Climate Change and Natural Disaster Management Policy Implications for Greek Cultural Heritage

Meilin Lyu
PhD Candidate National University of Athens

Introduction

Human-induced climate change and increased human activities have become a new reality that must be dealt with by archaeologists and heritage managers to the protection and preservation of cultural heritage. In recent years, we have seen Greek archaeological sites being posed with imminent threats with the increased frequency of extreme weather events such as storms, heatwaves, and droughts. These events could damage or destroy monuments, either directly by the force of weather or indirectly through deterioration, erosion and other processes. For examples: high temperature and droughts puts the higher risk of fires for sites located near forests and for monuments made of materials that are sensitive to temperature and humidity; coastal and island archaeological sites are vulnerable to sea-level rise; frequent rainfall could cause the ground around monuments to landslide, affecting the land stability of the site.

The management of cultural heritage sites is typically led by professionals who operate within parallel academic fields that rarely intersect, making it a final attempt to resist challenges such as environmental degradation, population growth, or resource exhaustion (Kyriakidis & Anagnostopoulos, 2016). To precisely understand the current state of preservation in Greece, systematic data collections are essential as baselines for monitoring and predicting ongoing changes. In managing stone-built heritage, the complexity arising from physical, biological, and chemical deterioration underscores the need for cross-disciplinary collaborations among such as archaeologists, heritage professionals, environmental physicists, biologists, and engineers, alongside consideration of the cultural, economic, and institutional contexts. Equally important is the participation of netizens in this digital age to visualize and address the issues outlined by the UN development goals.

Since 2014, the Intergovernmental Panel on Climate Change (IPCC) has formally adopted Representative Concentration Pathways (RCPs) to project different greenhouse gas (GHG) concentration trajectories by the year 2100. These include four main scenarios—RCP2.6, RCP4.5, RCP6.0, and RCP8.5—named after their respective levels of radiative forcing (in W/m^2), which also correspond to potential global temperature increases. Later, in conjunction with the Shared Socioeconomic Pathways (SSPs), three additional scenarios —RCP1.9, RCP3.4, and RCP7—were introduced to reflect broader mitigation possibilities. These projections are employed in climate modelling efforts through both Global Climate Models (GCMs) and more localized Regional Climate Models (RCMs), the latter developed under the WCRP's Coordinated Regional Downscaling Experiment (CORDEX), with EURO-CORDEX specifically addressing the European context.

Beyond physical impacts, climate change also brings substantial indirect consequences, especially economic. According to the Swiss Re Institute, if global temperatures are kept well below the 2°C target, Europe could still lose up to 2.8% of its GDP by 2050. However, in a scenario where global warming reaches 3.2°C, the economic impact could be as high as 10.5% of GDP (Merchant, 2021). For Greece specifically, projections by the Ministry of Environment and Energy (2016) estimate potential GDP losses amounting to €701 billion by 2100 in the absence of significant mitigation efforts. As a result of recent natural disasters, including extensive wildfires and flooding in September 2023, €10 million in emergency funds have already been allocated for local response and prevention.

Future climate projections for Greece give a concerning picture. Between 2071 and 2100, the number of days exceeding 35°C is expected to increase by 35–40 days annually, while frost nights in northern Greece could decrease by up to 40 days. Precipitation trends also suggest spatial divergence: eastern central Greece may experience a 30% increase, whereas western regions may face a 20% decrease. Drought durations are expected to extend by up to 20 days by 2050 and 40 days by 2100, especially in eastern Greece and northern Crete—further exacerbating wildfire risks, particularly from Thrace to the Peloponnese (Ministry of Environment & Energy, 2016). Although urban areas may see more high-intensity rainfall events, increasing

the risk of flash flooding, the general pattern is one of prolonged heat and dryness, paired with a decline in cold night events.

These climatic shifts are critically relevant for understanding stone weathering—a natural process long studied by geomorphologists and physical geographers. However, under contemporary climate dynamics, the frequency and intensity of contributing factors have increased, heightening the urgency for adaptive heritage management. The deterioration of stone-built archaeological sites may stem from three interlinked sources: (1) naturally occurring emissions and weather conditions, (2) anthropogenic pollution and land-use changes, and (3) a complex mixture of both, including extreme weather events that are becoming more common as a result of climate change.

Research Methodology

This research adopts a qualitative, interdisciplinary methodology combining literature review, legal analysis, and semi-structured interviews to examine the challenges and prospects of disaster risk management and climate change adaptation for cultural heritage in Greece.

First, a systematic literature review was conducted to gather insights from Greek and international scholarship on heritage management practices in Greece. Special emphasis was placed on studies that analyze the interaction between Greek heritage professionals and state authorities, reflecting on the heritage management ethics and the normative dimensions of cultural governance. The theoretical underpinnings of this research draw on concepts such as the state-centered "authoritarian approach" in heritage protection, the ethics of heritage as a common good, and value-based management frameworks.

Second, legal studies were undertaken to explore the Greek constitutional and legislative framework regarding cultural heritage protection, disaster risk management, and climate change adaptation. Key documents include the Greek Constitution (Article 24), Law 3028/2002 "On the Protection of Antiquities and Cultural Heritage in General," and relevant climate adaptation policies, particularly the emerging frameworks that integrate cultural heritage into climate resilience strategies.

Third, qualitative interviews formed a core component of this study. Semi-structured interviews were conducted with sixteen heritage experts, including professionals from non-governmental organizations (NGOs), university researchers, senior personnel from the Hellenic Ministry of Culture and Sports, and independent heritage consultants. Participants were selected based on their expertise and practical experience in heritage management, conservation, and cultural policy in Greece. Interviews explored topics such as the operational challenges faced by heritage institutions, perceptions of climate change risks, disaster preparedness measures, public participation in heritage management, and reflections on the evolving role of the State.

Data collected from the interviews were analyzed thematically to identify recurring patterns, and concerns. These qualitative insights were triangulated with findings from the literature and legal texts to provide a comprehensive understanding of the strengths, weaknesses, and emerging trends in Greek cultural heritage management, especially in relation to disaster and climate risks.

Influencing Factors on Heritage Deterioration Under Climate Change

The deterioration of built heritage under the influence of climate change is driven by a complex interplay of environmental factors that operate on both micro- and macro-scales. Regional climate, daily weather patterns, and the unique micro-environment of each site—including its proximity to the coast, forest, or urban center, as well as local microbial communities and soil acidity—play crucial roles in shaping both surface and internal changes within heritage materials. Micro-environmental conditions, such as site-specific wind patterns, directly influence the distribution of pollutants and evaporation rates. Additionally, local temperature fluctuations and shading create varied thermal responses among different facades, contributing to uneven heat insolation and subsurface thermal stress (Smith et al., 2008). On a broader scale, macro meteorological parameters such as humidity, precipitation patterns, and regional wind systems amplify or mitigate these localized stresses.

Weathering effects represent one of the most persistent threats to cultural heritage, as they are often the result of long-term, frequently repeated exposure to environmental stressors. These can lead to cumulative damage over time, with processes such as staining, surface erosion, biocorrosion, and the physical dissolution of stone into smaller crystal structures altering the material fabric of heritage assets. Biochemical deterioration also unfolds gradually, often under continuous yet subtle stress. It is marked by slow cumulative damage across diverse spatial scales, where mitigation is difficult and the impact of human-induced factors can be unpredictable.

The threat posed by natural disasters, including wildfires, floods, earthquakes, and landslides, is more sudden and severe. These events, though infrequent, can cause catastrophic and often irreversible damage. The risks are compounded by climate change, which increases the frequency, intensity, and duration of such extreme events. These disasters may also interact synergistically with ongoing environmental and industrial pressures, contributing further to the fatigue and eventual breakdown of historic structures.

Other critical influencing factors include the geometry and orientation of heritage sites, their construction history, and any previous restoration treatments. Inappropriate chemical cleaning, for instance, can inadvertently encourage biological colonization such as algae growth. The intrinsic properties of heritage materials also matter greatly. In the case of stone, even prior to quarrying, its internal crystalline composition and any structural or chemical stress retained from its geological past can significantly affect its response to environmental exposure (Smith et al., 2008). To comprehensively study weathering on natural stone surfaces, it is necessary to investigate their physicochemical, petrographic, and mineralogical characteristics. Emphasis is typically placed on observing color changes, the thickness and composition of deposition layers, the biochemical interactions between the substrate and the original material beneath, and the cumulative effects of prolonged exposure in relation to the surrounding environmental context (Kouzeli, 2008).

Why should we preserve cultural heritage: Insights from the Acropolis Site in Athens

Millennia have elapsed since the inception of monumental construction programs, during which architectural elements have undergone cycles of deterioration and reconstruction throughout the history, leaving each generation the task of preserving and extending the life of this passed-down heritage. As stated in the ICOMOS Training Guidelines (1993), the meaning of conservation "*is to prolong the life of cultural heritage and, if possible, to clarify artistic and historical messages therein without the loss of authenticity and meaning. Conservation is a cultural, artistic, technical, and craft activity based on humanistic and scientific studies and systematic research. Conservation must respect the cultural context* (Par. 3)."In Greece, the protection of cultural heritage involves a multifaceted approach, including identification, research, documentation, and combating illegal excavation and export. This effort is coupled with integrating cultural heritage into modern society through education, aesthetic appreciation, and citizen awareness, alongside preservation and restoration initiatives (Art. 3, Law 3028/2002).

Taking the Acropolis as a prime example, a series of interventions on the Acropolis hill have demonstrated these principles in action. Anastylosis on the Erechtheion was conducted between 1979–1987, while work on the Parthenon has been ongoing since 1986. The Propylaia underwent restoration during the early 20th century, and conservation of the Temple of Athena Nike began in 2000 (Mallouchou-Tufano, 2006). Additionally, directed pathways for visitors and consolidation efforts took place between 1979–1993. Despite these efforts, challenges remain. The Parthenon sculptures often display visible black crusts, the result of pollutant deposition and colonization by endolithic and epilithic microorganisms. Rainwater accumulation in the foundation and open joints has caused mechanical damage due to the growth of higher plants. These issues have resulted in structural cohesion loss, visible cracks, and internal voids, posing risks of falling fragments (Frantzi et al., 2008).

The Acropolis site itself is situated in the basin of Athens' city center, a location that exacerbates the spread of airborne pollutants due to urban heat island effects and high pollution levels. Average concentrations of nitrates and sulfates range from 4.60 and 13.70 $\mu g/m^3$ on rainy days to 8.09 and 16.52 $\mu g/m^3$ on sunny days (Apostolopoulou et al., 2021, p.4). Factors such as the orientation of buildings also play a role in the distribution of patinas, which are often linked to algae growth (Mihajlovski et al., 2015). These patinas interact with construction materials such as iron clamps, joint mortar, and paint, making preservation efforts

more difficult (Siedel & Siegesmund, 2011). Discoloration of the monuments has been a persistent issue. Since 1975, the Acropolis Monuments Conservation Committee has recorded the physical-chemical deterioration of the Parthenon friezes. Due to their significant artistic value, the friezes were relocated to indoor museum environments in 1993 and replaced outdoors with exact artificial stone copies. A preservation pilot program began in 1987 specifically targeting the surface of the Parthenon and its sculptures, culminating in a full-fledged restoration in 2000. Cleaning the surface of the Parthenon friezes remains controversial due to the irreversible nature of removing protective coatings, which have preserved ornamental details beneath (Frantzi et al., 2008; Panou et al., 2008; Mallouchou-Tufano, 2006).

Studies in the city centre of Athens have revealed pollutants from vehicular emissions, coal combustion, and domestic heating depositing on Pentelic and Karystos marble. Particles rich in silicon, titanium, and iron, as well as elements like lead, chromium, copper, and zinc, were detected. Ratios of copper to zinc indicate sources ranging from vehicular to industrial emissions (Mitsos et al., 2022, Apostolopoulou et al., 2021). Specifically, rainwater and acidic pollutants such as CO_2 and SO_2 contribute to the dissolution of calcite on Pentelic marble, causing patina formation.These patinas, referred to as the "epidermis of the marble," have been analyzed to contain compounds such as calcium oxalate, calcium carbonate, and gypsum, alongside trace elements like iron oxides, magnesium, aluminum, silicon, and chlorine (Frantzi et al., 2008, p.41). Even indoors, white leaching areas from the white coatings above the epidermis, caused by acid rain continue to deteriorate marble surfaces (Panou et al., 2008, p.29). Further, these air pollutants have obstructed the aesthetic appearance of these white marbles, with deposits of black soots which is although relatively easy to be removed. The uniform solid crust on the discoloured surface layers would be more difficult since the glossy marble surface layer would be lost during restoration, and the recrystallised crust was the most challenging for cleaning.

Structural cracks in marble monuments also arise as critical concerns when deformations caused by fluctuations in temperature and moisture levels are amplified due to inappropriate renovations. These deformations have resulted in volumetric changes, creating stress concentrations at sharp corners and within the composition of structural elements. Such stress concentrations accelerate the propagation of cracks, including seasonal ones, thereby needing continuous monitoring of temperature variations and crack movements to mitigate further damage effectively. Pentelic marble surfaces, particularly those of sculptures and ornaments, are highly sensitive to physico-chemical deterioration. One of the primary causes of this degradation is marble corrosion. This process includes granular disaggregation, typically affecting depths of less than 1 mm, resulting from the disintegration of calcite grains (Apostolopoulou et al., 2021). Additionally, precystalline wear and general decay contribute significantly to the marble's deterioration, affecting both its structural integrity and aesthetic value.

To address these challenges, preservation efforts in Acropolis have been focusing on two operations: rescue and systematic maintenance. Rescue operations involve immediate interventions, while strategic operations include collecting data, photographing, mapping damages, and investigating the causes of deterioration. Collaboration with scientific institutions has been crucial, employing inhibition methods for microorganisms and higher plants. The primary objectives remain to preserve the original surface, restore aesthetic integrity, and prevent further agents like rainwater from entering fissures (Frantzi et al., 2008). Therefore, continuous monitoring, forecasting and preservation efforts are needed to manage the ongoing vulnerability of the Acropolis and similar archaeological sites to environmental and anthropogenic factors.

Greek Archaeopolitics

In the18th century, there was a widespread fascination with Classical monuments in the Mediterranean region among Europeans, where archaeology usually coupled with architecture. The interests stemmed from the aesthetic architectural designs by the pursuit of the elites, and aspirations for social recognition through taste-making and the generation of knowledge concerning historical inquiry, philosophical aesthetics, and artistic expression (Kelly, 2016, p.514). For example, Vitruvius's treaties has emphasised three fundamental principles for Greek architectural theory: *firmitas* (strength), *utilitas* (functionality) and *venustas* (beauty). These principles have provided a framework for assessing and appreciating ancient buildings based on their functionality, integrity, and aesthetic appeal. Specifically, the Greek notion of *technē* emphasises on the functional dimensions of „measurement, regularity, and exactitude" to facilitate construction processes

(Jones, 2015, p.42). Concepts like *eurythmia,* which encompasses aesthetic qualities such as *charis* (charm), *euschemosyne* (gracefulness), *harmonia* (ordered suitability), and *rhythmos* (shape and pattern) (p.50), were reflected in the design of doric temples during the Classical period. Considerations such as the brightness of white marble were also important for increasing visibility of the temple (Tucci, 2015, p. 252). These principles of natural harmonies, such as deceiving visions with the use of inclinations, curvatures and tapering, would act as illustrative backdrops to construction history, and also has subsequently shaped the ideology of Western European nations, manifesting cultural supremacy. This "remembered intimacy" (Lambrinou, 2016, p.526) associated with Classical monuments in Greece, is therefore closely linked to the country's glorious history and European aristocratic recognition. Its tangible remains are subsequently deemed deserving of acknowledgement and preservation. As such, we can say that the Greece's antiquarian approach to antiquities, combined with a modern revival deeply fascinated by and embodied with the past to control the debates about present and future (Lambrinou, 2016). Correspondingly, as we would see in this chapter, its national strategies also portray Greece as a living entity possessing inherent cultural traits, emphasising the materiality of the past.

Since the formation of modern Greek State in 1834, the government has classified all antiquities as „national heritage" and „State property", marking the beginning of a concerted effort to revive classical monuments in Greece which has been intricately intertwined with political and economic developments. These revivals have often been strategically chosen by politicians to showcase the Hellenic classical heritage, a sentiment further elevated by the European middle class (Hamilakis, 2003). Also, the influence of Ottoman rule led Greece to embrace a late form of neoclassicism, a „purist" approach characterised by the removal of post-Classical elements, particularly targeting medieval structures, as argued by Lambrinou (2016), due to their reminder of the country's difficult past. The discipline of archaeology has a long standing presence in Greece since the nineteenth century. Greek archaeologists, along with archaeological institutions, have hold a central role in shaping and managing the nation's cultural heritage, in terms of safeguarding, interpreting, and projecting archaeological sites (Alexopoulos & Fouseki, 2013). The establishment of the Greek Archaeological Service in 1833 marked a significant milestone, making it one of the oldest archaeological national service in Europe (Hamilakis, 2007). The institution has played a key role in orchestrating the preservation of specific monuments while advocating for the demolition of post-Classical successive monuments. Also, the institution with its relevant legislation has stipulated exclusive state ownership. Instead of advancing in the broader archaeological science, these archaeological scholars and government officials have chosen to prioritise the antiquarian historical contexts (Plantzos, 2008, p.25). These carefully chosen monuments have been harnessed as "symbolic capital" within the Greek economy, contributing to the construction of national identities.

An illustrative case in point is the Acropolis of Athens, where the earliest instance of anastylosis was performed on the Athena Nike temple between 1835 and 1836, utilizing the temple's original materials, reflecting the significant emphasis placed on the physical expression of Hellenism. However, this process was accompanied by the intentional erasure of Ottoman heritage and history. Consequently, the Acropolis is frequently referred to as the "sacred rock," reinforcing ongoing religious connotations and the sacralisation of antiquities, as evidenced by the reverence displayed by contemporary visitors (Lambrinou, 2016; Hamilakis, 2003). Furthermore, the adoption of Western ideals, combined with the notion of a direct lineage from Classical Hellas, has reinforced Greek cultural identity, serving as evidence of alignment with European modernity and cultural narratives. This alignment is perpetuated through "discursive practices with meaning from the past produced, legitimised and recycled" (Plantzos, 2023, p. 40).

Archaeological Sites as Cultural Heritage

Archaeological sites, as integral elements of cultural heritage, have received limited attention within built heritage studies (Daly, 2011). The characteristics of archaeological sites can be understood as "objects of preservative investments" (Ferroni, 2002, p. 176), thereupon the management of these sites necessitates finding a balance between preservation and usage. Defined by UNESCO (1972) as "*works of man or the combined works of nature and man*", archaeological sites include areas of outstanding universal value from historical, aesthetic, ethnological, and anthropological perspectives. In Greece, the antiquities law (Law 3028/2002) further specifies that archaeological sites encompass locations on land, sea, lakes, or rivers that either contain ancient monuments or provide evidence of their existence. These sites may include

monumental structures, residential areas, or burial locations, along with their surrounding environments, which facilitate the integration of surviving structures into a historical, aesthetic, and functional context (Art. 1).

It is important to acknowledge that archaeological sites are constructed with a recourse to the past, while their legibility and significance rely on public appreciation in the present. These sites are not only remnants of specific places but also connections to surrounding natural environments, memories, and human experiences. However, excavation itself is a disruptive intrusion, once being done, it would alter the physical, biological, and chemical balances of these highly sensitive, buried sites. Once exposed, such sites are regarded as continuously deteriorating, non-renewable resources. Displaying these sites as heritage therefore involves a form of intervention that transforms them into bridges between past and present (Matero, 2006; Matero, 2008). Poor or neglected site management exacerbates the challenges these sites face, including frequent tourist visits, vandalism, improper conservation practices, and delayed maintenance. These factors have led to the characterization of archaeological sites as "*finite nonrenewable resources deteriorating at an increasing rate*" (Matero, 2006, p. 127). Therefore, conservation efforts play a crucial role in protecting the scientific and aesthetic values of these sites by protecting the physical integrity of the sites.

Archaeological Heritage Management as a Value-Driven Process

Heritage management is a value-driven process that underpins the use of established conservation guidelines and principles, aiding in transforming these values into practical actions (Demas, 2001). The Burma Charter recognizes the value-based approach to managing heritage sites, emphasizing two principal lines of values:

> Cultural values: These include identity values, artistic and technical values established by scientific evidence, and rarity values based on regulatory frameworks.
>
> Contemporary socio-economic values: These consist of monetary value as a heritage site, educational and tourism value, and political significance (Jokilehto, 2007, p. 77). Besides, heritage sites also rely on local communities for awareness and education, with the need for community involvement in their preservation and appreciation (Clark, 2005, p. 110).

In respect to archaeological sites, for scientific purposes these sites can serve as "documents." However, the available archaeometric information diminishes rapidly once the site is excavated and exposed. Delicate features such as surface finishes, macro- and micro-stratigraphy, and contextual details become limited. As such, the potential research value of archaeological sites can be both dynamic and elusive, since we cannot know what information could be yielded from the sites in the future. Recognising this potential thus becomes essential for policy planning, which involves safeguarding sites with significant study potential from looting, inadequate excavation methods, and agricultural activities (Demas, 2001). The adoption of non-invasive technologies further aids in preserving these research opportunities, since at present, heritage management involves determining the knowledge that could be derived from the archaeological deposition of a specific location, guided by pre-determined research criteria (Carver, 1996).

Archaeological sites also embody existence value as architectural landscapes and places of public display, holding significance for future generations. However, unclear conservation practices and the challenges of pre-emptive curation systems in the actual implementation stage—such as gathering data, determining priorities, achieving consensus, and implementing preservation agendas—can pose ongoing issues (Carver, 1996). Efforts in site stabilization and display of ruins often emphasize aesthetic value, focusing on visual and artistic qualities that make a cultural property appealing, a tradition rooted in European conservation practices. In the context of archaeological sites, aesthetic value directly affects their visual appearance and indirectly impacts notions of authenticity, including scientific, associative, and aesthetic perceptions. Current contemporary conservational techniques for archaeological site preservation could include „*structural stabilisation, reconstruction, reburial, protective shelters, and myriad fabric-based conservation methods*" (Matero, 2006, p.121), other techniques involve relocation of certain structural components to indoor environments and ex-situ preservation such as removal, excavation and reburial.

Political value is inherent in heritage as a human creation shaped by people over time. Conservation and preservation efforts are often influenced by contemporary political interests, reflecting the priorities and ideologies of the time (Carver, 1996). Additionally, archaeological sites hold social and cultural values for recreational activities, social and religious gatherings, and educational purposes. Further, archaeological sites often symbolize identity value, symbolising a particular focal point for local communities. Residents may proudly associate themselves with these sites, while excavation and conservation efforts collaboratively undertaken by locals and heritage professionals reinforce community pride and connection (Sakellariadi, 2010). However, economic exploitation of archaeological sites for tourism, especially in Mediterranean countries, remains a significant challenge (Palumbo, 2000). Despite this, many sites also hold ecological value for their surrounding flora and fauna, promoting sustainable development, particularly in cases where visitor access is restricted (Demas, 2001). Finally, archaeological sites often represent monumental value, carrying universal significance as defined by UNESCO's Operational Guidelines for the Implementation of the World Heritage Convention. It marks exceptional cultural or natural heritage sites as „*the world heritage of mankind as a whole*" that surpasses national boundaries with collective assistance or cumulative efforts for the next generations (UNESCO, 1972).

Role of Archaeologists in Cultural Heritage Management

The role of archaeologists in cultural heritage management (CHM) has been continuously expanding scientific investigation through unearthing the undiscovered and managing the dynamic and ever-evolving archives of the past. While "monuments" represent acknowledged archaeological heritage, they are defined by governments at a specific time (Carver, 1996, p. 307). Archaeological heritage management (AHM) should not be viewed as a separate discipline but as an embodiment of archaeological research, as such, the discipline of archaeology as a whole could enhance the institutional authority through its integration (Smith, 1993). Bauman (1987) describes archaeologists as "legislators", given their influence on the administration of archaeological sites, the sustainability of resources, and the balance of interests between local stakeholders, such as governments and communities. For instance, Kyriakidis and Anagnostopoulos (2017) highlight how, in a Greek village, the transformation of community-controlled land into state-managed resources, such as solar panel installations by private companies, deepened local insecurities. In such cases, archaeologists could act as "mediators", preventing commercial developments in areas of archaeological significance. Archaeologists also serve as "interpreters", utilizing their expertise to advance the understanding of sites. Heritage management should be seen as a space for the co-creation of archaeological knowledge rather than a one-sided dissemination from archaeologists to the public. The presence of archaeologists and their publications can reposition the importance of a site within local hierarchies of value, as archaeologists are often perceived by the locals to elevate the importance of their sites (Kyriakidis & Anagnostopoulos, 2017). Thus, it has underlined the need to reconsider the implications of archaeological research for local communities and their interests.

Although it can be argued that archaeology and conservation management are fundamentally at odds—archaeologists excavate, often causing irreversible deterioration, while conservationists aim to safeguard against decay and loss—these fields must collaborate to protect cultural property. Archaeologists should integrate their understanding of historical contexts with heritage management practices and consider their impact on local communities (Matero, 2006; 2008, p. 5). Smith's (2006) concept of "Authorized Heritage Discourse" (AHD) calls for inclusive local participation in heritage management, emphasizing the interplay between archaeological knowledge and community politics. Local perceptions of a site often align closely with its historical development and associated narratives, such as past ritual performances. By engaging in heritage initiatives, local communities reinforce the collective memory of a site, ensuring its preservation for future generations while sustaining the communities against urbanization challenges. However, narratives of village decline also reflect feelings of exclusion from central decision-making processes (Kyriakidis & Anagnostopoulos, 2016).

Since archaeological sites are closely tied to societal contexts, local communities often believe the value of these sites or materials are collectively owned and tied to the heritage value of their village. This raises important questions: For whom do we preserve? Which historical phase should be prioritized? What methods are appropriate, and how far should interventions go? How responsibly are interventions planned to address

the balance between preservation and community interests? These considerations are important ones for moving from a reactive to a proactive approach in heritage management and conservation.

Defining Archaeological Site in Greek Policy Framework

According to Greek legislation, an archaeological site is explicitly defined as "declared or demarcated based on the data of archaeological field research and a decision of the Minister of Culture" (Law 3028/2002, Art.12). However, the literature emphasizes the absence of a universally explicit definition for archaeological sites or monuments, highlighting instead that their identification and protection are strongly linked to multiple authorities' involvement and the symbolic significance attributed to each individual site or monument (Hartzoulaki, 2019). Furthermore, delays in the protective measures for archaeological sites may occur due to the legal requirement of pre-determining settlement boundaries before protections can be implemented.

The delimitation of ancient sites is considered a "direct tangible expression" that ensures effective protection by clearly encompassing the entirety, integrity, and authenticity of heritage properties (UNESCO, 2008, Art.99). This boundary establishment is crucial as it is equally reflected in the Greek legal framework within which an examining mechanism functions, whereby permits must be obtained before any agricultural, animal husbandry, hunting, mining, or excavation activities are allowed on archaeological sites (Law 3028/2002, Art.13).

Current legislation in Greece mandates joint decisions by the Minister of Culture and relevant authorities for determining building conditions within protected zones. Specifically, the Central Archaeological Council (KAS) advises on delineating archaeological sites and setting up Protection Zones A and B. Zone A entails a complete building prohibition unless new structures can enhance the monument's value, whereas Zone B allows continuation of existing legal activities under conditional permissions (Law 4858/2021, Art.13, para 2). When legally existing settlement boundaries are undetermined, activities must be suspended, and priority must be given to their delimitation through scientific evidence (Law 4858/2021, Art.12).

Moreover, within archaeological sites located in city plans or active settlements, regulations specify that interventions altering the character or urban fabric are prohibited. Nonetheless, with the Minister of Culture's permission and advisory body opinions, new constructions aligned with existing settlement volume, materials, and functions are permitted. Restoration of dilapidated buildings is permitted if their original form can be documented, whereas demolitions are allowed solely when a building poses a physical danger without altering the settlement's historical character (Law 4858/2021, Art.13, para 1 and 2).

An emerging critical aspect in heritage site management is incorporating climate change into local governance strategies. Given that not all regions are equally susceptible to climate-related risks, mapping precise climate vulnerabilities for each heritage site and protective zone is essential for targeted adaptation measures. Nevertheless, existing regional adaptation plans currently lack explicit references to cultural heritage considerations (Ministry of Culture, 2011).

Additionally, while special spatial plans have been effectively institutionalized in sectors like fishing and tourism, such detailed plans for cultural heritage sites remain undeveloped. The Cultural Heritage and Climate Change committee stating that they are actively preparing criteria-based special spatial plans focusing on vulnerability, exposure to climate risks, sensitivity, vulnerability intensity, and existing site infrastructure resilience. These specialized plans aim to optimize site-specific protection measures in response to the climate crisis.

Authoritarian Approach in Greece's Heritage Management

The management of cultural heritage in Greece is firmly rooted in a state-centered, authoritarian framework. Article 24 of the Greek Constitution explicitly states that "the protection of the natural and cultural environment is an obligation of the State and a right of everyone," assigning the primary responsibility for preserving cultural heritage to state authorities. This framework mandates that the State must take preventive or corrective actions to ensure the sustainability of heritage assets. Furthermore, State ownership is asserted

over all immovable heritage dating from before 1830, as well as more recent monuments deemed of particular significance. According to the Greek antiquities law, “On the Protection of Antiquities and Cultural Heritage in General” (Law 3028/2002, Art. 40), interventions are allowed to preserve the materiality and authenticity of these properties.

However, this strong centralized control over heritage—particularly antiquities and medieval monuments, has produced what scholars describe as a form of "reverse archaeology". In this process, a selective representation of the archaeological record is prioritized to shape the official historical narrative of the nation, reinforcing a notion where "it soon became imperative for Greeks not only to own their appointed heritage but also prove worthy of the privilege" (Plantzos, 2017, p. 68; Lekakis & Dragouni, 2020). The selection, interpretation, protection, and management of cultural heritage thus remain largely monopolized by the State, leaving limited space for broader public engagement or alternative narratives.

Although Article 24 theoretically provides an opening for public participation—one interviewee noted that it "*actually says that the public should, needs, and can participate*”, the practical implementation of public involvement remains minimal. The Ministry of Culture's efforts toward public participation are often superficial, primarily permitting public performances or cultural events to create a "*public face of archaeology*" without enabling real influence on decision-making processes (Interviewee 7).

Criticism from academic and professional circles highlights the superficiality and inertia within the Ministry’s operations. Despite political rhetoric emphasizing development and promises to strengthen cultural heritage institutions, substantial actions remain lacking. One scholar observed that the Ministry is severely understaffed and entangled in bureaucratic inefficiencies, making meaningful progress nearly impossible without structural reforms:

"*[A]nd when you listen to that, it's so generic that doesn't really cover the subject. For example, the last two governments have talked a lot about development and how economic finances would help the ministry and cultural heritage. But this is not reflected in actions... This cannot be achieved within the span of a four-year government term. Structural changes are necessary to address these challenges, and they have not been made. I feel we are operating at the same management level as we were in the 1970s or early 1980s—for the last 40 years*." (Interviewee 7)

Thus, while the legal framework provides a clear mandate for heritage protection, the practical reality remains deeply centralized, slow to adapt, and resistant to meaningful public participation or modern management innovations.

Disaster Risk Management in Greece: Current Situations

In terms of current and emerging risks to Greek heritage sites, fire and earthquake are the two most dominant hazards. Greece ranks first in Europe and sixth worldwide in terms of seismic activity. Fires have also become an increasing threat, with one of the most destructive incidents in recent years being the forest fires in the area of Ancient Olympia, where 150,000 hectares of forest and agricultural land were burned within five days. This case revealed that factors such as inappropriate landscape management, including the lack of maintenance of vegetation near high voltage cables or waste piles, can significantly increase fire risks. In response, the Olympia site introduced measures such as planting vegetation more resistant to high temperatures and upgrading fire extinguishing systems (Korka, 2018).

Primary fire hazards include the effects of heat, smoke, and combustion, which may result from visitor activities, such as the improper disposal of cigarette butts by tourists, bus drivers, or workmen, especially during festivals or periods of high visitation (Sakellariadi, 2010, p.80). These hazards can cause direct damage to structures and pose risks to human life, while also diminishing the aesthetic value of heritage landscapes. Secondary hazards stem from firefighting interventions, including the use of water and fire extinguishers and the proximity of firefighting stations to the site (Sakellariadi, 2010). In some cases, these emergency systems have proven inadequate; one researcher remarked that at Delphi, a newly installed fire extinguishing system was reportedly non-functional, with empty tanks (Interviewee 16).

In terms of fire response mechanisms, critical measures include drafting a clear evacuation plan, mapping the nearest water supplies, ensuring full accessibility for all visitors and staff, distributing emergency contact lists, creating a prioritization list of monuments for emergency protection, preparing essential materials and equipment, and mobilizing specialists for immediate conservation actions. Additionally, organizing volunteer patrols around archaeological sites can enhance early detection and prevention efforts (Sakellariadi, 2010, p.83).

Earthquakes and related hazards such as landslides also pose significant threats to Greek heritage. Local municipalities, police stations, and firefighting authorities are responsible for raising public awareness and protecting civilian lives. Seismic activity is monitored by the Institute of Geodynamics at the National Observatory of Athens, supported by seismological laboratories at the Universities of Athens, Thessaloniki, and Patras (Sakellariadi, 2010, p.80). Secondary risks, such as heavy rainfall following seismic movements, can lead to cliff destabilization and rockfalls, as observed in Delphi. In such cases, collaboration between ministries, including the Ministry of Infrastructure, Transport, and Networks, becomes crucial. Measures taken include building higher retaining walls, installing rockfall containment structures, reinforcing rock formations, and constructing protective shelters for visitors (Korka, 2018, p.76).

When considering climate-related risks, it is important to note that since 1988, the majority of disaster events affecting Greek heritage have been hydrological, meteorological, or climatological. The IPCC predicts that the frequency and magnitude of extreme weather events will continue to rise (Jigyasu, 2013). More frequent storms and heavier rainfall will likely lead to increased flooding at heritage sites, gradually washing away vulnerable outer surfaces and exposing deeper layers to pollution and further deterioration.

Other long-term climatic impacts include groundwater fluctuations, particularly where high seasonal differences between summer and winter allow oxygen to enter dry soil cracks, enhancing microbial metabolism and accelerating the oxidation of metal materials. Changes to local ecosystems—such as reduced vegetation cover, altered agricultural practices, or modifications in forest protection zones—can also significantly affect nearby archaeological sites (Daly, 2011).

Coastal archaeological sites are especially vulnerable to climate change, including land-based, intertidal, and submerged sites like shipwrecks (Daly, 2011, p.299). Greece, with its 16,300 km coastline, is particularly exposed. Approximately 58% of the Greek coastline is considered highly vulnerable, and it is expected that sea levels could rise between 0.2 and 2 meters by 2100 (Ministry of Environment & Energy et al., 2016, p.14). Research conducted by Mourtzas (2023) on the archaeological site of Delos shows that under current projections, the coast could experience a sea level rise of 0.14 meters by 2050 and 0.56 meters by 2100, resulting in the flooding of approximately 35 acres of the site by mid-century.

Another significant environmental factor affecting heritage sites is wind, particularly the strong Etesian winds that prevail over the Greek islands during the summer months. These northerly winds transport sand from African deserts, sea salts, and water vapor, contributing to abrasive damage to outdoor heritage elements such as sculptures, mosaic floors, and marble surfaces. Observations at the site of Delos have shown that salt crystals carried by winds have removed the limewash layers from mortars, leading to cracks and further deterioration (Korka, 2018).

Climate Change Impacts Measures and Adaptations

To address climate challenges, an interdisciplinary committee was firstly established in 2019, consisting of meteorological physicist, environmental physicist, spatial planning expert, geologist, and directorates in charge of monuments and buildings. As noted by physicist Prof. Constantinos Cartalis, a leading member of this committee, he highlighted the importance of conducting case-by-case analysis of each site, considering specific climate risk factors in Greek heritage sites. These factors include sea level rise affecting more than 300 coastal archaeological sites, the increasing risk of forest fires on archaeological sites located near dense vegetation, and the occurrence of extreme weather events leading to combination of natural hazards, such as extreme storm and consequently strong wind and flooding. Protection plans need to focus on enhancing soil moisture retention to combat erosion and desertification, particularly in arid regions of Southern Greece prone to prolonged forest fires ignited by human activities.

Also, the announcement of implementation of a National Action Plan for Cultural Heritage and Climate Change in 2022 marks a significant step forward, spanning until 2050 with incremental goals set for every five-year interval and specific actions laid out until 2030. At the strategic level, it is the first time in the Greek climate policies with explicit acknowledgements of cultural heritage properties as the major indicators to assess climate change impacts. The strategy involves formulating over 25 adaptation plans, tailored to specific cultural heritage sites in Greece, contextualising local landscape and local exposure to climate risks. Initially, systematic climate risk assessments will be conducted, followed by consultations with archaeologists managing different sites and targeted training sessions. As the Ephorate of Antiquities in Thessaloniki has noted that: „*they announced that they will provide us with some questionnaires by September 2023 and we will be asked to give them some data, because this is how the Ministry works, they are we are asked as local Archaeological services to provide data on these topics to the ministry. Data on the problems that we face on the climate change, on our monuments, or on solutions that we found in order to deal with them*„ (interviewee 8). We could see that surveys have been currently sent out to all regional Ephorates of Antiquities across Greece to understand the issues of climate change danger being considered by the local colleagues and site managers. Additionally, the ministry explicitly outlined the importance of making climate adaptation plans in the direction of managing and reducing the negative effects of climate change and by recognising the increasing climate-related events and vulnerability in the current infrastructure systems, taking steps towards the broad connected issues that influence policies of urban planning, environmental protection, and civil protection plans in terms of the safety of field workers and visitors. Finally, the Ministry would be leveraging new technologies with diverse data sources to monitor heritage monuments.

The Ministry of Culture has initiated a Memorandum of Understanding with the Ministry of Climate Change and Civil Protection and programmatic agreements with academic and research institutions to formulate Climate Change Adaptation Plans for the 19 major archaeological sites managed by the Directorate of Prehistoric and Classical Antiquities. These plans, supported by a budget of 1.4 million euros supported by Enterprise Agreement for the Development Framework, are expected to be adhere according to UNESCO climate parameters at the end of 2023. By the end of 2025, five key archaeological sites of high economic and touristic importance, which are specifically Delphi, Dio, Philippi, Mystras and the Minoan palaces of Phaistos and Malia would be developing in the aspects of protection works against rockfalls and soil erosion, flood, fire, while also monitoring on-site the microenvironment.

Nonetheless, at operational level, specific management plans and risk assessment tools to integrate cultural heritage in planning has not yet been developed so far (Guzman & Daly, 2021). While Ministry of Culture has asserted its commitment to adopting a comprehensive approach to managing archaeological sites amidst climate change, a traditional and cautious perspective prevails when in an official press release conference the Minister maintained a stance that no systematic risk observed so far for any particular monument or cultural heritage element due to the climate crisis, where „i*mmediate, widespread and systematic risk from the effects of climate change is not recorded*" (Ministry of Culture, 2021). Also, during a personal interview conducted by the author in late 2023, the Directorate for the Restoration of Ancient Monuments appeared to maintain the same conservation approach as before recognising climate crisis. It emphasized that climate change had not altered their restoration philosophy, asserting that monuments were more affected by historical factors, „*we can tell that monuments do not suffer from the climate change, they suffered from the earthquakes, the fires in the past, the ground drainage if there is water on the ground, deep in the ground, and these terms we can confront them*." Such perspective may suggest a continued focus on traditional natural disasters rather than a comprehensive response to emerging climate change challenges. Despite these proactive official statements by the ministry, there remains a concern regarding the lack of prevailing national practices in developing management plans for archaeological sites. The concept of strategic planning for the preservation and conservation of the site appears to be lacking, extending even to World Heritage Sites. Currently, as told by a local Greek NGO for cultural heritage, we could see efforts are underway led by private companied hired to conduct surveys and propose implementation measures. However, entrusting such tasks to external entities raises questions about their expertise, transparency in decision-makings, and potential gaps in heritage knowledge, *„if you give out something like that to private companies, they have their own reasons, they have their own structures, they have their own people, you don't know who is composing it, just know the head of the company. So they might not be heritage experts, there might be archaeologists, which is not, you can see the difference here"* (interviewee 7). Also, while the

ministry submits conservation plans, these plans often focus solely on materials and neglect other crucial factors. This minimum compliance with UNESCO standards highlights a lack of comprehensive planning. Although the ministry did gradually involve local Ephorates for questionnaires as mentioned in the previous chapter, it appears unwilling to have multilateral collaboration with local administration and stakeholders. A researcher extensively involved in the management of UNESCO site of Phillipi, raised concerns on the missed opportunities for synergy, „ *Greece has 53 environmental education centres, there is one in every prefecture… you have a dedicated group of educators who are specialists on creating educational programs on the environment, whether that is the human environment or the natural environment… Instead, the people of the environmental centre told me that the Ministry has never really helped or collaborated with them in any way"* (Interview 16). The Ministry's failure to engage with local professionals and the fragmentation may inhibit the effective utilisation of funding resources and expertise, further hindering efforts to address cultural heritage amidst climate challenges in the long run.

Financial Sustainability

In Greece, the financial sustainability of cultural heritage is managed through the Archaeological Resources Fund (*Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων*), which collects and allocates income generated from the country's cultural assets. A significant portion of this funding is often directed toward capital infrastructure development to facilitate visitor access to archaeological sites. However, these investments are typically short-term and lack enduring sustainability. According to Kyriakidis and Anagnostopoulos (2017), funding tends to prioritize the preservation of specific architectural features or the upgrading of visitor infrastructure, such as walking paths, walls, and ticket booths, rather than long-term site conservation.

Recent government policies have promoted the financial autonomy of archaeological museums, encouraging privatization and reducing the State's exclusive responsibility for safeguarding both movable and immovable antiquities. As a result, cultural heritage is increasingly treated as a marketable commodity. Museums are now expected to adopt business-like approaches to enhance their appeal, such as integrating culinary experiences to attract more visitors (Presidential Parliamentary Republic Session IV, 2023). While these efforts aim to increase financial viability, many heritage professionals interviewed during the empirical study expressed concern over persistent funding limitations. One interviewee noted, "*In Greece, we have to hit for the idea. We're really good in theory. So yes, in theory, universal protection, but what state could ever have the money to do this*" (Interviewee 16), pointing to the gap between ambition and practical financial capacity.

To address these constraints, several professionals and NGOs have proposed alternative models to improve economic incentives for heritage conservation. One suggestion involves capitalizing on intellectual property rights by licensing heritage sites for films or commercial products. Another involves creating premium visitor experiences for those willing to pay more, which would require practical enhancements, such as multilingual guides and improved signage. A more radical yet pragmatic proposition advocates for the selective closure and reburial of certain archaeological sites that attract minimal visitation but consume substantial resources. As one interviewee stated, "*At the moment, they can't, because they have too many sites exposed, and they cannot preserve everything to the same quality. That gives a bad impression and makes the site look unsustainable*" (Interviewee 15). Public-private partnerships also offer a potential avenue for supporting site maintenance, especially in areas with strong tourism economies. Local businesses, including hotels and tour operators, may have vested interests in protecting nearby heritage sites that enhance their appeal. "*A big hotel chain that takes advantage of the surrounding area should be interested to pay for the protection of a site nearby because their existence is somehow related*," suggested another interviewee (Interviewee 15). These partnerships could contribute not only to preservation efforts but also to risk mitigation measures such as natural disaster protection or enhanced security.

However, the shift toward market-oriented models has drawn criticism. Lekakis and Dragouni (2020) argue that the neoliberal appropriation of both tangible and intangible heritage prioritizes economic gain at the expense of cultural sustainability. In such frameworks, tourists are viewed primarily as consumers, and local communities are often excluded from the benefits generated by the heritage economy. As a result, smaller or remote sites are neglected, underfunded, or face the threat of irreversible decay. These communities are frequently relegated to passive roles, bound by rigid regulations, and excluded from decision-making processes. As an alternative, Lekakis and Dragouni (2020) advocate for reconceptualizing heritage as a commons, meaning that resources to be collectively managed and protected by the communities who live with and around them. This model emphasizes inclusivity, local stewardship, and social sustainability over

profitability. Such an approach not only strengthens the resilience of heritage sites but also fosters a more inclusive and engaged cultural landscape.

Conclusion

This study highlights the complex yet evolving challenges facing Greek cultural heritage in the context of climate change and natural disaster risks. While Greece has a strong constitutional and legal framework asserting State responsibility over heritage protection, the management system remains largely centralized, bureaucratic, and slow to adapt. Recent initiatives, such as the National Action Plan for Cultural Heritage and Climate Change, mark important steps toward integrating cultural heritage into broader climate policies. However, practical implementation remains fragmented, with limited public participation, underfunded institutions, and a continued reliance on traditional approaches to risk.

The interviews conducted underscore both the strengths and systemic shortcomings of heritage governance in Greece. Experts emphasize the need for more genuine structural reforms, greater local involvement, and a move beyond symbolic measures to real, site-specific action plans. A sustainable future for Greek heritage will require coordinated efforts across state, private, and community sectors, fostering resilience not only through technical solutions but also through inclusivity and long-term strategic planning.

Word Count: 8,371

References

Apostolopoulou, M., Drakopoulou, E., Karouglou, M., & Bakolas, A. (2021). Consolidation treatments for marble sugaring: Reinforced lime versus nanolime. Materials and Structures, 54(195), 1–18. https://doi.org/10.1617/s11527-021-01792-w

Carver, M. (1996). On archaeological value. In M. Sullivan & R. Mackay (Eds.), Archaeological sites: Conservation and management (pp. 295–312). The Getty Conservation Institute.

Clark, K. (2005). The bigger picture: Archaeology and values in long-term cultural resource management. In M. Sullivan & R. Mackay (Eds.), Archaeological sites: Conservation and management (pp. 105–119). The Getty Conservation Institute.

Daly, C. (2011). Climate change and the conservation of archaeological sites: A review of impacts theory. International Journal of Heritage Studies, 17(4), 293–310. https://doi.org/10.1179/175355211X13002726282407

Demas, M. (2001). Planning for conservation and management of archaeological sites: A values-based approach. In M. Sullivan & R. Mackay (Eds.), Archaeological sites: Conservation and management (pp. 653–675). The Getty Conservation Institute.

Frantzi, Y., Panou, A., Tsimereki, A., & Franzikinaki, K. (2008). Η συντήρηση της επιφάνειας στα μνημεία της Ακρόπολης. In Π. Αδάμ-Βελένη, Δ. Ιγνατιάδου, & Δ. Τερζόπουλου (Eds.), ΛΙΘΟΣ. Ημερίδα Συντήρηση ΑΜΘ 2007 (pp. 41–50). Archaeological Museum of Thessaloniki.

Guzman, P., & Daly, C. (2021). Cultural heritage in climate planning: The HiCLIP pilot project for understanding the integration of culture into climate action. ICOMOS Report.

Hamilakis, Y. (2003). Lives in ruins: Antiquities and national imagination in modern Greece. In S. Kane (Ed.), The politics of archaeology and identity in a global context (pp. 51–78). Archaeological Institute of America.

Hamilakis, Y. (2007). The nation and its ruins: Antiquity, archaeology, and national imagination in Greece. Oxford University Press.

Hartzoulaki, K. (2019). Use and protection of archaeological sites in Greece: Policies and practices 1975–2018. Heritage, 2(1), 366–379. https://doi.org/10.3390/heritage2010025

Jigyasu, R. (2013). Heritage and resilience: Issues and opportunities for reducing disaster risks. 4th Session of the Global Platform for Disaster Risk Reduction, Geneva, Switzerland.

Jokilehto, J. (2007). International charters on urban conservation: Some thoughts on the principles expressed in current international doctrine. City & Time, 3(3), 23–42.

Jones, M. W. (2015). Greek and Roman architectural theory. In C. Marconi (Ed.), The Oxford handbook of Greek and Roman art and architecture (pp. 41–69). Oxford University Press.

Kelly, J. M. (2016). The reception of Greek architecture in eighteenth-century Britain. In M. M. Miles (Ed.), A companion to Greek architecture (pp. 509–525). Wiley Blackwell.

Kouzeli, K. (2008). Στρώματα σε επιφάνειες ασβεστιτικής φύσης πέτρινων μνημείων και γλυπτών: Προσέγγιση σε θέματα καθαρισμού. In Π. Αδάμ-Βελένη, Δ. Ιγνατιάδου, & Δ. Τερζόπουλου (Eds.), ΛΙΘΟΣ. Ημερίδα Συντήρηση ΑΜΘ 2007 (pp. 11–26). Archaeological Museum of Thessaloniki.

Kyriakidis, E., & Anagnostopoulos, A. (2016). Archaeological ethnography, heritage management, and community archaeology: A pragmatic approach from Crete. Public Archaeology, 14(4), 240–262. https://doi.org/10.1179/1465518715Z.00000000061

Lambrinou, L. (2016). Ancient ruins and their preservation: The case study of the Parthenon's east porch. In M. M. Miles (Ed.), A companion to Greek architecture (pp. 525–545). Wiley Blackwell.

Lekakis, S., & Dragouni, M. (2020). Can cultural economy be social? Discussing about the rural heritage of Greece. Επιθεώρηση Κοινωνικών Ερευνών, 155, 99–120. https://doi.org/10.12681/grsr.24827

Mallouchou-Tufano, F. (2006). Thirty years of anastylosis works on the Athenian Acropolis, 1975–2005. In M. Sullivan & R. Mackay (Eds.), Archaeological sites: Conservation and management (pp. 471–483). The Getty Conservation Institute.

Matero, F. G. (2006). Making archaeological sites: Conservation as interpretation of an excavated past. In M. Sullivan & R. Mackay (Eds.), Archaeological sites: Conservation and management (pp. 120–132). The Getty Conservation Institute.

Matero, F. G. (2008). Heritage, conservation, and archaeology: An introduction. AIA Site Preservation Program, Archaeological Institute of America.

Merchant, N. (2021). This is how climate change could impact the global economy. World Economic Forum. https://www.weforum.org/agenda/2021/06/impact-climate-change-global-gdp/

Mihajlovski, A., Seyer, D., Benamara, H., Bousta, F., & Martino, P. (2015). An overview of techniques for the characterization and quantification of microbial colonization on stone monuments. Annals of Microbiology, 65, 1243–1255. https://doi.org/10.1007/s13213-014-0956-2

Ministry of Culture. (2011). Management plan for the archaeological site of Philippi for inscription on the World Heritage List of UNESCO.

Ministry of Culture. (2021). National action plan for cultural heritage and climate change.

Ministry of Environment & Energy. (2016). National strategy for adaptation to climate change. Athens, Greece: General Directorate of Environmental Policy.

Mitsos, D., Kantarleou, V., Palamara, E., Karydas, A. G., Zacharias, N., & Gerasopoulos, E. (2022). Characterization of black crust on archaeological marble from the Library of Hadrian in Athens and inferences about contributing pollution sources. Journal of Cultural Heritage, 53, 236–243. https://doi.org/10.1016/j.culher.2021.12.003

Mourtzas, N. (2023). Πόσο κινδυνεύει η Δήλος από την άνοδο της στάθμης της θάλασσας; The President. https://www.thepresident.gr/2023/12/19/poso-kindyneyei-i-dilos-apo-tin-anodo-tis-stathmis-tis-thalassas-grafei-o-nikos-moyrtzas/

Palumbo, G. (2000). Threats and challenges to the archaeological heritage in the Mediterranean. In M. Sullivan & R. Mackay (Eds.), Archaeological sites: Conservation and management (pp. 186–194). The Getty Conservation Institute.

Panou, A., Franzikinaki, K., Papakonstantinou, E., & Pouli, P. (2008). Evaluation of cleaning methods: The cleaning of the west frieze of the Parthenon. In Π. Αδάμ-Βελένη, Δ. Ιγνατιάδου, & Δ. Τερζόπουλου (Eds.), ΛΙΘΟΣ. Ημερίδα Συντήρηση ΑΜΘ 2007 (pp. 27–40). Archaeological Museum of Thessaloniki.

Plantzos, D. (2008). Archaeology and Hellenic identity, 1896–2004: The frustrated vision. Μουσείο Μπενάκη, 11–30. https://doi.org/10.12681/benaki.17969

Plantzos, D. (2017). Amphipolitics: Archaeological performance and governmentality in Greece under the crisis. In D. Tziovas (Ed.), Greece in crisis: The cultural politics of austerity (pp. 65–84). I.B. Tauris.

Plantzos, D. (2023). Αρχαιοπολιτική. Εκδόσεις του Εικοστού Πρώτου.

Sakellariadi, A. (2010). Management plan for the cultural resources of the area of Philippi: Towards a holistic approach. Hellenic Ministry of Culture and Tourism.

Siedel, H., & Siegesmund, S. (2011). Characterisation of stone deterioration on buildings. In S. Siegesmund & R. Snethlage (Eds.), Stone in architecture: Properties, durability (pp. 347–410). Springer.

Smith et al., 2008 [Already listed above as Smith, B. J., Gomez-Heras, M., & McCabe, S. (2008)]

Smith, B. J., Gomez-Heras, M., & McCabe, S. (2008). Understanding the decay of stone-built cultural heritage. Progress in Physical Geography, 32(4), 439–461. https://doi.org/10.1177/0309133308098119

Smith, L. (1993). Towards a theoretical framework for archaeological heritage management. In M. Sullivan & R. Mackay (Eds.), *Archaeological sites: Conservation and management* (pp. 133–148). The Getty Conservation Institute.

Smith, L. (2006). *Uses of heritage.* Routledge.

Tucci, P. L. (2015). The materials and techniques of Greek and Roman architecture. In M. W. Jones (Ed.), *The Oxford handbook of Greek and Roman art and architecture* (pp. 241–268). Oxford University Press.

UNESCO. (2008). *Operational guidelines for the implementation of the World Heritage Convention.* World Heritage Centre.