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Exploring Greek UNESCO Global Geoparks: A Systematic Review of Grey Literature on Greek Universities and Future Research Avenues for Sustainable Development

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Abstract: The relationship between humans and the environment in the modern world is challenging. UNESCO Global Geoparks are current holistic approaches for protecting and managing geographical areas that emphasise local communities and sustainability. This paper attempts to review the grey literature of Greek universities through their academic repositories, regarding the research field referred to as Greek UNESCO Global Geoparks from 2000 to 2022 and using the keyword “Geopark” to determine possible future research directions. Through the systematic literature review methodology, from 138 bibliographic sources, 28 were selected, which met the predefined criteria. In general, there is a growing scientific–academic interest in Geoparks, which mainly concerns the aspects of geotourism ($n = 7$), geology ($n = 6$), management ($n = 4$), and education ($n = 4$). Future research directions may focus on promoting the socio-economic and cultural aspects of Geoparks, investing in collaborative management and governance of Geoparks, facing climate change and environmental challenges in Geoparks, and enhancing Geoenvironmental Education in Geoparks. Such approaches may serve the United Nation’s Seventeen Sustainable Development Goals and cultivate cognitive and emotional bonds between local populations and the geoenvironment.

Keywords: UNESCO Global Geopark; geoheritage; geoconservation; geoeducation; Greece



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1. Introduction

1.1. Background on UNESCO Global Geoparks

Our world is experiencing increasing urbanisation, interconnectivity, and dynamic changes [1]. According to the United Nations World Population Prospects Report of 2022 [2], the global population is projected to reach 9.7 billion by 2030 and 10.4 billion by 2050, with half of this growth concentrated in only nine countries. Currently, 55% of the world’s population resides in urban areas, a percentage expected to rise to 68% by 2050 [3]. This urbanisation trend has significant implications for land use, biodiversity, and ecosystem pressures, with an estimated 50–60% of the total urban land use expected to be developed by 2030 [4].

However, our planet continues to face environmental challenges that threaten its “natural capital” [5,6], painting a worrisome future for humanity unless proactive measures and effective coping strategies are implemented. These challenges include pollution, erosion, desertification, deforestation, fires, intensified agriculture, overgrazing, the introduction and invasion of alien species, overfishing [7], climate change, greenhouse effects, droughts, floods, habitat loss, chemical pollution, environmental quality, sustainability issues [8], environmental emergencies, the anthropogenic impacts of population growth on economic systems, global warming, natural disasters, declining biodiversity, land degradation, water pollution, and mineral resource exploitation [9].

In this context, the environment should be regarded as a valuable and preservable resource, a shared responsibility, a problem to be addressed and solved, a system to be

understood for better decision-making, a place of residence to be understood and cared for, a biosphere in which we coexist over time, and a social issue that requires active community involvement [10,11]. Protecting and conserving the natural (biological and geological), historical, and cultural environment [7,12] and resources through rational management is crucial for ensuring the continuity of life itself [13] and requires informed and engaged citizens who act for the common good of society and humanity [14,15]. Our existence is intricately linked to the natural and human aspects of our planet in a dynamic relationship with the Earth [9], emphasising the critical role of diversity in our modern society [12,16].

UNESCO Global Geoparks represent a contemporary and innovative institution that aims to protect and develop specific geographical areas with a focus on sustainability [17]. According to UNESCO's latest definition, "UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education, and sustainable development. A UNESCO Global Geopark uses its geological heritage, in connection with all other aspects of the area's natural and cultural heritage, to enhance awareness and understanding of key issues facing society" [18].

The European Geoparks Network was established in 2000 through the collaboration between four regions of different European countries: France, Greece, Spain, and Germany, and later came under the auspices of UNESCO in 2001 [19–21]. In 2004, the Global Geoparks Network was formed with UNESCO's support, fostering collaboration among Geoparks for the protection of geoheritage and sustainable development [22]. The Global Network worked towards ensuring an equitable geographical distribution of Geoparks and enhancing expertise sharing [21,22]. In 2015, UNESCO created a new territorial designation under the International Geoscience and Geoparks Programme, which led to the establishment of the label "UNESCO Global Geoparks" for all Geoparks worldwide, addressing the contemporary challenges humanity faces [18,22].

UNESCO Global Geoparks, also described as "areas of resilience" [23], leverage their international geological heritage in conjunction with the natural and cultural (tangible and intangible) elements to promote awareness and understanding of societal issues [24]. Through geotourism and geoeducation, they contribute to sustainable social, economic, and cultural development, focusing on nurturing and developing the concept of geological heritage [25] and promoting the well-being of local communities [20,21]. All the stakeholders are involved in the development process, ensuring a hierarchical engagement from local to global levels, since Geoparks are viewed as continuous dynamic structures [26]. Geoparks aim to inspire local populations to re-evaluate their heritage and actively revitalise areas through tourism, education, and nature-friendly activities [27].

Currently, 195 UNESCO Global Geoparks are spread across 48 countries worldwide, as listed in the "List of UNESCO Global Geoparks" [28]. In Greece, eight (8) areas have been recognised and designated as UNESCO Global Geoparks (Table 1), and there are ongoing preparation, documentation, and nomination processes for two (2) additional aspiring Geoparks in the near future. The aspiring Nisyros UNESCO Global Geopark and the aspiring Meteora-Pyli UNESCO Global Geopark are areas under the establishment process.

Table 1. Greek UNESCO Global Geoparks.

	Name of the UNESCO Global Geopark	Year of Establishment
1.	Lesvos Island UNESCO Global Geopark	2000
2.	Psiloritis UNESCO Global Geopark	2001
3.	Chelmos-Vouraikos UNESCO Global Geopark	2009
4.	Vikos-Aoos UNESCO Global Geopark	2010

Table 1. *Cont.*

	Name of the UNESCO Global Geopark	Year of Establishment
5.	Sitia UNESCO Global Geopark	2015
6.	Grevena-Kozani UNESCO Global Geopark	2021
7.	Kefalonia-Ithaca UNESCO Global Geopark	2022
8.	Lavreotiki UNESCO Global Geopark	2023

1.2. Importance of Studying UNESCO Global Geoparks in Greece

Greece's geotectonic position imparts a rich geological field. The convergent zone between the African and Eurasian plates has contributed to a wide range of geofoms and formations worthy of protection for the global scientific community [29–33], rendering the Greek UNESCO Global Geoparks as invaluable sites.

Greece, as well as the Greek UNESCO Global Geoparks, are widely recognised as “natural geological laboratories” that chronicle the geological history of our planet. They harbour scientifically, aesthetically, culturally, and ecologically significant geotopes [31] that encapsulate the chronicles of Earth's past, spanning from the Proterozoic Eon to the present epoch [34]. Consequently, these Geoparks provide exceptional opportunities for researchers to uncover profound insights into Earth's geological evolution, processes, and dynamics and to investigate and comprehend various geological phenomena, such as tectonic processes, sedimentary deposition, volcanic activity, and landscape evolution [35–37].

Furthermore, the conservation and sustainable development of Geoparks assume paramount importance. Internationally, challenges such as ignorance and overtourism pose substantial threats to the integrity of geotopes, as well as the surrounding ecosystems and local communities [38,39]. In Greece, such problems do not exist yet, even though the main tourism development model is the “sun–sea” duopoly. In-depth scientific studies contribute to the formulation of effective conservation strategies and the promotion of sustainable practices, thereby ensuring the long-term preservation of these invaluable natural and cultural assets [27,40–44].

Additionally, Greek UNESCO Global Geoparks serve as remarkable platforms for education and public engagement, allowing for the dissemination of scientific knowledge and the enhancement of public awareness [27,45–48]. The integration of geological heritage with natural and cultural aspects within these Geoparks facilitates a comprehensive understanding of societal issues, leading to an increased awareness and a deeper appreciation of the intrinsic connections between geology, ecology, culture, and sustainable development. Educational programmes and geotourism initiatives organised within Geoparks further promote the sustainable social, economic, and cultural development of local communities [27,45–52].

The scientific exploration of UNESCO Global Geoparks holds broader implications for Geosciences and geoconservation as a whole [15,43,44,53–56]. It fosters interdisciplinary research, encompassing geological, biological, and cultural aspects, to unravel the complex interactions and interdependencies within Earth systems. Additionally, the knowledge gained from these Geoparks informs global efforts in sustainable development, environmental stewardship, and the preservation of Earth's geological heritage.

1.3. Purpose of the Review

Given the increasing domestic and global scientific interest in the constitution of territories with the designation of UNESCO Global Geoparks, and apart from the existing scientific publications in the proceedings and peer review journals in Greece, the purpose of this review is to examine the repositories of Greek universities to identify, appraise, describe, and cataloging evidence regarding the research topics and themes covered in the academic realm of literature [57–59]. Through a rigorous assessment of the grey literature,

the review seeks to determine the gaps, limitations, and areas of emphasis in the current understanding of Greek UNESCO Global Geoparks.

By amalgamating the insights derived from these sources, this review aspires to provide a comprehensive understanding of the current research landscape of Greek universities and highlight the areas that may not have received adequate exploration.

Furthermore, the review aims to elucidate the directions for future research in Greek universities and underscore critical domains that necessitate further investigation, particularly in the context of Greek Geoparks. By identifying these research gaps, the review intends to serve as a compass for future scientific inquiries and stimulate the emergence of fresh research avenues.

This systematic review [57–61] serves the purpose of sharing critical insights with the research community, policymakers, and pertinent stakeholders, with an emphasis on identifying the areas warranting additional investigation. Importantly, it refrains from diminishing the commendable commitment exhibited by the administrative bodies and coordinators of the UNESCO Greek Global Geoparks. It is crucial to reiterate that these Geoparks enjoy worldwide recognition as invaluable assets, effectively balancing their roles in facilitating scientific and academic research while also fulfilling vital societal functions.

The research questions to be answered in this paper are as follows.

Question research 1: Which research topics and themes are covered in the grey literature from Greek universities about Greek UNESCO Global Geoparks?

Question research 2: What are the research gaps in the Greek grey literature?

Question research 3: What may be the possible future research directions concerning Greek UNESCO Global Geoparks?

2. Materials and Methods

2.1. Overview of the Literature Search Procedure

This paper endeavours to gather existing research evidence to answer the research questions and determine the direction of future research. We followed a detailed methodology, rooted in the systematic review approach [57–62], which consisted of specific steps designed to ensure replicability and yield dependable conclusions, as shown in Figure 1. Our search strategy was designed to align with the above mentioned objective while acknowledging its potential limitations.

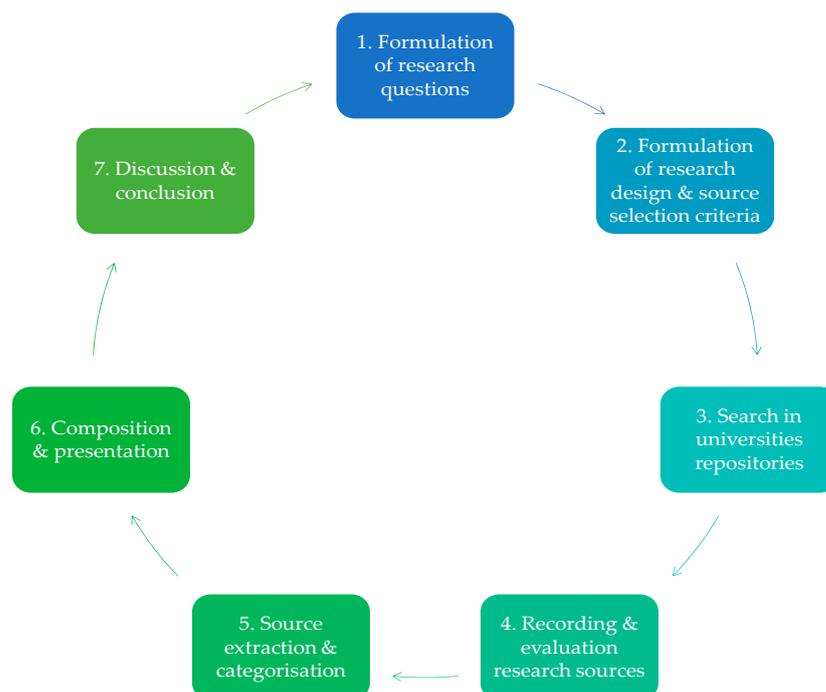


Figure 1. Steps of the systematic literature review.

2.2. Selection Criteria for Including Studies in the Review

The criteria for inclusion in this review were stringent, encompassing the following conditions: (a) the availability of publications in Greek university repositories; (b) a time frame ranging from 2000 to 2022; (c) the exclusive use of the keyword “Geopark”; (d) the presence of references to works related to Greek UNESCO Global Geoparks in the titles, keywords, or abstracts; (e) a primary focus on Geoparks rather than specific geological or other elements within Geopark areas.

2.3. Data Collection from Greek University Repositories

For the overview of the bibliographic sources, the search was focused on the grey literature [63] found in the institutional repositories of Greek universities, specifically on doctoral, master’s, and graduate theses. As there is still no fully functional single search engine in Greece, apart from the remarkable effort of the National Documentation Center through <https://www.openarchives.gr/> (accessed on 26 September 2023) which connects the repositories of Greek universities, the search process was conducted separately in each university repository to ensure the reliability of the results. We carried out a search in all Greek universities, including (alphabetically) the Agricultural University of Athens, Aristotle University of Thessaloniki, Athens School of Fine Arts, Athens University of Economics and Business, Democritus University of Thrace, Harokopio University of Athens, Hellenic Mediterranean University, Hellenic Open University, International Hellenic University, Ionian University, National Technical University of Athens, National and Kapodistrian University of Athens, Panteion University, School of Pedagogical and Technological Education, Technical University of Crete, University of Patras, University of the Aegean, University of Crete, University of Ioannina, University of Macedonia, University of Piraeus, University of Thessaly, University of West Attica, University of Western Macedonia, and University of the Peloponnese. Additionally, there are no longer Higher Technological Educational Institutions in Greece; all the departments were absorbed by the existing universities or formed new university institutions. In this screening phase, the literature search delivered a total of 138 potentially relevant items.

Additionally, we should mention that the keyword used was “Geopark” in Greek and English, and we tried the lowercase keyword “geopark”, which produced the same results. The keyword “UNESCO Global Geopark” included the word “Geopark”, so it was not used.

Moreover, apart from searching in the titles, keywords, and abstracts of the theses, in many repositories, there was no option to search specifically in the titles, keywords, or abstracts. Therefore, the search was performed in the entire text body, resulting in more irrelevant findings.

Some theses did not have an English title, so we have provided an English translation for them.

2.4. Source Selection Based on the Predefined Criteria

A total of 138 bibliographic sources were identified, of which 28 met the selection criteria. Following the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [64], we constructed a flow chart for the review process (Figure 2).

As we mentioned, we acknowledged the challenges posed by the variations in the search engine capabilities and criteria settings across the different institutions. Especially, from the sum of 138 bibliographic sources, 74 were excluded based on their irrelevant titles. Those theses may have contained the word “Geopark” once in their body text, but they had nothing to do with Greek UNESCO Global Geoparks. In the next screening phase, a total of 64 bibliographical sources were taken into account for further evaluation. From them, 18 sources were rejected due to the contents of the abstracts. Those theses seemed to be relevant to the field of Greek UNESCO Global Geoparks by their titles, although they did not contain the word “Geopark”. Based on the contents of their abstracts, we excluded

them. Finally, 46 university theses were examined and 18 of them were excluded as their content was irrelevant to the scope of this review or did not align with the inclusion criteria. In total, 28 theses met the inclusion criteria for this review (Table 2) as they fulfilled the specific objectives of our systematic review by addressing the research questions.

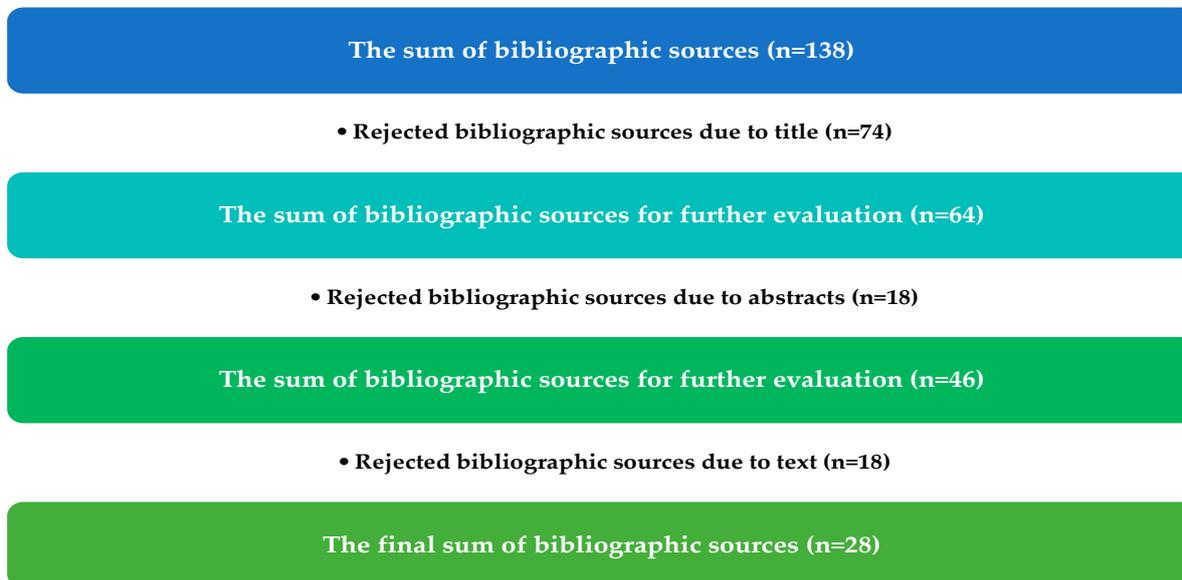


Figure 2. Flow chart for the literature review.

Our approach involved conducting an intelligible statistical analysis of university theses related to Greek UNESCO Global Geoparks. Given the relatively limited number of identified theses, we also undertook the task of descriptively outlining the general content of each manuscript, aiming to provide a comprehensive understanding for the scientific–academic community.

2.5. Limitations of the Review Approach

While our search strategy was designed to align with our research objectives, we acknowledged several limitations inherent in this approach. The use of a single keyword, “Geopark”, may not have captured all the potentially relevant grey literature. Variations in the terminology or language could have resulted in the omission of works that used different terminology to describe Geoparks. The challenges related to the access and availability of specific institutional repositories or documents were encountered during our search. We recognised the potential for bias in the search results due to variations in the search capabilities and criteria settings across the different institutions or databases. While we aimed to mitigate this bias, it remained a limitation of our study.

3. Results

3.1. Overview of Greek UNESCO Global Geoparks

Greece hosts eight (8) of the Global Geoparks of UNESCO and two (2) aspiring UNESCO Global Geoparks (Figure 3). In Figure 4, we present some of the most significant geotopes of the Greek UNESCO Global Geoparks. It is worth noting that the first Greek Geoparks have existed for over two decades.

The Lesvos Island UNESCO Global Geopark, the former Lesvos Petrified Forest Geopark, was founded in 2000 and was one of the four founder members of the European Geoparks Network in 2000. Lesvos Island is located in the Northeast Aegean Sea, close to the coast of Asia Minor. It contains an area of 1636 km² and 370 km of coastline. Lesvos Island belongs to the Pelagonian geotectonic zone of Greece, representing fragments of the Cimmerian Continent. The Lesvos UNESCO Global Geopark hosts “one of the most

complete early Miocene forest ecosystem records of the world”, which led to its designation as a National Protected Monument and its inclusion in “The First 100 IUGS Geological Heritage Sites” [65] as it was preserved by a massive volcanic eruption 20 million years ago and features rare and impressive fossilised tree trunks. In the area of the Lesvos Island UNESCO Global Geopark, there is evidence of the oldest known land mammal (*Prodeinotherium bavaricum*) in Greece from 19 million years ago [66], impressive fossils of animals that lived on Lesvos 2 million years ago, numerous volcanic sites and thermal springs that witnessed intense volcanic activity (21.5–16.2 million years ago), faults and landscapes created from tectonism, caves and karstic structures, erosional forms and waterfalls, as well as impressive coastal landforms [67].



Figure 3. Satellite photo of Greece indicating the locations of the Greek UNESCO Global Geoparks and aspiring Geoparks.



Figure 4. Representative views of the geotopes of the Greek UNESCO Global Geoparks. (a) Lesvos Petrified Forest; Lesvos Island UNESCO Global Geopark (“Lesvos Petrified Forest” by C messier is licensed under CC BY-SA 4.0; accessed on 21 September 2023). (b) Plateau of Lakos Mygerou; Psiloritis UNESCO Global Geopark (“A ponor close to the Mygero mountain hut” by Pampuco is licensed under CC BY-SA 4.0; accessed on 21 September 2023). (c) Waters of Styx; Chelmos-Vouraikos UNESCO Global Geopark (“Water of Styx” by Blume2002 is licensed under CC BY-SA 4.0; accessed on 21 September 2023). (d) Stone Forest in Monodendri; Vikos-Aoos UNESCO Global Geopark (“Stone Forest” by John Salatas is licensed under CC BY-SA 4.0; accessed on 21 September 2023). (e) Folded rocks at Cavo Sidero; Sitia UNESCO Global Geopark (with permission from E. Perakis). (f) Alpine meadow on the Tsiolika plateau of Vounasa; Grevena-Kozani UNESCO Global Geopark (“Alpine meadow on the Tsiolika plateau and Mt Prionos” by Panos Tzouvaras is licensed under CC BY-SA 4.0; accessed on 21 September 2023). (g) Melissani cave; Kefalonia-Ithaca UNESCO Global Geopark (“Melissani Cave” by Christos Vittoratos is in the public domain; accessed on 21 September 2023). (h) Ancient mine gallery; Lavreotiki UNESCO Global Geopark (“Ancient mine gallery in Lavrio next to ancient Thorikos theatre” by Dr. Peter Tzeferis is licensed under CC BY-SA 4.0; accessed on 21 September 2023).

The Psiloritis UNESCO Global Geopark was founded in 2001 as a Natural Park. It is located in the central part of the island of Crete in southern Greece, encompassing an area of 1272 km². It includes the entire scope of Mountain Idi (Psiloritis), reaching up to 2456 m. The Psiloritis Mountains rose through the sea a few million years ago when the African continent encroached on Europe. The Psiloritis UNESCO Global Geopark is characterised by its superb geodiversity. The Geopark's geodiversity is reflected by volcanic, sedimentary, and metamorphic rocks ageing from the Permian to Pleistocene period (300 to 1 million years ago), outstanding folds and faults, and fascinating caves and deep gorges [68] with rich biodiversity. These are exposed in many excellent outcrops and cross-sections that provide insight into Earth's mountain-building processes [27,69].

The Chelmos-Vouraikos UNESCO Global Geopark was established in 2002 as a National Park and, since 2009, has been a member of the Geoparks Network. It is located in the Northern Peloponnese over an area of 647 km². The Chelmos-Vouraikos UNESCO Global Geopark unfolds at least 485 million years of geological history with an alpine basement of three geotectonic zones (Tripolis zone, Pindos zone, and Phyllites-Quartzites suite) and post-alpine formations, including geological formations (folds, faults, rocks, and lithological formations, etc.), karstic geomorphs (caves, karstic springs), geomorphosites (gorges, high peaks, alpine lakes, etc.), and fossil sites [56]. Mount Chelmos, the Waters of Styx, Vouraikos Gorge, the Aesthetic Forest of Kalavryta, Kastria Caves, Tsivlos, and the Doxa lakes are remarkable geosites. The area is also valued for its numerous animal and plant species. Among the plant species, there are Greek endemics, endemics of Peloponnese or local endemic plant species, many of which either belong to one of the IUCN Red Data Book risk categories and/or are included in an international conservation regime [40].

The Vikos-Aoos UNESCO Global Geopark was founded in 2010. It is located in Epirus, Ioannina, northwest Greece and covers 1200 km². It occupies the northwestern part of the Pindus Mountain Range and is characterised by mountainous and rugged terrain. The Vikos-Aoos UNESCO Global Geopark is made up of deep-sea sedimentary rocks that, 20 million years ago due to the collision of the African and Eurasian plates, were folded and faulted by the powerful compressive movements that prevailed in the Greek area. It combines geomorphological, hydrogeological, stratigraphical, tectonic, sedimentological and prehistorical features, which can be directly observed to understand the geological processes that have occurred over time. It includes Mt. Smolikas (2637 m.)—the second highest mountain in Greece—and Mt. Tymfi (2497 m.), the two spectacular gorges of Vikos and Aoos, and the Drakolimni (Dragon Lake), a formation which is located at a height of 2000 m. [70]. Due to its geological isolation and the absence of a human presence, the Vikos Gorge includes rare plant and flower species of Epirus. Additionally, Mt. Tymfi is among Greece's most interesting floristic regions, with approx. 1700 species of plants.

The Sitia UNESCO Global Geopark was founded in 2015 and is located on the easternmost edge of Crete, covering an area of 517 km². The geology of the Sitia UNESCO Global Geopark includes distinctive characteristics that make it unique and of international value. It has the oldest known rocks in Crete and has been named a "geological laboratory". The abundant Pleistocene mammal fossil sites (dating back from 2.6 billion years to 11.700 years ago), the discovery of three *Deinotherium proavum* fossils, the extensive cave systems, as well as the palaeo-shorelines of the Zakros area are unique for Crete and of national importance [41]. Its geographical position, combined with the intense dry and hot climate of the area, created a mosaic of habitats and ecosystems, such as the Aesthetic Palm Forest of Vai (*Phoenix theophrasti*), which is included in the native palm tree forests in Europe [71].

The Grevena-Kozani UNESCO Global Geopark was founded in 2021 and lies in the Greek province of West Macedonia in North Greece, covering 2486 km². The unifying element within the Grevena-Kozani UNESCO Global Geopark is its recognition as one of the global sites of geoheritage relating to the birth of the plate tectonic theory. The region includes the site of the oldest rocks in Greece found to date, which expose the geologic history and rifting processes surrounding the "birth" of the Tethyan Ocean and Europe as an independent continental mass. Glaciers and rivers sculpted and abraded the remains of

Tethys to form a spectacular array of landscapes, each hosting a unique ecosystem with numerous endemic species of plants, fungi, and insects [72].

The Kefalonia-Ithaca UNESCO Global Geopark was founded in 2022 and is located in Western Greece, belonging to the Heptanese in the Ionian Sea. Kefalonia Island and Ithaca Island occupy an area of 773 km² and 117 km², respectively. The Geopark's most significant geological feature is the karstic network consisting of caverns, lake caverns, and karstic caves. The Sinkholes of Argostoli is a scarce hydrological phenomenon, telling a geological history of more than 250 million years. Both islands are located close to a mountain chain shaped like an arc (the Hellenic arc) formed by the subduction of the African Plate under the Eurasian Plate. It is the most tectonically active region in Europe [33,73].

The Lavreotiki UNESCO Global Geopark was founded in 2023 and is located near Athens, covering 177 km². The Lavreotiki UNESCO Global Geopark is in an incomparable area, combining exemplary mineralogical, geological, mining, and archaeological characteristics. The Lavrion deposit comprises five different styles of deposits related to each other, a feature that has yet to be seen in another ore deposit elsewhere. Its minerals contain the highest number of elements of any known mining district and are, thus, more diverse than anywhere else in the world [74]. Apart from being famous for its silver, the district contains more different minerals than any other location on Earth. The effects of surface weathering and oxidation at Lavrion and the frequent rises and falls in sea level resulting from oscillating climate change over the last million years have created an unmatched diversity of secondary minerals. As a result, the Lavrion mining district is unique in its mineralogical features. Currently, out of the globally known mineral species, nearly 12% are present in the Lavreotiki UNESCO Global Geopark, making it a natural mineralogical museum [74].

3.2. Review of the Greek Grey Literature on UNESCO Global Geoparks

During the review of the grey literature in the repositories of Greek universities, twenty-eight ($n = 28$) theses were identified (Table 2).

Table 2. Overview of the Greek grey literature for the keyword “Geopark”; alphabetically by university.

	Author	Date	Thesis Title	University and Department	Type of Thesis
1.	Makridou, E. [75]	2020a	Geoparks: A New Sustainable Tool for Tourism Development.	Aristotle University of Thessaloniki (School of Spatial Planning and Development)	Graduate thesis
2.	Makridou, E. [76]	2020b	Tourism Development and Geotourism—The Case of the Grevena-Kozani Geopark.	Aristotle University of Thessaloniki (School of Spatial Planning and Development)	Graduate thesis
3.	Vlachopoulos, N. [77]	2012	Ecosystem Management Bodies, Natura 2000 Areas—Geoparks: Case studies—Comparative Evaluation Management Bodies.	Hellenic Open University (Environmental Design)	Master's thesis
4.	Koupatsiaris, A.A. [78]	2018	The Geocultural Heritage through the Global Network of National Geoparks of UNESCO and its Contribution to the Development of an Area. Case Study of Sitia's Nature Park in Crete.	Hellenic Open University (Cultural Organisations Management)	Master's thesis
5.	Avgeri-Balaska, P. [79]	2020	The Contribution of Geotourism to Sustainable Local Development. Case Study of the Vikos-Aoos Global Geopark.	Hellenic Open University (Tourism Business Administration)	Master's thesis
6.	Batzogianni, C. [80]	2020	The Contribution of Geological Heritage to the Enhancement of the Tourist Product. Cases of Psiloritis and Sitia.	Hellenic Open University (Tourism Business Administration)	Master's thesis

Table 2. Cont.

	Author	Date	Thesis Title	University and Department	Type of Thesis
7.	Tzouliadaki, A. [81]	2020	Prospects for Geotourism Development in Crete.	Hellenic Open University (Tourism Business Administration)	Master's thesis
8.	Karagiannaki, M. [82]	2022	Sitia UNESCO Global Geopark as a Pillar of Tourism Development in eastern Crete.	Hellenic Open University (Tourism Business Administration)	Master's thesis
9.	Kanellopoulou, G. [83]	2014	Interpreting the Geodynamics of the Past: Georoutes in the Karst Geoforms of the Vikos-Aoos Geopark to Develop Geotourism in the Area.	National Technical University of Athens (Environment and Development of Mountainous Regions)	Master's thesis
10.	Tzounidou, Z. [84]	2021	Protected Landscape and Infrastructure: A Vital Interface of Natural and Cultural Heritage.	National Technical University of Athens (Architecture—Space Planning)	Master's thesis
11.	Todi, V. [85]	2022	Ecosystem Services of Vikos-Aoos Geopark.	National Technical University of Athens (Environment and Development of Mountainous Regions)	Master's thesis
12.	Kogiou, M. [86]	2018	The Importance of Geoparks and Georoutes in Environmental Awareness and Management: Examples from Europe.	National and Kapodistrian University of Athens (Department of Geology and Geoenvironmet)	Master's thesis
13.	Papaspyridakou, P. [87]	2013	Typotopika and Aesthetically Mineral of Lavreotiki. A New Geotrails Pursuit.	National and Kapodistrian University of Athens (Department of Geology and Geoenvironmet)	Master's thesis
14.	Spyridaki, A. [88]	2017	Preliminary Actions of Mapping, Integrating and Highlighting the Cultural Stock on the Broader Area of Sitia's Geopark in Crete.	National and Kapodistrian University of Athens (Department of Geology and Geoenvironmet)	Master's thesis
15.	Toumasi, P. [89]	2022	Physical Geographical Study of the Island of Kefalonia—The Role of Geotopes.	National and Kapodistrian University of Athens (Department of Geology and Geoenvironmet)	Master's thesis
16.	Nikitopoulos, E. [90]	2018	UNESCO Global Geoparks as Training Bodies for the Environment and Sustainability; the Case of Greece.	Panteion University (Department of Communication, Media and Culture)	Master's thesis
17.	Koumoutsou, E. [91]	2022	Species, Habitats, Ecosystem Diversity and Ecosystem Services Assessment at the Chelmos-Vouraikos National Park.	University of Patras (Department of Biology)	PhD thesis
18.	Groumpou, M. [92]	2017	Holocene Evolution of the Krathis River Bed in Lake Tsivlou, Central Corinthian Gulf.	University of Patras (Department of Geology)	Master's thesis
19.	Lipioti, P.T. [93]	2022	Production of a Cultural Documentary about the Petrified Forest of Lesvos.	University of the Aegean (Department of Cultural Technology and Communication)	Master's thesis
20.	Ververis, K. [94]	2021	Promotion and Utilisation of Natural Monuments and Climate Change. The Case of the Lesvos Petrified Forest Park. A Workshop for Understanding the Impacts of Climate Change.	University of the Aegean (Department of Geography)	Master's thesis
21.	Lamprakopoulos, A. [95]	2020	The Utilisation of Modern Methodologies for the Study and Highlighting of Tectonic Geotopes to Raise Awareness of Seismic Risk: The Example of W. Lesvos.	University of the Aegean (Department of Geography)	Master's thesis

Table 2. Cont.

Author	Date	Thesis Title	University and Department	Type of Thesis
22. Zoulinakis, G. [96]	2020	Environmental Education and Contribution of Geoparks to Developing Positive Environmental Attitudes: The Case of Sitia Geopark (Eastern Crete).	University of the Aegean (Department of Preschool Education Sciences and Educational Design)	Master's thesis
23. Antonakis, E. [97]	2019	Promotion and Management of Geodiversity on the Island of Lesvos.	University of the Aegean (Department of Geography)	Master's thesis
24. Valiakos, I. [98]	2018	Geography, Assessment and Management of Geosites of Greece.	University of Aegean (Department of Geography)	PhD thesis
25. Savvalas, P. [99]	2017	Natural Heritage Management Using Modern Thematic Cartography Methodologies. The Case of Lesvos Island Geopark.	University of the Aegean (Department of Geography)	Graduate thesis
26. Tsermentselis, G. [100]	2009	Development of a Geographic Database and Web-based User Interface for Geological Monuments.	University of the Aegean (Department of Geography)	Master's thesis
27. Lampaki, O.K. [101]	2006	Geoconservation: Highlighting and Managing Natural Monuments—Geotopes: The Lesvos Petrified Forest Geopark Case.	University of the Aegean (Department of Geography)	Master's thesis
28. Plakenta, E. [102]	2022	The Organisation of Visits to Technoscience Sites and a Literature Review Emphasising Geosciences.	University of Western Macedonia (Department of Early Childhood Education)	Master's thesis

These theses consisted of twenty-three ($n = 23$) master's theses, three ($n = 3$) graduate theses, and two ($n = 2$) doctoral theses, as illustrated in Figure 5.

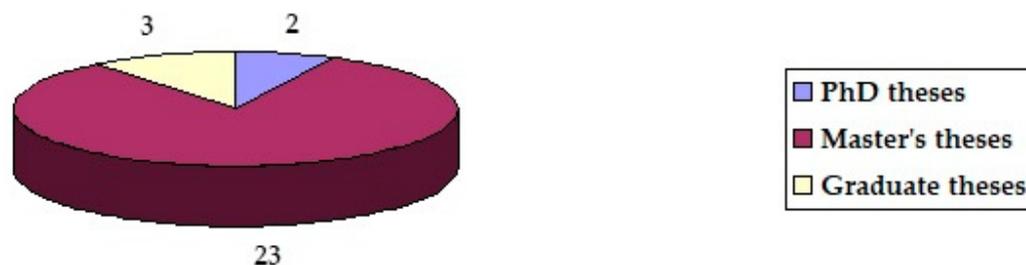


Figure 5. Distribution of the theses by type.

The literature review revealed that the identified theses exhibited an increasing trend, providing further evidence of the growing interest in Geoparks within the academic community. In Figure 6, we present the theses identified by their year of publication ($n = 28$) along with a trend line. Notably, the number of publications in 2021 ($n = 2$) was negatively impacted by the SARS-CoV-2 pandemic, which was also observed globally [51].

In Figure 7, we present the distribution of the theses by university. Most of the theses were found at the University of the Aegean ($n = 9$). One possible explanation was that the Lesvos Island UNESCO Global Geopark, being the oldest Geopark in Greece, has established effective cooperation with the university, where it serves as the scientific coordinator. Additionally, the presence of the President of the Global Geoparks Network has had a positive influence on this outcome.

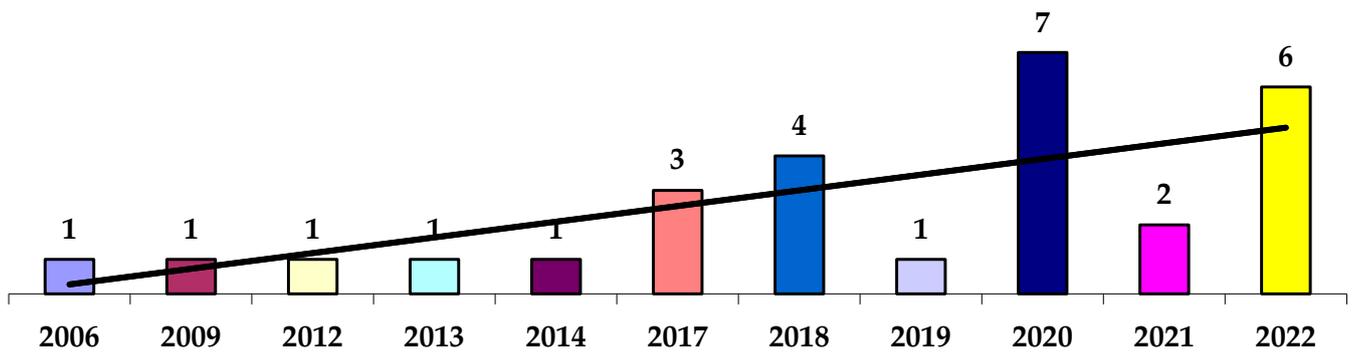


Figure 6. Distribution of the theses by the year of publication.

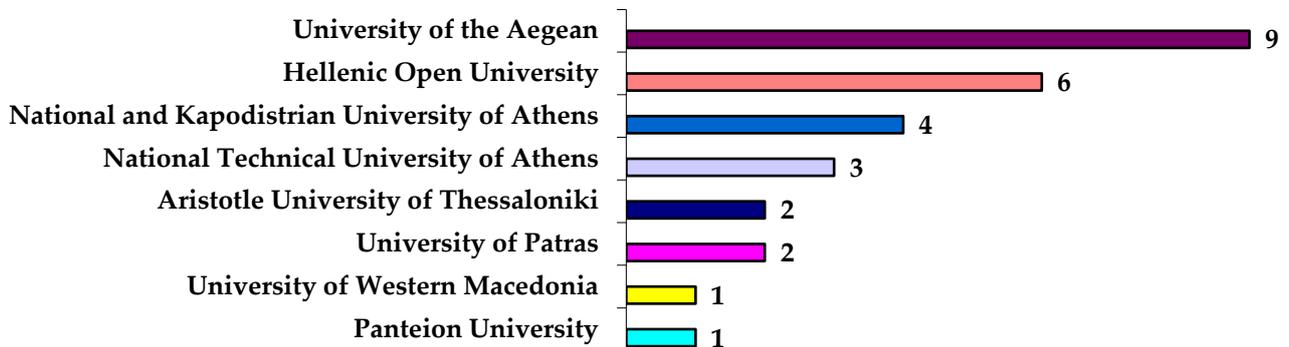


Figure 7. Distribution of the theses by university.

In Figure 8, we present the distribution of the theses by university department. It was observed that the majority of the theses ($n = 23$) were conducted in the departments and master’s programmes that focus on various aspects of the structure and operation of Geoparks. Specifically, the Department of Geography at the University of the Aegean had the highest number of theses ($n = 7$), followed by the Department of Geology and Geoenvironment ($n = 4$) at the National and Kapodistrian University of Athens and the Tourism Business Administration ($n = 4$) at the Hellenic Open University.

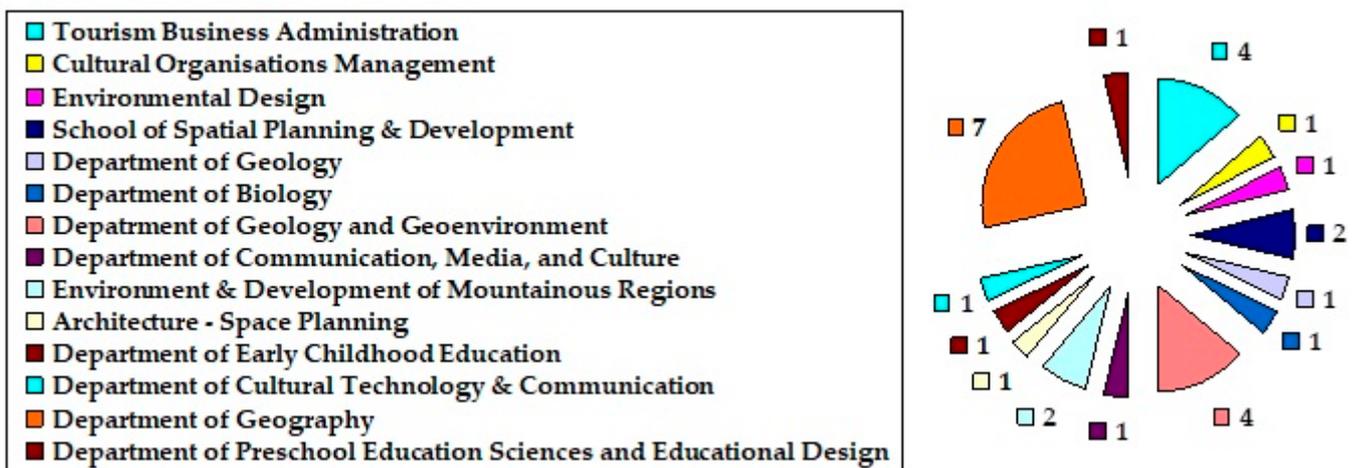


Figure 8. Distribution of the theses by university department.

Figure 9 presents the distribution of the theses by each Greek UNESCO Global Geopark. It was evident that most of the theses ($n = 11$) were focused on the Lesvos Island UNESCO Global Geopark. This can be attributed to the fact that Lesvos Island UNESCO Global Geopark was the first to be established in Greece and is home to the Department of

Geography at the University of the Aegean. Additionally, within the Geopark's boundaries is the Natural History Museum of the Lesvos Petrified Forest, which further enhances research opportunities. Interestingly, despite being relatively new and isolated, the Sitia UNESCO Global Geopark has generated significant research interest ($n = 6$).

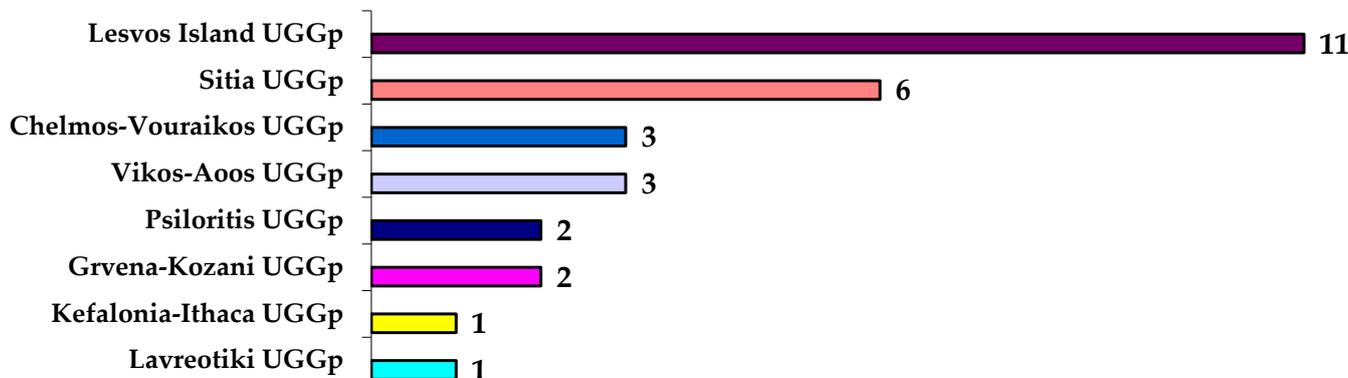


Figure 9. Distribution of the theses according to their Greek UNESCO Global Geopark focus.

In Figure 10, we present the classification of the theses based on their content and fields of knowledge. The majority of these were focused on geotourism ($n = 7$), indicating significant interest for studying the tourism aspects of Greek UNESCO Global Geoparks. This was followed by research on geodiversity and geology ($n = 6$), emphasising the exploration and understanding of the geological features within the Geoparks. Sustainable management and conservation ($n = 4$) was another important category, highlighting the commitment to ensuring these area's long-term preservation and sustainable development. The interconnection of Greek UNESCO Global Geoparks with education was also a notable research focus ($n = 4$). Other categories of research orientation included geoinformatics ($n = 2$), biodiversity–biology ($n = 1$), cartography ($n = 1$), cultural development ($n = 1$), spatial planning ($n = 1$), and the promotion of georoutes ($n = 1$). Overall, these findings demonstrated the diverse range of research interests and the multidisciplinary nature of the studies conducted within the Greek UNESCO Global Geoparks.

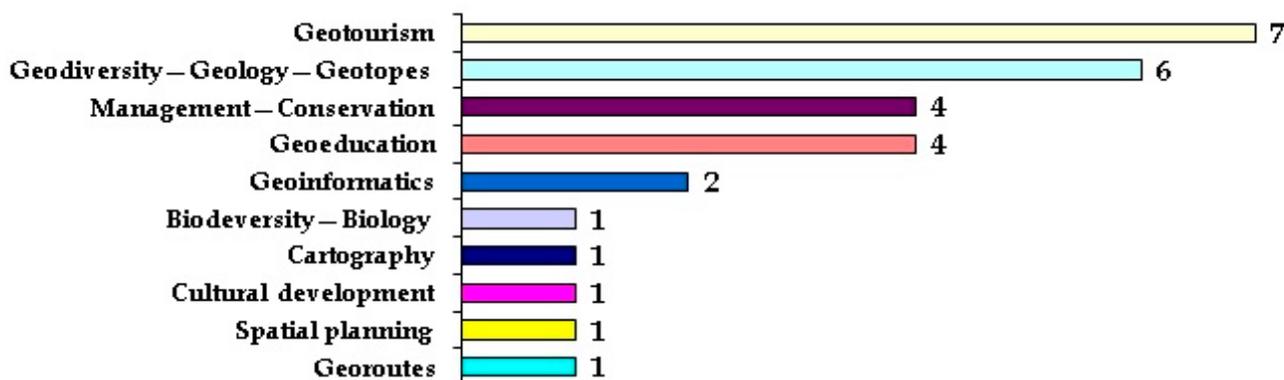


Figure 10. Content classification of the Greek grey literature.

3.3. Analysis of the Existing Research on Greek UNESCO Global Geoparks

In the mentioned theses (refer to Table 2), Makridou [75,76], Avgeri-Balaska [79], Batzogianni [80], Tzouliadaki [81], Karagiannaki [82], and Kanellopoulou [83] investigated the geotourism potential of Greek UNESCO Global Geoparks. Makridou [75] discusses the challenges faced in tourism development, highlighting the need for alternative models promoting sustainable practices. She emphasised that Geoparks, operating through tourism development, contribute to geoconservation and cultural and scientific education.

Additionally, she cited the Lesvos Island UNESCO Global Geopark as an excellent example of such an operation.

Makridou [76] focused on exploring the geotouristic potentials of the Grevena-Kozani UNESCO Global Geopark within the wider prefecture. Her survey concluded that the Geopark has the potential to contribute to the development of tourism in the region. She highlighted the geotourism attractions, the brand name of the Geopark, and the natural and geological resources as key elements for sustainable and socially responsible development. The Geopark's actions were aimed at environmental care, improving resident's quality of life, and promoting a vision of mild and sustainable tourism development.

Avgeri-Balaska [79] surveyed sustainable tourism development in the Vikos-Aoos UNESCO Global Geopark, the usefulness and influence of geotourism, and the contribution to the region's economic, tourist, and cultural development through questionnaires from public service employees, management bodies, and environmental parks in the prefecture of Epirus. She underlined that the product of geotourism should not be at the expense of the natural environment or with the risk of deterioration of the cultural environment. Stakeholders can contribute to sustainable tourism development in the region, and the formulation and implantation of development policies requires the absorption of significant financial resources.

Batzogianni [80] examined the characteristics and parameters related, to a smaller or larger extent, to the development of a sustainable form of tourism—geotourism—which in addition to nature and the natural environment, can be combined with culture and local gastronomy, composing complete packages for tourist experiences in Psiloritis and Sitia UNESCO Global Geoparks, respectively.

Tzouliadaki [81] explored geotourism development in Crete and the possibilities for future progress. She conducted surveys via interviews with individuals directly involved with the Psiloritis and Sitia UNESCO Global Geoparks. The results signified the significant role of Geoparks in developing these regions, environmental protection, and ecological awareness but also underlined the need for more education and infrastructure, bureaucracy, and financial issues. The cooperation of municipal, government, and private stakeholders is needed to maintain the rich geomorphological heritage of the Island of Crete.

Karagiannaki [82] detected the classic “sun–sea” type of mass tourism in Crete, which could be considered dangerous for the Island's natural resources. In light of the climate crisis, adopting more alternative tourism types, such as geotourism, is necessary. She investigated, using a questionnaire, the local's people knowledge, attitudes, and views about the Sitia UNESCO Global Geopark, regarding the tourism and economic development of the area. The main conclusion was that there is a need for specific initiatives and actions to be taken regarding the Geopark that will inform tourism professionals, youth, and students through a medium-term strategic plan.

Kanellopoulou [83] focused on the inextricable connection between a Geopark's geological and geomorphological characteristics and their utilisation for touristic development. She studied the Astraka plateau in the Vikos-Aoos UNESCO Global Geopark by focusing on the emergence of the natural and the anthropogenic environment through the rare landforms and local culture to propose geotrails as an interpretative tool for the uniqueness of the region's geological and cultural monuments.

Papaspyridakou [87], Toumasi [89], Groumpou [92], Lamprakopoulos [95], Antonakis [97], and Valiakos [98] searched the aspects of geodiversity, geology, and geotopes in their theses. Papaspyridakou [87], in her thesis about Lavreotiki, which was almost a decade before the formal establishment of the Lavreotiki UNESCO Global Geopark, made a brief reference to the geographical position of the municipality of Lavreotiki, the historical area, the ancient technique and technology in Lavrio, the geomorphology, geology, soil sciences elements, mineralogy, and economic geology, as well as data on the pollution of the area. Finally, she suggested a complete geotour of Lavreotiki concerning its mineral wealth, visiting places of geological and historical interest.

Toumasi [89] studied the physical geographical features (geographical location, demographic and economic characteristics, geology and major seismic events, climatic and meteorological conditions, and geotopes) of the Island of Kefalonia. She focused on the Coastal Vulnerability Index, presenting a relative map of the vulnerability of the coastal zone.

Groumpou [92] presented sedimentological and micropalaeontological results from the swamp that developed in the riverbed of the Krathis River in the Chelmos-Vouraikos UNESCO Global Geopark in Peloponnese. The study aimed to investigate the possible relationship between the swamp that forms today and the historical landslide of Tsivlos in 1913, identifying similar phenomena before 1913 in the area. The results of the sedimentological, micropalaeontological, and dating data analyses showed that the landslide of Tsivlos was not the possible cause of the swamp's formation, as sediment accumulation has continued until today. However, the tectonic movements of the area seemed to play a decisive role in sediment accumulation as they caused an uplifting in the area, creating a natural barrier in the sediment flow.

Lamprakopoulos [95] examined geodiversity as an expression of the vast changes in the planet's surface and the various geological processes. He studied tectonic geotopes and, more specifically, the faults and how information and awareness actions of the public in the area where the faults appear can contribute positively to dealing with seismic risks. He focused on the western part of the Lesvos Island UNESCO Global Geopark, where active faults appeared through artificial slopes during the opening of the Kalloni-Sigri road. He stated that geotopes under the UNESCO Global Geoparks are an effective method for management and protection.

Antonakis [97] studied the geodiversity of the Lesvos Island UNESCO Global Geopark and proposed a methodology for mapping the pyroclastic flows in the western part of Lesvos Island. He aimed to create a tool for better geodiversity management and its development. He concluded that a pattern in their direction was exhibited in each location of the fossilised trunks. By knowing the direction of the pyroclastic flows, we can map the palaeo-relief that flowed on them.

Valiakos [98] focused on developing an integrated methodology and the criteria for assessing geosites, the basic unit of the geological and geomorphological heritage, and used this methodology to implement an integrated geoconservation policy. The quantitative evaluation of geotopes aims to be a fundamental tool for the management of Greek Geoparks, as well as for Geoparks internationally. His dissertation contributed to the expansion of the Lesvos Petrified Forest Geopark, which initially included the protected area of the Petrified Forest, to include the entire Island of Lesvos, resulting in the recognition of it as the Lesvos Island UNESCO Global Geopark.

Vlachopoulos [77], Todi [85], Kogiou [86], and Ververis [94] examined the management of Greek UNESCO Global Geoparks. Vlachopoulos [77] studied the management of Protected Areas in Greece, regarding the state-of-the-art legislation in Greece and internationally. He proceeded to conduct a comparative evaluation of the management body of the Chelmos-Vouraikos UNESCO Global Geopark and the management body of the National Forest of Oite through the data collected after in situ visits, interviews with employees, members of the board, and citizens. He proposed a new model of management with the need for participation from all the stakeholders.

Todi [85] focused on the Greek and European legislation about Geoparks and presented the role of the Vikos-Aoos UNESCO Global Geopark and its ecosystem services.

Kogiou [86] analysed the concepts of Geoparks, geotracks, geotopes, geological heritage, geoenvironment, geodiversity, and geoconservation in light of the need to preserve geological heritage. She also presented the region of the Tethys Geopark, which later became the Grevena-Kozani UNESCO Global Geopark, with its significant number of geotopes through eight georoutes.

Ververis [94] referred to the Petrified Forest of Lesvos Island, part of the Lesvos Island UNESCO Global Geopark, and the efforts made to protect it since the 1980s. This area includes impressive standing and laying fossilised trunks and root systems of fossilised

trees in total development. He highlighted the need for this area to act as a place of information and awareness on the phenomenon of climate change, the role of man in the intensity of the phenomenon, and its impact on the future.

Koupatsiaris [78], Nikitopoulos [90], Zoulinakis [96], and Plakenta [102] dealt with the pillar of education in the UNESCO Global Geoparks. Koupatsiaris [78] stated that the promotion, preservation, and passing on of ecumenical geocultural goods to humanity are a fundamental obligation of man towards history, the environment, and the global natural and cultural capital. He surveyed the views, attitudes, and perceptions of Sitia's province elementary school teachers concerning Environmental Education, its role in education, and the prospects of exploitation of the Sitia UNESCO Global Geopark as a geoeducation and implementation tool for Environmental Education programmes. He concluded that such surveys could provide a guideline for further development and effective planning for implementing Environmental Education programmes associated with multiple benefits for participating students in formal education. The critical element was that teachers were willing to implement Environmental Education programmes related to the Geopark with the appropriate guidance and provision of educational materials.

Nikitopoulos [90] examined the UNESCO Global Geoparks as an environmental and sustainability training body. In particular, he visited the Muskauer Faltenbogen/Łuk Mużakowa UNESCO Global Geopark, a cross-border Geopark between Germany and Poland. Through an interview with the head of educational programmes and in situ surveys, he examined the educational programmes of the Geopark. Regarding Greece, he presented the educational programmes of the Lesvos Island UNESCO Global Geopark and interviewed the head of the educational programmes. According to him, Geoparks can significantly contribute to Education for the Environment and Sustainability through formal and informal education, owning and distributing their accumulated scientific, historical, and cultural knowledge, as well as their skills and values.

Zoulinakis [96] theoretically investigated the connection between the Sitia UNESCO Global Geopark and Education for Sustainable Development. He presented the characteristics, goals, and principles of Education for Sustainable Development and gave a brief overview of the content of Geoparks. He highlighted the features of the Sitia UNESCO Global Geopark and emphasised the environmental education activities and good practices.

Plakenta [102] presented the relationship between non-formal education and visits to areas of technological science, especially of geological interest, through a literature review. She designed a student's visit to the "Memories of Gaia" exhibition, where UNESCO Global Geoparks from Greece and Cyprus and various rocks, minerals, and fossils were presented. She evaluated the visit through three in-service geologists and high school teachers. The conclusion was that in most of the exhibitions, the exhibits were placed from oldest to youngest by age and region of origin. When planning such a visit, the teachers do not carry out structured activities but only informed themselves about the field in advance and informed their students in consultation with the tour guides. During the visit, they watched for safety and behaviour issues. The visit results were positive since the visitors were impressed by the exhibits and the fields cultivated a positive attitude towards Geosciences, with expressed intentions to repeat such visits.

Tsermentselis [100] and Lampaki [101] used geoinformatics. Tsermentselis [100] developed a geographic database and web-based user interface for geological monuments using modern geoinformatics technologies. He took into account the three levels of hierarchical organisation of geological monuments. In particular, he used data concerning the European Geoparks, the geotopes of the Lesvos Petrified Forest Geopark, and the geological monuments sites of the Geopark. Gathering information on the geological monuments in a single database consisting of geographical data and displaying them in a web space allowed for their correct and more comprehensive management. It also contributed to sharing the information with the public.

Lampaki [101] designed a geographic database using GIS for the Lesvos Petrified Forest Geopark. She digitalised all the Geopark's data in a geographic database to create thematic maps to achieve the monument's promotion and better management.

Koumoutsou [91] examined the natural capital and ecosystem services in the Protected Area of the Chelmos-Vouraikos National Park and the UNESCO Global Geopark via a local-scale study of the ecosystem services. By using the guidelines of the European Union and following the European Biodiversity Strategy 2020, she identified and recorded the biophysical and geospatial characteristics of the park's area with particular emphasis on the relation of the floristic diversity to the park's geodiversity, the ecosystem conditions, and the relevant ecosystem services with the support of assessment indicators. The results have been used to reach scientifically sound conclusions and proposals, support local and national efforts to implement the National Biodiversity Strategy, and contribute to guiding land use management and spatial planning in the protected area.

Savvalas [99] pointed out the positive contribution of the utilisation of modern thematic cartography methodologies in the management of natural heritage. He created a map comparing two digital terrain models (one topographic and one using drone data) for the Nissiopi area. Additionally, he made a thematic map and a 3D model for the Bali Alonia area and the Nissiopi marine area in the Lesvos Island UNESCO Global Geopark.

Lipioti [93] created a narrative documentary for the history of the Petrified Forest in the Lesvos Island UNESCO Global Geopark titled "Petrified Nature". The documentary aimed to inform viewers of the environment, so they could understand the importance of our geological and cultural heritage.

Tzounidou [84] explored the physical and conceptual interface of the protected landscape and infrastructure. According to her, the landscape was recognised as an entity of cultural heritage and a field in which natural and human factors interact. It could be studied as a component of various dimensions. Infrastructure was interpreted as an anthropogenic materialised landscape, an integral part of cultural development, which can be a field for potential spatial actions that are vital for the management and the continuation of the protected landscape. She studied the Corinth Canal in Peloponnese and the new-built Kalloni-Sigri road on Lesvos Island that intersects the Petrified Forest of Lesvos; an infrastructure in a UNESCO Global Geopark.

Spyridaki [88] studied the role of the mountainous path of Ziros-Epano Zakros, part of the georoutes of the Sitia UNESCO Global Geopark, as a communication network and its importance to the cultural development of the semi-mountainous villages that joined together in the middle of the twentieth century. Such georoutes showed the interaction between humans and the environment based on sustainable management, adapted to the absence or presence of water.

4. Discussion

4.1. Summary of the Key Findings from the Review

The rapid urbanisation [2,3], the environmental challenges of our era [7–9], the increasingly intense alienation of humans from nature [103,104], and the globalised neoliberal economic (capitalistic) model [105,106] combined with the educational system's pursuit of an almost exclusive provision of high-level academic knowledge [107] are at the centre of the scientific and academic community, and society's debate on the need to redefine policies and practices at the global, national, and local levels regarding sustainability and resilience.

It is well documented in the scientific community that Greece, as a tectonically active place, constitutes a "natural geological laboratory and museum" [29,30,34,68]. This inherent geological richness is vividly exemplified by Greece's possession of eight (8) UNESCO Global Geoparks, each offering a distinct geological narrative and environmental significance. These Geoparks, situated across the country, present a unique opportunity for conservation, interpretation, education, and public awareness regarding Earth's dynamic processes and the interplay between geology and culture. Furthermore, it is important to emphasise that the field of activity of the UNESCO Global Geoparks is exceptionally multi-

faceted, encompassing natural resources, geological hazards, climate change, education, science, culture, gender equality and women empowerment, sustainable development, and the cultivation of local and indigenous knowledge and geoconservation [18,22].

The grey literature review played a vital role by shedding light onto a scientific area that is not obvious or presented in the international literature, and by providing a documented snapshot of the current state of research in a particular field. This review may serve as a valuable tool for identifying potential academic research gaps, comparing international practices with those at the domestic level, and ultimately, outlining a roadmap for future research directions in Greek universities.

It's worth noting that our focus was exclusively centered on the grey literature emanating from Greek universities. This choice was motivated by the belief that universities are the most representative sources of scientific interest and public awareness. However, we also acknowledged the significance of insights from experts in the field. Our approach involved a comparative analysis of our findings with international data and trends. This comparative assessment allowed us to gauge the extent to which Greece's research efforts, in the frames of the higher education, align with global trends, enabling us to pinpoint areas most conducive to future research endeavours.

Our review showed a long-term and intense academic interest in Greek Geoparks from different universities (refer to Figure 7) and various scientific disciplines. The university departments were mainly related to geology, biology, tourism, and culture (refer to Figure 8). After all, these are key pillars of the operation of the Geoparks since they refer to geological, biological, and cultural heritage and geotourism. This happens because the field of Geoparks itself is broad and covers many research aspects such as geology, culture, education, sustainability, and management.

The 28 university theses (graduate, master's, and PhD) (refer to Table 2) concerned all the Greek UNESCO Global Geoparks (refer to Figure 9). More specifically, most of them concerned the Lesvos Island UNESCO Global Geopark, probably because this was the first institutionalised Geopark in Greece. The Sitia UNESCO Global Geopark was also at the centre of interest, although it counted less than ten years of operation. The rest of the Greek UNESCO Global Geoparks also had a notable number of research theses. We have to point out that the Grevena-Kozani UNESCO Global Geopark, Kefalonia-Ithaca UNESCO Global Geopark, and Lavreotiki UNESCO Global Geopark are relatively new institutions, as they were established in 2021, 2022, and 2023, respectively, so it was obvious that they did not have many relevant works.

Regarding the contents of the theses ($n = 28$), the majority of them concerned a theoretical approach to the aspects of Geoparks, and few contained a research part. Four presented the possibilities and advantages of geotourism and sustainable development in a bibliographic manner [75,76,80,83], and research was conducted in three using questionnaires [79,82] and interviews [81]. Four theses were about the geology of Geoparks, the laboratory study of their geological or geomorphological features [89,92,95,97]. One was related to the geographical features [87], and one was about the development of the geotopes assessment methodology [98]. For the management of Geoparks, three theses were about their institutional framework and importance in geoconservation [85,86,94], and one, used interviews to study the value of stakeholder participation [77]. Concerning education in Geoparks, two examined the presentation of educational programmes and activities [90,96], one included research on teachers serving in the area of a Geopark [78], and one concerned the utilisation of geoexhibition for geoeducation [102]. Two theses concerned the use of geoinformatics to promote Geoparks [100,101]. One thesis was about the ecosystem services of a Geopark [91]. One dealt with digital cartography [99], another with the creation of a narrative documentary [93], another with the impact of infrastructure on the management and protection of Geoparks [84], and one on a georoute as a communication network [88].

4.2. Identification of Research Gaps and Limitations in the Grey Literature of Greek Universities

Martini [108], one of the pioneers of the idea of “Geoparks” [19], argued that in the 21st century, Geoparks must offer innovative experiences to the public. He suggested a reimagining of natural areas and the role of Global Geoparks, emphasising the holistic and symbolic significance of geoheritage and advocating for deeper connections with nature. Martini also underscored that Global Geoparks should evolve beyond being solely geology-focused and shift their central focus from the “geo” context to the broader “earth” concept [108] (p. 87). This viewpoint aligns with that of McKeever et al., who emphasised that “a Geopark can relate to not only geology but also archaeology, ecology, history, and culture” [109] (p. 14). Recently, Martini et al. [23] outlined a comprehensive roadmap for UNESCO Global Geoparks in the “World-after”, highlighting primary themes such as climate change, water resources, marine environments, sustainable tourism, sustainable development, visibility, and the involvement of indigenous populations to raise community awareness and encourage active engagement. Additionally, they stressed the urgent need for educational initiatives under a novel geoscientific approach.

However, within the context of the Greek UNESCO Global Geoparks, our review revealed a notable research gap. The grey literature predominantly focused on the “geo” aspect, with most research papers primarily rooted in natural sciences and management-related topics. Conversely, there was a relative scarcity of research in social sciences and humanities. Even within the domain of geotourism development, the theses predominantly centered on the geomorphological attributes of the Geoparks. This disparity underscores the need for a greater integration of social, economic, and cultural aspects within Geopark research. Local entrepreneurship should be more actively engaged to view UNESCO Global Geoparks as avenues for sustainable tourism development and value-added services.

Furthermore, one of the most pressing global challenges today is climate change, and international agreements are being made to mitigate its impact. However, our review suggests a gap in policies and education regarding climate change within the Greek UNESCO Global Geoparks. These Geoparks can serve as ideal laboratories for research and action to combat climate change and its consequences.

Finally, there was also a noticeable gap in community awareness, particularly among students, who represent the future generation. Their limited participation in educational programmes related to nearby Geoparks or geoeducational initiatives within schools should be addressed.

The identified research gaps within the Greek UNESCO Global Geoparks provide a roadmap for future academic research endeavours. Addressing these gaps is crucial for tackling future uncertainties and environmental challenges and harnessing the potential of UNESCO Global Geoparks to contribute significantly to environmental awareness, sustainable development, and education.

4.3. Insights from International Studies on UNESCO Global Geoparks

International research on UNESCO Global Geoparks, exemplified by Stoffelen [110] and Herrera-Franco et al. [111], provides valuable insights into this field. Stoffelen conducted a systematic bibliographic review focusing on the geomorphological aspects of Geoparks and emphasised the need for interdisciplinary studies to explore their social value [110]. Herrera-Franco et al.’s bibliometric analysis highlighted the dominance of geomorphology and the growing interest in Geoparks research, particularly from Asian and European countries [111]. Ferreira and Valdati [112] conducted a bibliometric analysis and content review regarding Geoparks and sustainable development from the Scopus database until 2021 and indicated that the inventory of geodiversity and the presentation of activities related to geoconservation and geotourism were the main topics addressed. They also noted that despite the intrinsic relationship between Geoparks and sustainable development, few works proposed in-depth discussions about this relationship and the substantial results about the benefits to local populations [112]. These studies underscored the

importance of broadening the research perspective to include social aspects and community engagement in the Greek UNESCO Global Geoparks.

Moreover, a 2019 self-evaluation of the International Geoscience and Geoparks Programme, in respect to its operational guidelines, assessed the general operation of the UNESCO Global Geoparks [113]. The evaluation found that Geoparks contribute significantly to the United Nation's Sustainable Development Goals (SDGs) [114], and part of the evaluation was "Quality Education" (SDG 4). This aligns with sub-target 4.7 of the SDGs, aiming to promote the sustainable development of education and global citizenship. Martínez-Martín et al. [51] conducted a bibliometric analysis from 2012 to 2022, indicating that educational topics remained underrepresented in Geoparks research. Catana and Brihla's study [115] emphasised the role of the UNESCO Global Geoparks for promoting geoeducational activities, revealing their focus on raising awareness about natural and cultural heritage and offering various educational activities.

In Spain, the Villuercas-Ibores-Jara UNESCO Global Geopark successfully developed educational programs for schools, employing a holistic, interactive approach [116]. Similarly, the Arouca Geopark in Portugal combined classroom and field activities to promote Education for Sustainable Development and earth sciences awareness [117]. Portugal's distinct approach to incorporating Geoparks in secondary education national examinations positively impacted their student's knowledge and interest in Geoparks [117]. Escorihuela's study [50] emphasised the importance of teaching environmental subjects and promoting a multidisciplinary approach.

Additionally, the UNESCO Global Geoparks can collaborate with universities, offering students valuable theoretical and practical learning experiences, showcased by the educational opportunities provided by the Fangshan UNESCO Global Geopark and the Lesvos Island UNESCO Global Geopark [48].

In comparison to the international research trends, Greek academic research on Geoparks in generally aligned. Still, there is a need for more research focusing on the social and humanitarian aspects of Geoparks. Most of the Greek theses concentrated on geotourism, geology, and management, with limited exploration into the stakeholder's views or education. International studies emphasised the crucial role of education within Geoparks, and Greek research should consider a broader social perspective and explore the social development potential of Geoparks.

4.4. Future Research Directions

Future research directions in the context of the UNESCO Global Geoparks, specifically within the realm of grey literature such as theses and PhD dissertations, can be delineated based on the systematic review of this academic resource. Firstly, there is a compelling need to delve into the socio-economic and cultural aspects of these Geoparks within the context of academic works. While their geological and ecological significance is well documented, more research should be directed towards understanding and promoting the socio-cultural elements within Geoparks. This entails a holistic approach that emphasises not just the geological history but also the historical and cultural narratives of the local communities as explored through these academic endeavours. By incorporating grey literature into this endeavour, Geoparks can evolve into not only geological attractions but also fundamental components of the local culture, identity, and economic advancement, thereby enhancing their academic significance within the community and drawing from the rich insights of the grey literature. This direction aligns with the operational guidelines of UNESCO and the recent trends in the UNESCO Global Geopark's emphasis on the multifaceted heritage within these territories, as investigated in the grey literature.

Collaborative management and governance is another critical research area within the domain of the grey literature. Effective Geopark management extends beyond geoscientists to involve all the stakeholders, from local communities to students, agencies, and special interest groups, as highlighted in theses and PhDs. Investigating the participation and involvement of these diverse stakeholders in Geopark management, as reflected in this

academic research, is crucial for creating innovative governance structures that can enhance the visibility and recognition of Geoparks. This research direction, based on the findings within the grey literature, supports the idea that Geoparks should be seen as integral parts of the local culture and identity, and their management should reflect this inclusiveness.

Additionally, climate change and environmental challenges constituted a pressing research area in the grey literature. Geoparks, as explored through academic works, can play a significant role in educating the general population about climate change and fostering resilience in the face of environmental challenges. They can serve as living laboratories for researching vulnerability and resilience to climate change and studying its impact on local ecosystems, all within the realm of these academic documents. Moreover, engaging the local community in climate action through community science initiatives, as discussed in the grey literature, can contribute to public health and well-being.

Finally, enhancing Geoenvironmental Education within the UNESCO Global Geoparks, as investigated in these theses and PhDs, should be a focal point for future research. While Geoparks have primarily focused on geology, their role as educational spaces for fostering a sense of place and geoeducation is vital, as underscored in the grey literature. Future research should aim to develop effective geoeeducational programmes, curricula, and methodologies, as explored within these academic works, assessing their impact on student learning outcomes and behaviours. This aligns with the global emphasis on Education for Sustainability and the cultivation of environmentally literate citizens who actively participate in a democratic society.

These research directions build upon the rich body of knowledge found in the grey literature, particularly within the realm of theses and PhDs, and can contribute significantly to the continued development and impact of the UNESCO Global Geoparks.

5. Conclusions

The review of the academic work from Greek universities strongly highlights the UNESCO Global Geoparks as a vibrant and diverse field of study. The UNESCO Global Geoparks cover a wide range of topics such as geology, climate change, tourism, sustainability, geodiversity, biodiversity, and education, making them significant in Greek academic circles.

In terms of research towards the UNESCO Global Geoparks, Greek universities have mostly focused on the geology, landscape features, tourist sites, and tourism. However, one notable gap is the lack of involvement of the local communities in these Geoparks, which is a valuable insight from the Greek academic perspective.

Future research at Greek universities should look at using the UNESCO Global Geoparks as effective platforms for teaching about the environment. By emphasising the participation of the communities, especially students, this research direction has the potential to reshape education in Greece. Additionally, by using the local environment as a tool for learning and promoting environmental literacy within the Greek education system, researchers can enhance the educational aspects of the UNESCO Global Geoparks, all while considering the unique Greek academic context. These efforts, informed by Greek universities, can contribute to the United Nation's Sustainable Development Goals and nurture a strong sense of belonging and responsibility among future generations in Greece and beyond.

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