. The disaster magnitude, which is due to the occurrence of a natural phenomenon or a technological accident, depends on the area vulnerability and vulnerability, the combination of risks that will arise after the phenomenon occurrence and the ability of those responsible people to reduce as much as possible the negative effects [15].

The primary goal of risk management is to avoid disaster by preventing or mitigating the effects of a potentially catastrophic event to such a level that society is able to cope with it. In parallel, the way to deal with the disaster is sought to be effective to such an extent, that allows the affected area to recover in a short period of time.

Natural disasters management is considered a cyclical process and consists of two phases that take place before the disaster occurs and three phases after the disaster. Before the disaster there is prevention and preparedness disaster and after there is relief, restoration and reconstruction disaster [16]. The above phases constitute the so-called "Natural Disaster Management Cycle", which has been used since the 1970s and is a useful tool for managing disasters and their effects [17].

The lack of prevention and protection measures often causes disasters in modern societies. Both the people and the state are responsible for taking these measures. If such measures are not taken, the consequences can be devastating both physically and materially. For risk assessment, the physical and socio-economic background plays a decisive role, as risk analysis is based on the probability of occurrence as well as the severity degree of an event consequences [18].

CONCLUSION

Cultural heritage connects the past, present and future of a place, playing a multifaceted role in today's multicultural society. One of the cultural heritage main threats, and especially to architectural cultural heritage, is natural disasters, which in the past have caused irreparable damage and destruction to cultural sites and monuments. Climate change is an additional potential threat, as it worsens expected synthesis rates and/or contributes to the new decomposition changes emergence.

In September 2023, the wider area of Thessaly in Greece, was tested by Daniel storm, an extreme weather phenomenon, product of climate change, which caused major disasters, mainly economic and social. Also, Thessaly possesses architectural cultural heritage areas, such as the traditional settlements of Pelion, which is a popular tourist destination for visitors. The floods and disasters that occurred in the wider area of Volos from this particular storm, created significant financial problems both in architectural cultural heritage areas and in modern monuments, especially in renovated industrial buildings during the end of 19th century until the begging of 20th.

The anti-flood measures development and the projects creation in high importance areas and zones, are necessary not only for the tourism sector and local economy preservation but also for natural environment preservation. The natural or non-natural disasters effects are great for the natural environment and businesses as they affect the micro-economy as well as the macro-economy of the region. Through the regional framework of spatial planning and sustainable development of Thessaly and through the framework of spatial planning and sustainable development for

tourism as well, the economy recovery based on alternative tourism in architectural cultural heritage areas can be made.

ACKNOWLEDGMENTS

I would like to thank the University of West Attica, in Athens, Greece, for supporting and funding my research.

REFERENCES

1. E. Lekkas, *Natural and Technological Disasters,* (ACCESS Pre-Press, Athens, 2000). Ανακτήθηκε 6 Απριλίου 2020 από: http://labtect.geol.uoa.gr/pages/lekkase/PDF%20Files/fysikes_katastrofes.pdf), pp. 25–30.
2. N. Konsola*, The International Protection of World Cultural Heritage,* (Papazisi Publications, Athens, 1995).
3. M. Lyratzi, *Guide for Drawing up a Disaster Response Plan in Museums and Libraries*, (Athens,2014).
4. F. Desmarais, and T. Schuler, "Museums in a dangerous time", in *ICOM News 17*, (2011), pp. 16- 1.
5. ICOMOS, *World Heritage in Danger*, (2009). Retrieved April 18, 2024 from: http://whc.unesco.org/document/106357
6. A. Russo, "The "vicious circle" of tourism development in heritage cities", *Annals of Tourism Research*, *Vol. 29, No. 1,* (2002). pp. 165-182. Retrieved April 18, 2024 from: https://is.muni.cz/el/1456/jaro2014/BKR_GECR/um/The_Ovicious_circleO_of_tourism_develop ment_in_heritage_cities.pdf. https://www.dianeosis.org/wp-content/uploads/2017/06/klimatiki_alagi_parartimata.pdf.
7. H. Coccossis, "Sustainable Development and Tourism: Opportunities and Threats to Cultural Heritage from Tourism. In Cultural Tourism and Sustainable Local Development", (Surrey, England: Ashgate, 2009), pp. 47-57. Retrieved April 18, 2024 from: https://books.google.gr/books? hl=en&lr=&id=chNiJ3QEeMYC&oi=fnd&pg=PA47&ots=6Rkj3sUE3-&sig=htCTEMz2PY19sV_Q2XMg4p9JOb8&redir_esc=y#v=onepage&q&f=f alse
8. K. Kartalis, H. Cocossis, and D. Economou, *Effects of Climate Change on Development*, (DiaNEOsis Research and Analysis Organization, 2017). https://www.dianeosis.org/wp-content/uploads/2017/06/klimatiki_alagi_parartimata.pdf.
9. C. Redman, & A. Kinzig, "Resilience of past landscapes: resilience theory, society, and the longue durée. Conservation ecology", (Environmental Science, History, 2003), DOI:10.5751/ES-00510-070114.
10. L. Labaka, J. Hernantes, E. Rich, and J. Sarriegi, "Resilience building policies and their influence in crisis prevention, absorption and recovery", in *Journal of Homeland Security and Emergency Management*, 10 (2013), pp. 289-317.
11. R. Amoêda, S. Lira and C. Pinheiro, *Heritage 2010 – Heritage and Sustainable Development*,(Publisher: Green Lines Institute, 2010).
12. C. S. Holling, and L.H.Gunderson, L. H., "Resilience and adaptive cycles", in *Panarchy: Understanding Transformations in Human and Natural Systems*, (2002), pp. 25-62.
13. K. Macropoulos, "Natural Disasters: Earthquakes and Protection Measures", in *15th Concrete Conference*, 15th Concrete Conference Proceedings (TEE, ETEK, Alexandroupoli, Greece, 2006), pp 1-9. Retrieved April 18, 2024 from: http://library.tee.gr/digital/m2173/m2173_makropoulos.pd.
14. UNESCO, World Heritage Convention, *Reducing Disasters Risks at World Heritage Properties,* Retrieved April 18, 2024 from: http://whc.unesco.org/en/disaster-risk-reduction.
15. G. Mouzalis, *Technological and NaTech disasters*, (Athens, 2015).
16. C. J. Van Westen, (2000) "The Modelling of Landslide Hazards Using GIS" in *Geophysics, 21*, (2000), pp. 241-255.
17. C. Coetzee, and D. van Niekerk, "Tracking the evolution of the disaster management cycle: A general system theory approach", in *Jàmbá: Journal of Disaster Risk Studies, Vol 4 (No 1),* (2012).
18. K. Younghwan, K. Minki and K. Wonjoon, 2013. "Effect of the Fukushima nuclear disaster on global public acceptance of nuclear energy," in *Energy Policy, Elsevier, vol. 61(C)*, (2013), pp. 822-828.