



Geotourism management for sustainable development of tourism: A bibliometric analysis of the main research areas and domains of knowledge

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ABSTRACT

Geotourism has attracted an increasing academic interest in recent years due to the new demands of society for sustainable and alternative destinations and its their effective management is essential. This study conducts a comprehensive bibliometric analysis of geotourism management covering research published from 1991 to June 2023. The objective of this study is to perform a bibliometric analysis to demonstrate the current research and key findings on geotourism management. In addition, we identify the existing limitations in the current literature to show research trends and future directions. To achieve this objective, we analysed 813 publications with 10,937 cited references from Web of Science. Our analysis encompassed three key bibliometric techniques (co-authorship, co-citation and co-occurrence of keywords). The main results show the increasing popularity and investigations in geotourism and destination management. Using mapping techniques, our study shows the relevance of research in geoconservation, sustainable tourism and, to a lesser extent, in geological heritage. The findings contribute to a broad and diverse understanding of the management of geotourism, which can provide insights for DMOs and policymakers in establishing proper management in geotourism to ensure conservation in geodestinations.

KEYWORDS

Geotourism; Landscape; Sustainable Tourism; Bibliometric Analysis; VOSviewer; Web of Science

RESUMEN

El geoturismo ha despertado un creciente interés académico en los últimos años debido a las nuevas demandas de la sociedad de destinos sostenibles y alternativos y a que su gestión eficaz es esencial. Este estudio realiza un análisis bibliométrico exhaustivo de la gestión del geoturismo que abarca las investigaciones publicadas desde 1991 hasta junio de 2023. El objetivo de este estudio es realizar un análisis bibliométrico para demostrar la investigación actual y los hallazgos clave sobre la gestión del geoturismo. Además, identificamos las limitaciones existentes en la literatura actual para mostrar las tendencias de la investigación y las direcciones futuras. Para lograr este objetivo, analizamos 813 publicaciones con 10.937 referencias citadas de Web of Science. Nuestro análisis abarcó tres técnicas bibliométricas clave (coautoría, co-citación y co-ocurrencia de palabras clave). Los principales resultados muestran la creciente popularidad e investigaciones en geoturismo y gestión de destinos. Mediante técnicas cartográficas, nuestro estudio muestra la relevancia de la investigación en geoconservación, turismo sostenible y, en menor medida, en patrimonio geológico. Los resultados contribuyen a una comprensión amplia y diversa de la gestión del geoturismo, lo que puede aportar ideas a las OMD y a los responsables políticos para establecer una gestión adecuada en el geoturismo que garantice la conservación en los geodestinos.

PALABRAS CLAVE

Geoturismo; Paisaje; Turismo sostenible; Análisis bibliométrico; VOSviewer; Web of Science

1. INTRODUCTION

Nowadays, the tourism sector has grown exponentially. It has led to the appearance of a wide range of new tourism types, depending on the objective and the experience offered (Tiago et al., 2021). One of the most demanding tourism is sustainable tourism, which is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCDE 1987). This type of tourism has become a priority for companies due to the importance that its suitable management can have in their competitiveness (Hernández-Garrido et al., 2023).

Between the different sustainable tourism alternatives, a phenomenon called geographic tourism or geotourism has emerged, which is having a great scientific interest around the world (Reynard & Brilha, 2018). Although there is not a uniform definition of geotourism (Ólafsdóttir & Tverijonaite, 2018), it refers to a type of natural tourism that focuses mainly on the geosystem, taking advantage of the synergy of landscapes and geographical accidents, which provides social, economic and environmental benefits (Gray, 2011; Dowling, 2009). This tourism was also defined by Lopes et al. (2011) as a modality of tourism related with ecotourism that can be considered as crucial for the promotion of values and social benefits and sustainable development that is based on participation of local communities. Therefore, geotourism can be considered as a branch of sustainable tourism that seeks to preserve all natural and human attributes of a place, instead of focusing on minimizing impact on the ecological environment (Stokes et al. 2003).

People who engage in this type of alternative tourism are known as geotourists who visit natural areas or urban areas where there is geological attraction (Hose & Vasiljević, 2012). In the last years, the number of tourists has increased due to the search for nature, heritage or contact with local culture (Duarte et al., 2020). Therefore, it is necessary to protect this area from overtourism to enhance sustainability. For instance, Neches & Erdeli (2014) carried out a comparative analysis with the aim of showing the educational potential scope and the danger status of natural and cultural geoscapes. For this aim, they analysed two

geodestinations in Romania (the Bucegi plateau and Mt. Caraiman geolandscape). The results of the research mainly show that, although geoscapes are complex territorial units with natural characteristics, they have crucial cultural relevance. Pásková (2018) analysed the main aspects of the indigenous environmental knowledge in the southern part of the aspiring Rio Coco Geopark (Nicaragua) and its potential to enhance the sustainability management of geotourism and other geopark activities. The result of this study shows that the best-conserved indigenous environmental knowledge relates to the use of land, rocks, and plants. Altinay-Ozdemir & Topaloglu (2023) analysed the sustainability at Knidos, an archaeological site located on the southern coast of Mugla, Turkey. For this purpose, the authors examined the visitor's experience through the opinions of TripAdvisor. The results show that this site faces several sustainability challenges, particularly, transportation problems, lack of protection and conservation which negatively affect to the visitor satisfaction.

In addition, different authors consider that geotourism should be a distinctive for companies and professionals who manage the tourism industry, since it represents a challenge for the management of this sector (Newsome, 2010; Hull, 2010; Jennings, 2010). For example, Sen et al. (2023) have explored the potential which has the Tuwaiq Mountain (Saudi Arabia) to enhance the tourism in the area. The results show the concern which has the protection and the policy development for geotourism development. Merella et al. (2023) highlight the importance of the conservation of three quarries of Tuscany (La Serra, Arcille, and Certaldo) to enhance the tourism in the area. Besides, geotourism is also subject to planning that could lie behind in the context of tourism planning frameworks, community group initiatives, national park and protected area management plans and geopark management plans, local authority action plans (Newsome et al., 2012).

Bibliometric analysis is a quantitative analysis that allows the objective examination of research in each field through the use of statistical and mathematical tools (Pelit & Katircioglu, 2022). It plays a fundamental role in comprehensively examining the existing information as well as indicating future lines of research (Rousseau, 2012; Ertz & Leblanc-Proulx, 2019). Therefore, this analysis examines

the relationships between different research components (e.g., authors, countries, institutions, keywords) (Donthu et al., 2021). Bibliometric analysis is a specific type of analysis which has grown considerably in tourism in recent years (Pelit & Katircioglu, 2022), for example in slow tourism (Mavric et al. 2021); diaspora tourism (Ciki, 2023); coastal tourism (Pathmanandakumar et al., 2021); smart tourism (Johnson & Samakovlis, 2019); hospitality industry (Montero et al., 2023); cycling tourism (Ciascai et al., 2022) and other studies (Atsiz et al., 2022; Ciki et al., 2023; Koseoglu et al., 2016).

There are bibliometric studies directly or indirectly related to geotourism in the hospitality and tourism domain (Duarte et al., 2020; Herrera-Franco et al., 2020; Quesada-Valverde & Quesada-Román, 2023). However, this bibliometric analysis does not associate geotourism to destination management. Moreover, these studies do not provide a general overview of this field because it does not identify the current lines and future research opportunities in the management of geotourism. To bridge the gap between geotourism and management (Jennings, 2010), the current study aims to present an integrated review of articles on this specific field. The practical contributions of this article can provide ideas for tourism management organizations and policy makers to establish appropriate geotourism management to ensure conservation in geodestinations. In consequence, the future research agenda should be directed to analyze the sustainability in geodestination from a global perspective. For this reason, it is considered that it could be crucial to carry out a bibliometric study that shows the intellectual structure in this scientific field, with the aim of collecting the most important studies of this topic.

Therefore, the objective of this research is to fill the bibliometric gap in research on geological tourism and destination management. To face this aim, the following specific research objectives are proposed(O):

O1. Examine the essential papers, nations, institutions, and authors involved in managing geotourism.

O2. Investigate the cooperative connections among these authors by examining co-authorship within geotourism management.

O3. Ascertain the primary documents that have influenced the intellectual framework of geotourism management over time by conducting co-citation analysis.

O4. Assess the thematic clusters and emerging patterns for future research in geotourism management by scrutinizing the co-occurrence of keywords.

2. MATERIALS AND METHODS

2.1) ANALYSIS BIBLIOMETRIC

With the aim of showing the current research, the key findings and research trends in a specific scientific field, researchers use different techniques to synthesize the findings of previous research (Zupic & Carter, 2015). For this purpose, it can be found three methods: firstly, the structured review of the literature, through a qualitative approach; secondly, the quantitative approach through meta-analysis; and finally, the quantitative approach through bibliometrics (Schmidt, 2008). Bibliometrics is increasingly used with the aim of mapping the scientific structure and development of a scientific discipline (Zupic & Carter, 2015). Pritchard (1969) defined the term bibliometrics as “the application of mathematics and statistical methods to books and other media of communication”. In recent years, their popularity has gained attention due to the expansion of easily accessible online databases that provide authorship, citation, or scientific category data (e.g., Web of Science, Scopus, or Google Scholar) and the development of software that allows bibliometric analysis (e.g., BibExcel, VOSViewer or SciMAT) (Donthu et al., 2021).

Regarding to the bibliometric analysis investigations in the tourism field, there are many investigations related to geotourism (Duarte et al., 2020; Quesada-Valverde et al. 2023). However, there are no studies that analyze the management of geotourism with the aim of conserving the geological resources correctly and natural landscapes of the geotourism destination (Gordon et al., 2018). Therefore, it is necessary to map the intellectual structure and predict a source for future research from the studies indexed in the Web of Science database on this topic. The exclusive use of WoS has been since this database contains a greater number of articles and most of them are

present in Scopus (Zhu & Liu, 2020). In addition, the selection of more than one database makes the integration of information more complex by presenting different structures, to which must be added the limitations presented by the current tools available to integrate the information (De Oliveira et al., 2019).

The objective of the study is to perform a bibliometric analysis with the aim of demonstrating the current research and key findings on geotourism management. In addition, we identify the existing limitations in the current literature to show research trends and future directions. The contribution of this bibliometric study will make easier for researchers to identify those authors who have collaborated jointly (co-authorship), to know the scientific intellectual structure of this scientific field (co-citation) and the most outstanding content and influential themes (co-occurrence of keywords analysis). Firstly, the co-authorship analysis shows the relationships between the authors who collaborate jointly in the production of scientific articles (Peters & van Raan, 1991; Acedo et al., 2006). In addition, it allows to observe the information on institutional affiliations and the geographical location of the authors with the aim of examining those institutions and countries that are most and least productive in each scientific field (Zupic & Cater, 2015) Secondly, the co-citation analysis allows us to observe the relationship between two articles that have been cited together and, therefore, are thematically similar (Small, 1973; Hjørland, 2013). This analysis allows to reveal the underlying themes (Liu et al., 2015) and the intellectual structure of a given scientific field (Rossetto et al., 2018). However, this analysis must be complemented with the keyword co-occurrence analysis, since it does not show the most recent publications and, consequently, is not optimal for observing future research trends investigation (Zupic & Cater, 2015; Donthu et al., 2021). Finally, the analysis of co-occurrence of keywords allows to content analysis of the documents with the objective of establishing relationships between the conceptual structure of the scientific field and the current content of the publications (Callon et al., 1983; de la Hoz-Correa et al., 2018). The keyword co-occurrence analysis complements the co-citation analysis, since it allows to analyze the current content of the analysed documents and forecasting future research in the scientific field (Chang et al., 2015).

2.2) DATA COLLECTION

To identify the search in the Web of Science database, we used sample articles using the following procedure, based on the recommendations of Liu et al. (2022). Firstly, we identified the ten articles with the most citations in relation to geotourism management to identify the most frequent keywords (Hose et al., 2012; Lane & Kastenholz, 2015; Raun et al., 2016; Vujicic et al., 2011; Fassoulas et al., 2012; Newsome et al., 2012; Kent et al., 2002; Ashourian et al., 2013; Alexandrakis et al., 2015; Hose & Vasiljević, 2012). Since the objective of this study is to analyze geotourism management, the search keywords were (geotouris* OR geographical touris*) AND (management OR destination management OR tourism management) (Illustration 1). These keywords had to appear in the topic, that is, in the article title, abstract or keywords of the search query. Based on these keywords, we identified 1,098 documents as of June 15, 2023. After that, we filtered these documents based on the following rules to ensure that all sample articles were consistent with the research objectives of our study, following the recommendations of Vatankhah et al. (2023). Initially, only articles and early access articles in English were included (that is, book reviews, editorial materials, proceeding papers, review articles, etc. were excluded). After that, we checked carefully all the articles and eliminated those that were not relevant to our study. Finally, Excel software was used to eliminate duplicate records.

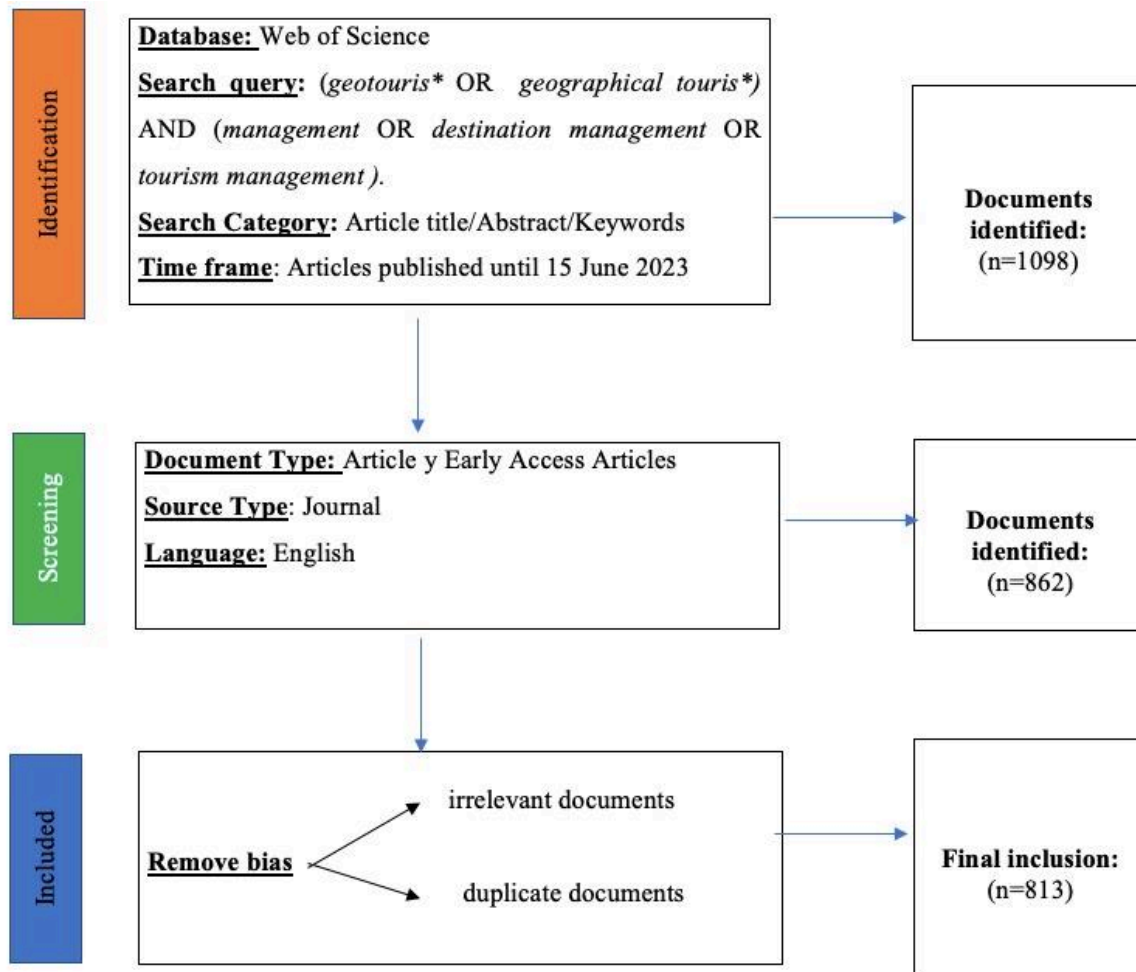


Illustration 1. Data inclusion criteria.

2.3) DATA ANALYSIS

To carry out this analysis, we used the bibliometric program VOSViewer (version 1.6.18) (Van Eck & Waltman, 2022), following the recommendations of Donthu et al. (2021) and Pelit & Katircioglu (2022), because it allows data analysis in a very pragmatic way and includes a robust graphical interface that allows creating maps that represent the connections of each unit of analysis (Feng et al., 2017). We use the Thesaurus File tool, which is integrated into VOSViewer, with the aim of eliminating duplicate and similar elements in the database, following the recommendations of Van Eck and Waltman (2022). The database used to carry out the analysis was Web of Science (WOS), since it includes studies published in the most prestigious scientific journals (Donthu et al., 2021) from the main publishers such as Elsevier,

Emerald, Springer, Wiley and Taylor and Francis, among others (Oliveira et al., 2019). In addition, it contains enough information to carry out a bibliometric analysis (Merigo et al., 2015), with approximately 15,000 journals and 80,000,000 articles.

3. RESULTS AND DISCUSSION

3.1. DESCRIPTIVE ANALYSIS

3.1.1) GENERAL OVERVIEW OF THE MANAGEMENT IN GEOTOURISM

In this section, it was carried out a descriptive analysis with the aim of giving an overview of the topic analysed following the recommendations of Ciki (2023), Liu et al. (2022), Mishra et al. (2022) and Vatankah et al. (2022). To face it, it has been analysed the summary of data, the number of publications and citations, and the most productive journals, authors, and institutions.

Table 1 shows the summary of the analysed database. The first article that analysed the management of geotourism is published by Eid and Fawzi (1991), who analysed environmental management and the appropriate use of coastal zones in Egypt.

Web of Science	Record Count
Articles	813
Citations (WOS)	10937
Journals	339
Authors	2561
Institutions	1161
Countries	107
Study time	1991-2023

Source: own elaboration.
Table 1: Summary of data.

Illustration 2 shows the evolution over time of the number of papers and citations by year for the subject area of this study. As it can be seen, the number of publications has increased considerably since 2013, with the maximum production peak in 2022. This indicates that research on geotourism management has considerably increased its importance in recent years and the forecast indicates that will increase in the future. This is due to the geotourism is a new type of tourism with

great projection, because the fact that the recent and growing popularity of sustainable tourism (Suzuki & Takagi, 2018; Resmi, 2023).

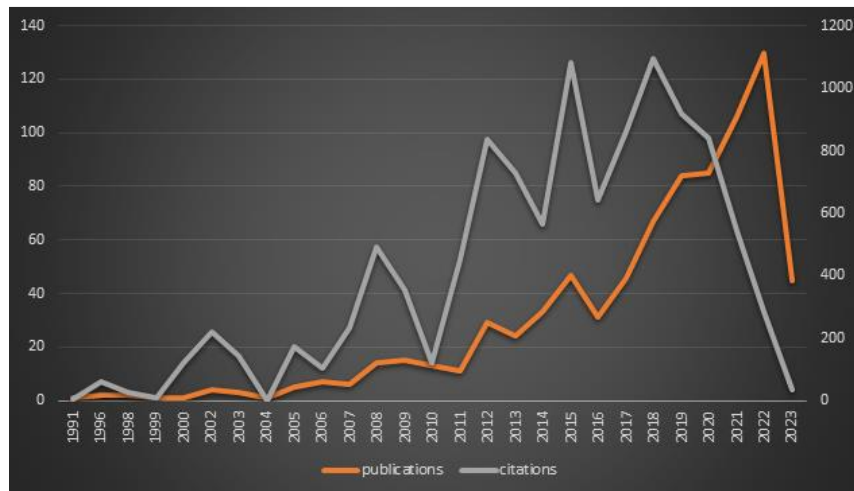


Illustration 2: Number of publications and citations from 1991 to 2023.

Table 2 presents the top 10 journal for geotourism management, which occupy 270 articles (33.21% of the total sample). As it can be seen, the journals are generally focused on geosciences, environmental sciences, tourism and management, which indicates the multidisciplinary of the subject analysed. All journals have a high Journal Citation Report (JCR) and Scimago Journal Rank (SJR), indicating the impact of geotourism management in academia. *Geoheritage* journal is the dominant one with 114 articles published (14.03% of the sample), followed by *Sustainability* with 44 articles (5.04% of the sample).

Journals	Papers	Cites	C/P	First Paper	Last Paper	JCR (2021)	SJR (2022)
Geoheritage	114	1641	14,39	2011	2023	2,786	0,76
Sustainability	44	364	8,27	2015	2023	3,889	0,66
Geosciences	33	376	11,39	2018	2023	-	0,66
Resources-Basel	15	144	9,6	2018	2023	-	0,7
Land	13	66	5,08	2020	2023	3,905	0,65
Tourism Geographies	12	343	28,58	2008	2023	11,355	2,6
Tourism Management	11	727	66,09	2000	2020	12,879	3,56

Ocean and Coastal Management International Journal of Contemporary Hospitality Management	11	306	27,81	1996	2023	4,295	1,13
Journal of Mountain Science	9	92	10,22	2014	2023	9,321	2,5
Journal of Mountain Science	8	85	10,63	2013	2022	2,371	0,58
Total	270						

Note: C/P (average citation per paper); First Paper (year first published); Last Paper (year last published).

Table 2: Most productive journals by number of papers based in the WOS data.

Table 3 presents the ten most productive authors in this analysed field, based on the number of articles, citations and the h-index score. The h-index is a complementary indicator that complements the number of articles and citations to assess the solidity, originality, or scientific value of documents and to measure the success in the professional career of authors (Aksnes et al., 2019). On an institutional level, it is observed that geotourism management is a field of study with international relevance, with European universities standing out. It is noteworthy that all the authors have published in the last two years, which indicates the increasing of popularity in this topic.

Author/s	Papers	Cites	C/P	First Paper	Last Paper	University	h index (WoS)
Ruban, Dmitry A.	23	273	11,87	2015	2023	Southern Federal University (Russia)	22
Carrion-Mero, Paul	11	188	17,09	2018	2023	ESPOL Polytechnic University (Ecuador)	15
Herrera-Franco, Gricelda	9	141	15,67	2017	2023	Pontificia Universidade Catolica do Parana (Brasil)	11
Kubalikova, Lucie	8	139	17,38	2019	2023	Institute of Geonics, Academy of Sciences of the Czech Republic (Czech Republic)	10
Berrezueta, Edgar	8	118	14,75	2018	2022	Instituto Geologico y Minero de España (España)	12
Yashalova, Natalia N.	8	116	14,50	2018	2023	Cherepovets State University (Russia)	10

Morante-Carballo, Fernando	7	53	7,57	2020	2023	ESPOL Polytechnic University (Ecuador)	12
Markovic, Slobodan B.	6	158	26,33	2011	2023	University of Novi Sad (Serbia)	15
Ermolaev, Vladimir	6	50	8,33	2020	2023	Plekhanov Russian University of Economics (Russia)	9
Zglobicki, Wojciech	5	97	19,40	2014	2021	Maria Curie-Sklodowska University (Poland)	13

Note: C/P (average citation per paper); First Paper (year first published); Last Paper (year last published).

Table 3: Most productive authors by number of papers based in the WOS data.

Table 4 presents the ten most productive institutions in the field of geotourism management. In terms of productivity, the Southern Federal University (Russia) stands out with 20 published articles, followed by the Chinese Academy of Sciences (China) and the University of Extremadura (Spain), with 16 and 14 published articles respectively. First, the Southern Federal University started its production in 2015 and has been producing until now. The most productive author of this university (Ruban, Dmitry A.) coincides with the most productive author in the analysed field. The publications are focused on geological heritage, geoparks and geoheritage. In the second place, the Chinese Academy of Sciences has started its production in 2011 and has been producing up to the present time. The publications are focused on sustainability, geoconservation and tourist satisfaction. In the third place, the production of the University of Extremadura, starting in 2018 to the present day. The publications are focused in geoheritage, geoparks and rural accommodation.

University	Country	Papers	Cites	C/P	First Paper	Last Paper	SIR (2023)
Southern Federal University	Russia	20	232	11,60	2015	2023	1669
Chinese Academy of Sciences	China	16	222	13,88	2011	2023	44
University of Extremadura	Spain	14	256	18,29	2013	2023	651

ESPOL Polytechnic University	Ecuador	12	192	16,00	2018	2023	1782
University of Novi Sad	Serbia	11	357	32,45	2011	2022	511
Peninsula State University of Santa Elena	Ecuador	10	187	18,70	2015	2023	-
Cherepovets State University	Russia	10	144	14,40	2018	2023	273
Maria Curie-Sklodowska University	Poland	9	119	13,22	2014	2021	1763
University of Wroclaw	Poland	9	147	16,33	2016	2022	1888
Instituto Geologico y Minero de España	Spain	8	120	15,00	2019	2023	-

Note: C/P (average citation per paper); First Paper (year first published); Last Paper (year last published).

Table 4: Most productive institutions by numbers of papers based in the WOS data

Table 5 presents the five documents with the highest number of citations in the field of study analysed. The documents have a large number of citations, which indicates the relevance of the thematic field. The most cited article is published by Li et al. (2008) which analysed the geographic characteristics of World Heritage Sites in China. The results showed the importance of managing geological tourism of the World Heritage Sites in China (for example, Mt. Huangshan or the Mogao Cave) with the aim of achieving sustainability in the area and avoiding negative externalities such as over tourism or the lack of public funding. The second most cited article is published by García-Nieto et al. (2013), which analysed the impact of new environmental policies in Sierra Nevada (Spain), through reforestation, erosion control and controlled hunting. This area is characterized by winter tourism, being declared a National Park in 1999. The results showed the importance given by the residents to the new management of sustainable tourism in the area with the aim of preserving the social conditions -cultural, economic and environmental. The third most cited article is published by Hose et al. (2012) which analysed three main issues of proper sustainable management of geotourism destinations in geoparks in UK: geoconservation, geohistory and geointerpretation. The first is related to the

cultural and environmental preservation of the area, the second refers to the study of events, characters and institutions in geological zones, and the third is related to the science of communicating and interpreting a geomorphological phenomenon or event. The results indicate that there is an increasing of tourists in these geosites and it is necessary to preserve the sustainability through a correct management.

Title	Author/s	Cites	C/Y	Type of study
Tourism development of World Heritage Sites in China: A geographic perspective	Li et al. (2008)	213	14,2	Quantitative
Mapping forest ecosystem services: From providing units to beneficiaries	García Nieto et al. (2013)	198	19,8	Quantitative
3G's for Modern Geotourism	Hose (2012)	2012	182,9	Qualitative
Rural tourism: the evolution of practice and research approaches-towards a new generation concept?	Lane and Kastenholz (2015)	171	21,38	Quantitative
Measuring tourism destinations using mobile tracking data	Raun et al. (2016)	139	19,86	Quantitative

Note: C/Y (average citation per year).

Table 5: Most productive papers by numbers of cites based in the WOS data.

3.1.2) CO- AUTHORSHIP ANALYSIS

In this section, it has been examined co-authorship to identify collaboration and relationships between authors (Illustration 3). In addition, we carry out the evolution and changes of collaboration over time (Illustration 4). In our analysis, we use the co-authorship of authors because they remain stable over time, while affiliations or countries are not stable over time because they change over time Koseoglu et al., 2016).

To establish the most appropriate level to determine the most relevant clusters, we established a minimum level of 2 documents per author. As appeared in the Illustration 3, there are four clusters of co-authorship. The red network is made up of

Morante-Carballo, Fernando; Aguilar-Aguilar, Maribel; Apolo-Masache, Boris; Merchan-Sanmartin, Bethy; Carrion-Mero, Paul (ESPOL Polytechnic University, Ecuador), Herrera-Franco, Gricelda; Jaya-Montalvo, Maria (Peninsula State University of Santa Elena, Ecuador); Berrezueta, Edgar (Geological and Mining Institute of Spain, Spain) and Mata-Perello, Josep (Polytechnic University of Catalonia, Spain). This network is the most productive, it is international and inter-institutional in nature and began in 2017 and ended in 2023 (Illustration 4). The yellow network is made up only of Mora-Frank, Carlos (Peninsula State University of Santa Elena, Ecuador), without belonging to no network with more authors due to lack of collaboration with other authors. The blue network is made up of Briones-Bitar, Josue (ESPOL Polytechnic University, Ecuador), Jose Dominguez-Cuesta, Maria and Jimenez-Sanchez, Montserrat (University of Oviedo, Spain). This network is international and inter-institutional in nature and began in 2018 and ended in 2020 (Illustration 5). Finally, the green network is made up of Caldevilla, Pablo (Universidad de Leon, Spain); Ballesteros, Daniel (University of Granada, Spain); García-Avila, Manuel (University of Vigo, Spain); Vila, Ramon (Montañas do Courel UNESCO Global Geopark, Spain); Carlos-Barros, Xose and Alemparte, Martín (Ribeira Sacra Courel Rural Development Group, Spain). This network is inter-institutional in nature and began in 2018 and ended in 2020 (Illustration 4). As we have seen, the networks are inter-institutional and international in nature, which implies the global relevance of the field analysed.

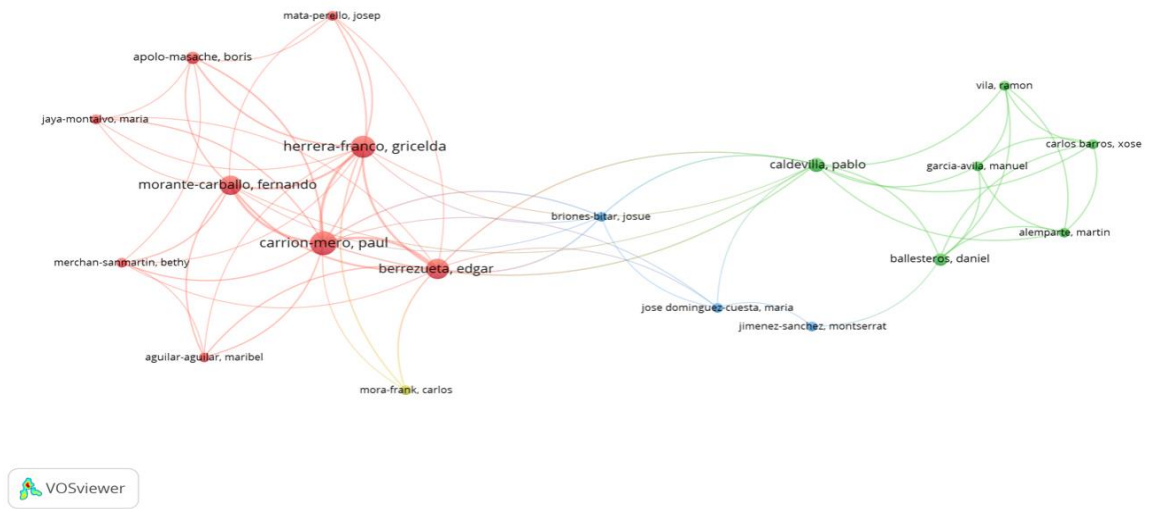


Illustration 3: Co-authorship (authors) clusters based in the WOS data. Source: Own elaboration

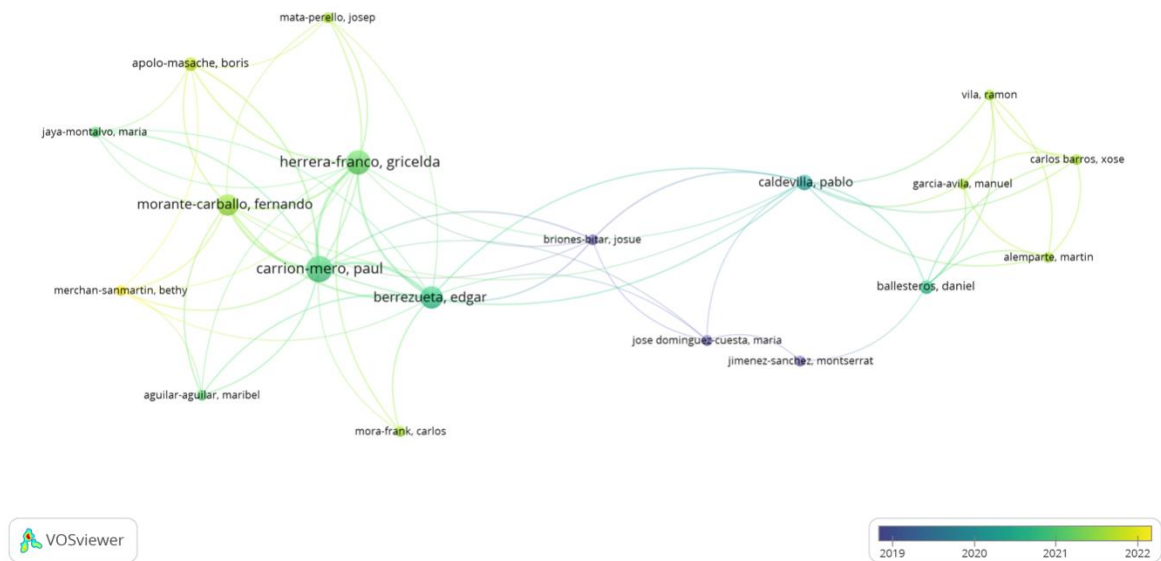


Illustration 4: Co-authorship trends (authors) clusters based in the WOS data.

3.1.3) CO-CITATION ANALYSIS

In this section, it has been carried out the co-citation analysis with the aim of observing the intellectual structure of the field analysed from the publications co-cited by the documents in the sample (Illustration 5). In our analysis we used the co-

citation of the references, since the co-citation of authors can misinterpret the result because the authors usually contribute to more than one research area (Hota et al, 2020). To demonstrate the most appropriate level to determine the most relevant clusters, we established a minimum level of 20 citations per reference. As it can be observed in the Illustration 5, three types of clusters that have been analysed from the inductive and qualitative interpretation of the authors can be found.

- Cluster 1 (red colour): Cluster 1 is labeled as "the importance of geoconservation for the sustainable management of destinations". Geotourism involves the conservation of natural heritage through adequate sustainability measures with the aim of minimizing the adverse effects of tourism in the tourist area (Dowling & Newsome, 2010). Therefore, these investigations are related to the management of geoconservation in geodestinations. For example, Brilha et al. (2018) conducted a systematic review of the literature about geodiversity. The results indicate the importance of public and legal management with the objective of preserving the geodiversity of the tourist areas involved with geotourism.

- Cluster 2 (green colour): Cluster 2 is labeled as "quantitative measurement of geosites for geoconservation". With the objective of protecting geotourism destinations, an exhaustive evaluation must be carried out to determine the condition of the geosites of a destination. Therefore, the articles in this cluster are focused on the evaluation of geosites for their protection, promotion and monitoring (Pereira et al., 2007). For instance, Reinard et al. (2016) presented a methodology for the selection of geosites and their management and subsequent use. To carried out the model, the glaciers of Chablais (France), the natural park in the valleys of Hérens and Réchy (Switzerland) and Gruyère Pays-d'Enhaut Regional Nature Park (Switzerland) were chosen. The results showed the existing difficulty to monitor the potential of the geosites before their selection as a tourist destination.

- Cluster 3 (blue colour): Cluster 3 is labeled as "Role of tourists in visiting geodestinations". In recent years, tourism has changed its perspective in which tourists place give a greater value on the sustainable use of resources that combines aesthetic and scientific points of view (Gordon et al., 2018). Geotourism is a type of tourism that has a larger number of tourists due to the economic, cultural and social

benefits it provides for both visitors and residents. The articles in this cluster are focused on analyzing the perceptions of tourists who visit geotourism destinations. Gordon (2018) analysed the role of managing policies in geotourism destinations to incentivize the sustainable protection of a tourist area. For this purpose the authors analysed the public policies in five areas in Iceland, Australia, Scotland and China. The results indicate that geotourism must promote the geoconservation and, in consequence, this type of tourism must work for both people and the land in a harmonious relationship. Therefore, there must be a balance between tourism and the protection of the resources.

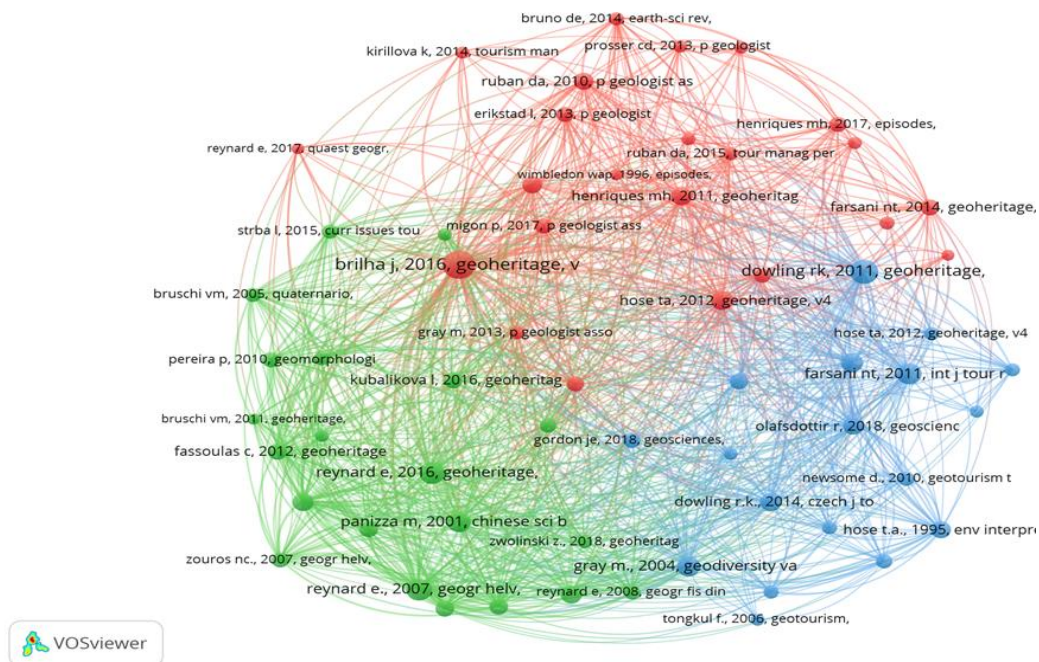


Illustration 6: Co-citation (references) clusters based in the WOS data.

3.2) CONTENT ANALYSIS

In this section, the content analysis has been carried out using the co-occurrence analysis of keywords that will help us to establish relationships and build a conceptual structure of the field of geotourism management. We use author's keywords as standard practice in bibliometric analysis literature (Zupic & Carter, 2015; Donthu et al., 2021; Pelit & Katircioglu, 2022; Bacic, et al., 2022). Consequently, we do not

make use of the "Keywords Plus" that are automatically provided by Web of Science, because they are less representative from the content of the article (Hernández-Garrido et al., 2023). From a total of 2,718 keywords, we selected 39 keywords, since they were the ones that appeared at least 7 times (minimum number of occurrences of 7).

Table 6 presents the 20 keywords with the highest number of occurrences and the associated total link strength. The total link strength is calculated by adding the number of times that two specific keywords appear together in the documents of the analysed sample (Van Eck & Waltman, 2022). We highlight the most representative keywords based in the average year, the number of citations, the number of articles and the average of citations per article. In this sense, it must be highlighted that "geomorphosites" appears as a fashionable topic and together with other words, as in the case of "geoheritage," "geoparks," "geodiversity" and "geosite," they display evidence of the current trend for research in this field. Finally, it must be highlighted that "sustainable tourism" appears as a relevant topic and together with other words, as in the case of "conservation," "geoconservation," "climate change" and "geological heritage," they display evidence of the most relevant topics in this field.

Rank	Keywords	Nº Articles	Total link strength	Nº Citations	Average Year	C/P
1	geotourism	182	792	2951	2018,64	16,21
2	management	146	77	2031	2016,71	13,91
3	geoheritage	118	474	1423	2019,55	12,06
4	conservation	95	79	1729	2018,19	18,20
5	geoparks	86	275	1285	2019,08	14,94
6	geosites	82	333	1053	2019,6	12,84
7	geoconservation	65	309	1143	2018,78	17,58
8	geographic information system (gis)	53	124	630	2016,17	11,89

9	geodiversity	44	198	582	2019,52	13,23
10	sustainability	40	136	432	2017,35	10,80
11	geomorphosites	32	131	330	2019,75	10,31
12	sustainable development	28	121	245	2019	8,75
13	sustainable tourism	24	112	653	2016,63	27,21
14	assessment	56	71	1042	2018,18	18,61
15	ecotourism	17	67	341	2016,12	20,06
16	protected areas	17	63	172	2016	10,12
17	cultural heritage	17	66	245	2018,77	14,41
18	climate change	14	61	265	2015,71	18,93
19	geological heritage	14	60	310	2016,21	22,14
20	tourism development	14	55	233	2017,5	16,64

Note: C/P (average citation per paper)

Table 6: Top 20 keywords based in the WOS data

Illustration 7 presents the map of the keyword co-occurrence analysis network and Illustration 8 shows its temporal evolution. Based on our interpretation, we analyze the content of the 4 clusters with their corresponding label:

-Cluster 1 (red colour): This cluster has twenty-two items. The most representative keywords are “sustainability”, “sustainable tourism”, “climate change”, “environmental management” or “ecotourism”. Based on these keywords, this cluster is labeled as “sustainability in geotourism”. Geotourism promotes a double objective: the conservation of the geological heritage of the area and the sustainable tourism development of the area (Newsome et al., 2010). In this way, it seeks to reduce the environmental, economic and social impacts of tourism, while improving the well-being of the local population (UNESCO, 2021). Perez-Calderon et al. (2022) analysed the perception of residents about the sustainability of Spanish Geoparks. The results showed that residents valued the economic boost that geotourism promoted in the tourist area more highly than environmental preservation and cultural development.

- Cluster 2 (Green colour): This cluster has eight items. The most representative keywords are “geoheritage”, “geoconservation”, “geodiversity”, “geosites”, “geomorphosites”. Based on these keywords, this cluster is labeled “geoheritage in geotourism”. Geotourism and geoheritage are closely linked, since geoheritage is

composed of the geological and geomorphological elements of a given area, such as minerals, rocks, fossils and landforms (Coratza et al., 2018). While geotourism is based on visiting these places with the aim of learning about geology and geomorphology (Hose, 1995). As it can be seen in Illustration 8, in recent years more research has been given to the protection of geodestinations due, on the one hand, to a greater demand from tourists in search of sustainability and, on the other hand, to mitigate the negative effects of climate change (Hernández-Garrido et al., 2023). Hueso-Kortekaas & Iranzo-García (2022) analysed the effect that tourism has had on four geological zones (Añana in Spain, Guérande in France, Læsø in Denmark, and Sečovlje in Slovenia). The results showed the importance of the management and legal regulations of geotourism to preserve these areas, in addition to the contribution for the tourism development of the area.

- Cluster 3 (blue colour): This cluster has five items. The most representative keywords are “geoparks”, “sustainable development”, “geological heritage”. Based on these keywords, this cluster is labeled as “the role of geoparks in geotourism”. Geoparks are geographical areas that stand out for their exceptional geological heritage. Its main objective is to preserve and conserve this geological heritage, while implementing strategies to promote the scientific, cultural and educational development of the region (Eder, 2008). In addition, they allow the socio-economic development of the region through the multiplication and diversification of the tourist offer (Elkaichi et al., 2022). The articles in this cluster are focused on analyzing the role of geoparks in geotourism. For example, Pinheiro et al. (2023) concluded the requisite to establish specific legislation to promote the sustainable protection of geoparks in Brazil, since the lack of public management was producing environmental degradation in the area.

- Cluster 4 (yellow colour): Cluster 4 has four items. The most representative keywords are “cultural heritage”, “natural heritage” and “regional development”. Based on these keywords, this cluster is labeled as “cultural heritage in the geodestinations”. In recent years there has been an exponential growth in visits to sites registered as World Heritage Sites (Del Barrio et al., 2012). This fact stems from the fact that, while initially the material heritage was restricted to monuments, historic

buildings, archaeological sites or a part of the natural heritage (UNESCO, 1972), the possibility opened up towards other cultural resources such as gardens, stages, spaces rural (UNESCO, 1983). Therefore, geotourism may involve visiting geodestinations recognized as World Heritage Sites due to the natural and cultural heritage of the area (Sánchez-Martín et al., 2020). For instance, Fernández-Álvarez et al. (2020) analysed the role of public management in the Villuercas-Ibores-Jara Global Geopark (Spain), recognized as a UNESCO World Geopark in 2015, through the introduction of educational projects. The results showed a substantial increase in students visiting the area due to a growing interest in geology and contact with the local population.

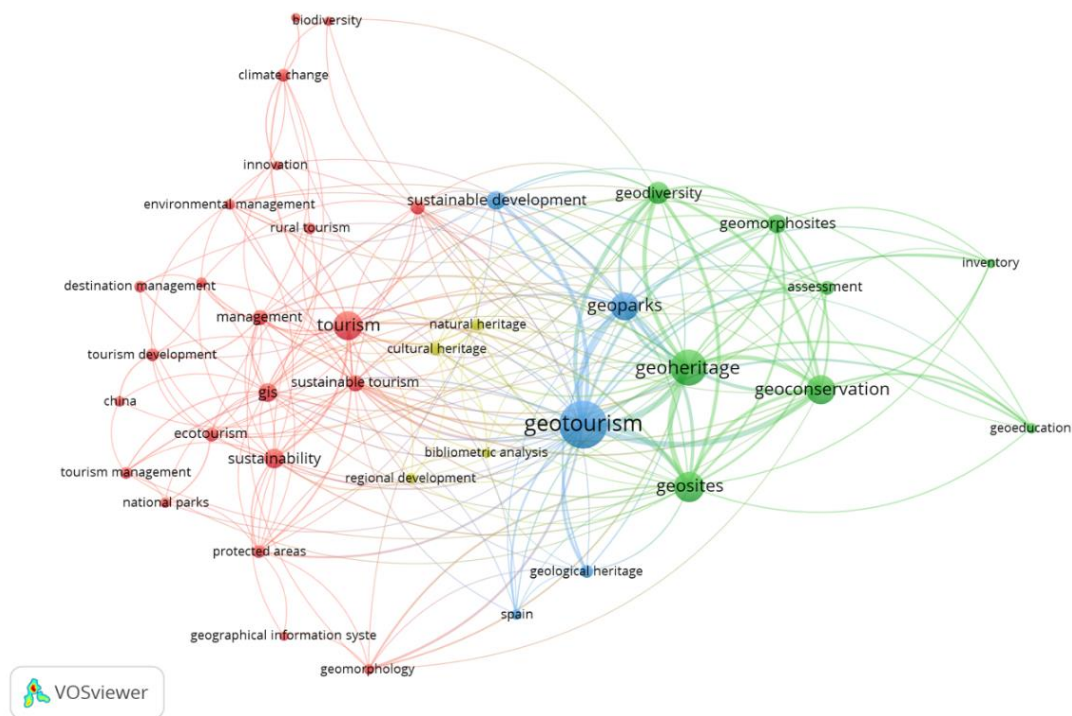


Illustration 7: Co-occurrence analysis of keywords (author's keyword) clusters based in the WOS data.

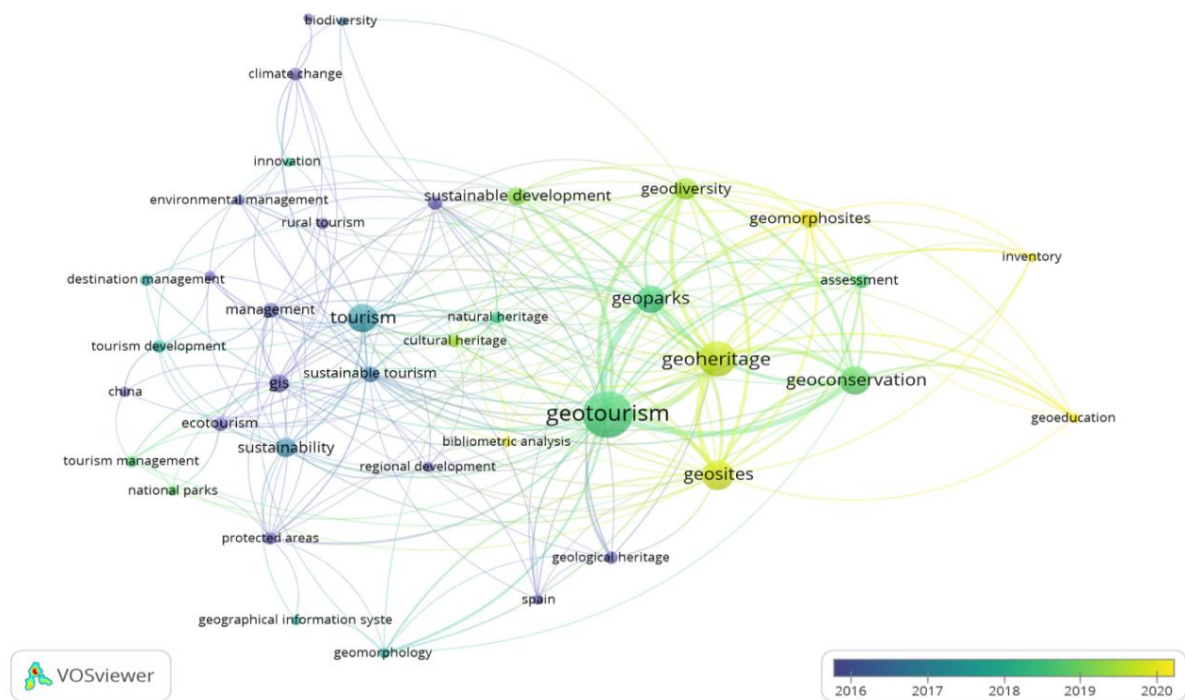


Illustration 8: Co-occurrence analysis of keywords trends (author's keyword) clusters based in the WOS data.

3. DISCUSSION

In this section, we provide a general framework of the results obtained from the content analysis to understand the key findings in the field of geotourism management. Moreover, we highlight the gaps in this field of study to recommend future research directions. Table 9 summarizes the key findings and limitations of the previously studied literature.

4.1) *SUSTAINABILITY IN GEOTOURISM*

Through a systematic review of the literature, the bibliometric analysis carried out shows that effective management in geotourism could promote the sustainability of geodestinations and enable long-term development. Many scientific articles examine that local authorities and tourism management organizations manage different geodestinations, such as Marjanovic et al. (2022) in Knjaževac (Serbia), Antic et al.

(2022) in Mount Kalafat (Serbia), or Quinta-Nova y Ferreira (2022) in Beira Baixa region (Portugal).

However, it has been found several limitations that need to be addressed in future research. Firstly, there is a lack in the literature of sustainability in geodestinations from a global perspective because this research is mainly focused on the local level. Secondly, while it is emphasized that the local population plays a fundamental role in the sustainability of geodestinations, there are few studies that analyze the geosite population's perception of this type of tourism. Finally, more research is needed to analyze the long-term effects of geotourism on destinations, as tourist development can sometimes have negative consequences for the area's sustainability.

4.2) GEOHERITAGE IN GEOTOURISM

Geotourism is conceptualized as places that hold special geological significance due to their natural resources, such as mountains, cliffs, caves, fossils, rocks, minerals, landforms, and other geological features. Not only are these places significant from a scientific and educational standpoint but also have historical and cultural value, often linked to human history, folklore, and traditions (Ruban et al., 2021; Santagelo & Valente, 2020). These scientific articles analysed the common characteristics that these tourist destinations should have to be considered natural heritage and, consequently, protected by local administrations (Spezes et al., 2017; Ruban et al., 2021).

However, several limitations were identified that need to be addressed in future studies. Firstly, there is a need for more research analyzing tourists' perspectives on the proper conservation of these areas and the reasons why they are attracted to them. Secondly, further research is required to develop better assessment methods for geosites. Encouraging collaboration among researchers, institutions, and stakeholders is vital to share knowledge, data, and methodologies, enhancing the quality of geotourism research and collectively addressing limitations. Finally, few studies analyze environmental regulations concerning the protection of geosites. Therefore, future research should analyze regulations in different countries to

improve the preservation of geosites and establish common characteristics for these areas adequately.

4.3) GEOPARKS IN GEOTOURISM

A geopark could be defined as a nationally protected area containing a series of geological heritage sites of particular importance, rarity or aesthetic appeal (UNESCO 2006, p. 2). Geotourism is an innovative idea that revolves around the sustainable preservation and management of geological heritage and geodiversity (Ólafsdóttir, 2019). In addition, geoparks are becoming an essential tourist resource for economic development in different places, becoming important tourist destinations (Ateş & Ateş, 2019; Sánchez-Martín, 2019). The demands for managing and organizing this domain and its related services are consistently rising as there is a growing need for nature preservation and the adoption of sustainable principles (Molokác et al., 2023). Therefore, there are articles which investigate the relationship between the preservation of the geological heritage in geoparks and the rise of this type of tourism (Hernandez-Gutierrez & Povedano-Marrugat, 2023; Ocelli Pinheiro et al., 2023).

Currently, online marketing is an effective tool to promote these tourist destinations, being a key element in management and organization (Cartwright et al., 2021; Obrenovic et al., 2020). For example, Molokac et al. (2023) analysed the marketing of geoparks as a promotional tool, analyzing the websites of 7 European geoparks. The results demonstrated how the geoparks had information available about the tourist services offered. However, in these articles there is a lack of promotion of geoparks that encourage traveling to this destination, in line with the results of Sánchez-Martín, et al., (2019). Therefore, in a context where potential tourists are increasingly informed through new information and communication technologies, DMOs must introduce new tools to improve the promotion of the geoparks.

4.4) CULTURAL HERITAGE IN GEOTOURISM

The UNESCO aims to promote and support the recognition, safeguarding, and conservation of cultural and natural heritage globally that is considered to possess

exceptional significance for humanity (UNESCO, 2017). However, there are a few types of dangers for these natural and cultural properties which can threaten the conservation of World Heritage Sites (WHS), such as the decline in the population of an endangered species, conflicts with the local population, the deterioration of the traditional architecture or the lack of local protection (Ferretti and Degioanni, 2017). In consequence, there are articles which analyze the protection of WHS destinations specifically in geotourism (Ferretti and Gandino, 2017; Meini et al., 2018)

However, several limitations were identified that need to be addressed in future studies. In the first place, future scientific studies should analyze how the different stakeholders, together with the local community, can contribute to the preservation of these tourist areas. In the second place, future studies should analyze how to improve the tourist experience in the geodestinations and promote its attractiveness.

Themes	Examples of studies	Key Findings	Limitations of current studies
Sustainability in geotourism	Antic et al. (2020); Antic et al. (2022); Connell et al. (2009); Quinta-Nova y Ferreira (2022); Marjanovic et al. (2022); Mokhtari et al. (2019); Trisic et al. (2023).	-Effective management by local authorities and tourism management organizations allows geodestinations to be effectively conserved. -Positive relations with local populations allow geodestinations to be sustainable. -The articles emphasize how the sustainable behavior of tourists is a fundamental factor for sustainability.	-There are no studies that have analysed the sustainability of geodestinations from a global perspective. - There are few studies that have analysed the role of the local population in the sustainability of geodestinations. -It is necessary to analyze the long-term effects of geotourism in geodestinations.

Geoheritage in geotourism	Cappadonia et al. (2018); Migon and Pijet-Migon (2017); Ruban et al. (2021); Szepesi et al. (2017); Ticar et al. (2018).	<ul style="list-style-type: none"> -The role of geoeducation in the protection of the geoheritage -The geoheritage is the combination of the geological value and the social and human impact on local communities -It is necessary to introduce regulations to protect the geoheritage 	<ul style="list-style-type: none"> - Few articles analyze the tourists' perspectives on the proper conservation of these areas. - Further research is required to develop better assessment methods for geosites. - Future studies should analyze regulations in different countries to improve the preservation of geosites
Geoparks in geotourism	Guo & Chung (2019); Elkaichi et al. (2023); Gutiérrez & Marrugat (2023); Molokác et al. (2023); Sánchez-Martín et al. (2019); Ocelli Pinheiro et al. (2023)	<ul style="list-style-type: none"> -Online marketing to promote geoparks -Regulation for the local community to avoid overtourism - Environmental and social sustainability to protect environment and avoid overtourism 	<ul style="list-style-type: none"> -Research should propose strategies to improve the management of geoparks -There are no tourism products to encourage travelling to geoparks destinations
Cultural heritage in tourism	Álvarez-García et al. (2019); Ballesteros et al. (2022); Boshier et al. (2020); Meini et al. (2018); Marrero-Rodríguez et al. (2022); Skibinski et al. (2021).	<ul style="list-style-type: none"> -Use of technology to the preservation of cultural heritage. -Driver of the economic sustainability. -Build a local identity and promote the territory. - Development of policies to promote landscape conservation. 	<ul style="list-style-type: none"> - Lack of communication to promote a new attractiveness to make memorable visitors' experience. -It is crucial to deal with multiple stakeholders to preserve the cultural heritage.

Table 9: Key Findings and Limitations of Previous Studies

4. **CONCLUSIONS**

This study has explored the scientific research of geotourism and management destination that has been developed over the last thirty-two years, specifically from 1991 to 2023. The interest in geotourism and destination management has been raising gradually in the recent years because of the increasing concern of this industry. Besides, the forecast indicates that its importance even will increase in the future. It is since geotourism is considered by a competitive advantage for companies and professionals who manage the tourism industry as it is a challenge for the management of this sector.

Scientific literature related to geotourism, and destination management has exponentially increased since 2014, experiencing peaks in production in 2022. As for the citations, the literature has also shown growth since 2010, reaching a maximum in 2018. Furthermore, the importance of employing bibliometric analysis as a research methodology has grown in the last decade, serving as a valuable quantitative and qualitative tool for synthesizing a specific scientific field. Therefore, this emerging interest in bibliometric analysis and geotourism management has prompted us to accomplish this research.

Our bibliometric analysis was carried out using 813 articles from 339 scientific journals. Firstly, concerning to the main scientific journals for geotourism management, it revealed that, although tourism journals are the most influential, it should not be underestimated the importance of the fact that researchers have also resorted to geosciences, environment and management journals, which shows the interdisciplinary nature of the management in geotourism. Secondly, regarding the most productive countries, South America and Europe stand out, both in institutions and in authors. Thirdly, concerning the co-authorship analysis, it pointed out the international relevance and the involvement of different universities in the subject analysed. This is since we find four clusters, two of which are international and three are inter-institutional. Fourthly, when it comes to the co-citation analysis, it distinguished the existence of four related clusters: the importance of geoconservation for the sustainable management of destinations, the quantitative measurement of geosites for geoconservation and the role of tourists in visiting geodestinations. Therefore, the intellectual structure reveals that the papers related with conservation in geotourism are a topic which serves to the basis for the management in geotourism. Finally, regarding the content analysis, it highlighted the existence of four clusters related to sustainability in geotourism, geoheritage in geotourism, the role of geoparks in geotourism and cultural heritage in the geodestinations. Moreover, the longitudinal analysis shows that sustainability is a current emerging topic in the management of geotourism. The main findings are related with the responsible behavior of the tourists, and the necessity of a regulation to protect environment. However, due to the increase in geotourism, there are

numerous geodestinations that have become overcrowded in recent years. Therefore, future studies should examine how conservation of these areas and sustainable tourism can be made compatible through management and education (Neches & Erdeli, 2015).

Unlike previous studies, our study is specifically focused on geotourism management, indicating the relevance to geoconservation, sustainable tourism, and geological heritage. These findings provide insights for destination managers to ensure proper conservation of geodestinations. In addition, in the discussion section we provide new lines of research: the promotion of geodestinations through new technologies, the management of the sustainability of geodestinations at a global level, the analysis of the regulations in countries regarding this type of tourism or the improvement of the tourist experience, among others. Finally, our study is more exhaustive and comprehensive in terms of identifying the authors, co-authorship networks and co-words networks with the highest scientific output and academic impact.

Regarding the limitations of the studies analysed in this paper, first, there are no studies that analyze sustainability in geodestination from a global perspective. In the second place, there are few investigations that analyze the tourists' perspectives on the proper conservation of these areas. In the third place, investigations should propose strategies to improve the management of geoparks. Finally, there are a lack of communication to promote a new attractiveness to make memorable visitors' experience.

There are a few theoretical implications of this research. Firstly, this bibliometric analysis can serve as a basis for empirical studies that analyze the role of management in geotourism. Secondly, the number of studies in management of geotourism has increased in recent years, indicating the necessity of establishing proper management in geotourism to ensure conservation in geodestinations. Lastly, this study highlights that bibliometric analysis is a valuable tool for synthesizing a specific field of study, revealing the collaboration between authors, the origin of this field of study, and the thematic clusters and emerging patterns for future research.

In terms of the practical implications of this study, companies are constantly facing competitive challenges related to the achievement of sustainable development goals that minimise negative environmental impacts, promote the conservation of natural resources and encourage the introduction of environmentally responsible services through innovation. Moreover, the results show that the adequate management of geodestinations and geotourism has positive consequences on the satisfaction of tourists, on the natural heritage conservation of geosites and on the well-being of the local population. Therefore, an adequate management on geotourism helps to the tourism industry to have a correct conservation in the geodestination and benefits in economic terms.

Regarding the limitations of our research. The primary limitation of this study lies in its reliance on a single database (Web of Science) for data gathering and synthesis. While it is common practice in bibliometric studies to use a single database to avoid duplication, this approach may lead to the exclusion of valuable articles from other databases that could have been beneficial to the field of sustainable tourism. Another limitation to highlight is that the study use the tool VOSviewer, which prevents the identification of prominent thematic areas within a particular field, an aspect that could be explored by employing other bibliometric analysis programs.

Finally, regarding to future lines of research, we should consider implementing other bibliometric analysis using other databases as Scopus or Google Scholar with the aim of comparing the obtained results. Furthermore, other tools could be used to carry out the bibliometric analysis as SciMAT or Bibliometrix. Moreover, it is interesting to note that this bibliometric analysis would serve as basis to empirical studies which analyse the management in geotourism.

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