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Ecotourism research progress: A bibliometric analysis (period 2002–2022) using VOSviewer Software

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ABSTRACT

This study aims to conduct a bibliometric analysis of ecotourism literature in the period from 2002 to 2022 using VOSviewer software. 1,693 articles indexed by Scopus were analyzed. The results reveal that ecotourism is a developing research field that attracts scholars from many countries. Most of the articles were published in the United States, China, Indonesia, Malaysia, Australia, and the United Kingdom. The study identified four main thematic areas: (a) the involvement of local communities and stakeholders in ecotourism management and development in protected areas; (b) ecotourists' perceptions, attitudes and behaviours; (c) the use of technology and environmental management to support ecotourism development planning and management; and (d) biodiversity conservation and sustainable development in ecotourism. This study suggests that decision-making based on data, stakeholder participation and climate adaptation in the planning and management of ecotourism is attracting the attention of researchers worldwide.

KEYWORDS

ecotourism, bibliometric analysis, sustainable development, VOSviewer

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1. Introduction

Ecotourism is one of the forms of sustainable tourism that aims to meet the needs of sustainable development worldwide (Fennell, 2008). The concept of ecotourism gained popularity due to the negative social and environmental impacts associated with mass tourism, which places more emphasis on income and growth rather than the conservation of the environment and the sociocultural goals of the community (Ziffer, 1989). One of the most widely accepted definitions of ecotourism is that of Hector Ceballos-Lascurain. According to this author, ecotourism is "travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas" (Ceballos-Lascurain, 1987, p. 14). Discussions on ecotourism have gained prominence in both environmental and social

conferences and journals worldwide, with expanded definitions incorporating ethical issues or normative elements (Cobbinah, 2015).

The increasing popularity of ecotourism at the global level has opened up many opportunities for research in this field. Moreover, the availability of numerous ecotourism-related publications has increased the demand for conducting research to examine and analyze their characteristics, trends and impacts (Hasana et al., 2022). Bibliometrics is a technique for examining the evolving principles over time based on the social structure, concepts and intelligence of a given field (Zupic & Čater, 2015). It utilizes representative abstracts from existing literature to analyze and categorize bibliographic documents (Suban et al., 2021). As a result, researchers employ this analysis to identify developing trends, intellectual structures and research characteristics, and to gain deeper insights into collaboration models within a specific field of existing literature (Donthu et al., 2021). Bibliometric indices were measured using the VOSviewer, a reliable software for bibliometric data research (van Eck & Waltman, 2010). This is a free software tool for creating, visualizing and exploring maps based on network data.

In the above context bibliometrics can also be used to explore and analyze trends and opportunities in ecotourism research in a given period of time. Unfortunately, the scope of previous studies in this field has been quite limited. They primarily have used data extracted from the Web of Science database (Liu & Li, 2020); focused only on articles published in selected journals (Khanra et al., 2021); focused only on articles published in the same journal (Singh et al., 2021); limited the content of ecotourism development to conservation areas (Hasana et al., 2022). Therefore, in order to fill the existing gaps, the current study has used the Scopus database. The analysis includes qualitative and quantitative aspects of ecotourism research in the period from 2002 to 2022 with the support of VOSviewer software. Specifically, the specific tasks identified in this study include: (a) analysis of the output of articles on ecotourism; (b) identify leading authors, journals on ecotourism research; (c) explore collaborative research trends; (d) identify the main research topics of the field of ecotourism. The study results provide the characteristics and research topics in different stages of development in the field of ecotourism since 2002. This analysis also identifies new research directions that researchers need to address in the future.

The rest of the article is organized as follows: in part 2, the bibliometric analysis method is introduced, and data collection is presented. Part 3 presents the results and discussion of the main findings of the bibliometric analysis while part 4 presents the conclusions, and finally, the references used for the study.

2. Data collection and method

The first stage of bibliometric analysis is to select a suitable database which has been determined by its usefulness for the research. The Scopus database was used to select a sample for the current survey. This is a database that is capable of providing detailed information on documents that are recognized by the academic community (Caviggioli & Ughetto, 2019). To perform the sample search process, a Boolean string was used in the initial search to find articles containing the keywords 'ecotourism OR eco-tourism'; these were chosen based on the experience of previous studies (Hasana et al., 2022; Khanra et al., 2021). The keywords may appear in the titles, abstracts, and author's keywords; however, this study only focused on searching for them in the titles because using a broader search would retrieve unrelated documents (Niñerola et al., 2019). The selected time frame for the search was from 2002 to 2022. The initial search yielded 2,630 articles.

The process of refining the research sample continued by selecting the most directly relevant articles on the ecotourism topic. The criteria chosen were (a) documents in the form of academic journal articles; book chapters, conference papers and books were excluded from the analysis; (b) academic journal articles written in English. As a final result, 1,693 articles from 572 different journals were selected and manually processed before being entered into for directory evaluation and analysis. The directory details of the articles were exported to an Excel spreadsheet for analysis, including journal title, publication date, author information, article title, keywords, abstract and citation count.

The continuous increase in tourism literature makes bibliometric analysis useful in tourism research for accumulating information, evaluating research performance and providing a profound insight based on evidence by analyzing previous research publications (Hall, 2011). The performance analysis techniques used include the total number of publications, total number of citations, authors and the leading countries publishing scientific articles on ecotourism. Using VOSviewer, this study examines the co-occurrence of author keywords, source co-citations, author and document co-citations, by utilizing scientific mapping (network analysis). The quantity, quality and structure of all types of bibliometric indices were also evaluated. Specifically, quantitative indices reflect the output of journals or authors; quality indices assess the importance and influence of authors, publications and journals; and structural indices reflect the degree of relatedness and connection of research topics, countries and scholars (Durieux & Gevenois, 2010). VOSviewer was used to compute and graphically represent the keywords on two types of bibliometric maps: network

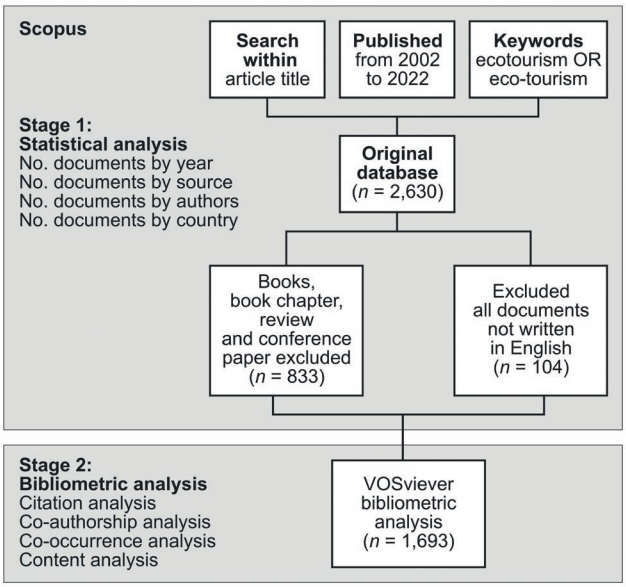

Figure 1. The process of data collection and the main research method
Source: authors

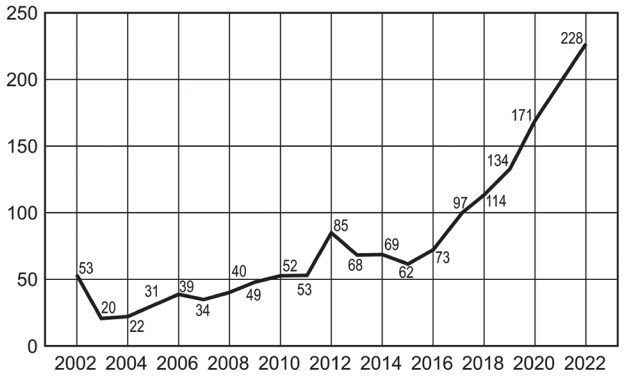

Figure 2. Number of academic articles from 2002 to 2022
Source: Scopus data

visualization and overlay visualization (van Eck & Waltman, 2017). The process of data collection and the main research method are illustrated in Figure 1.

3. Results and discussion

3.1. Annual publications

There were 1,693 articles published on the topic of ecotourism from 2002 to 2022 (Figure 2). The number of research articles on ecotourism has significantly increased in the past 20 years, from 53 articles in 2002 to 228 articles in 2022 (an average of 84 articles per year). Starting in 2002, designated as the International Year of Ecotourism, research has been conducted worldwide to gain a deeper understanding of ecotourism (Fennell, 2001). The number of articles recorded in 2002 was 53, followed by minor fluctuations from 2003 to 2008, and a growth trend from 2009 onwards when ecotourism began to be studied in developing countries (Mowforth & Munt, 2008). Therefore, what can be inferred from this data is that ecotourism is a developing research field and a topic that attracts the attention of scholars in many countries.

3.2. Leading journals

The number of articles and the number of citations can be employed to determine the popularity of journals, authors and articles in the field of ecotourism. The citation count of an article is used as a measure of the degree of recognition a published article has gained in academia (Caviggioli & Ughetto, 2019). However, this technique only takes into account a publication's popularity and not its importance in a research domain (Khanra et al., 2020).

The present study encompasses a total of 572 journals from various fields publishing research articles on ecotourism. Table 1 lists the top 10 journals based on the number of published articles and citations. These journals only account for 27.4% of the total articles, but they represent up to 53.6% of the total citations in the sample. *Journal of Ecotourism* tops the list with 141 articles and 3,550 citations. Established in 2002, this journal publishes theoretical, empirical and conceptual research on social, economic and ecological aspects of ecotourism, contributing innovative ideas and models for planning, management and practice in ecotourism (Singh et al., 2021). *Journal of Sustainable Tourism* comes in second for both indices with 68 articles and 3,489 citations. As the only journal devoted to sustainable tourism research (Lu & Nepal, 2009), it is entirely suitable for the ecotourism theme. Long-established tourism journals, such as *Annals of Tourism Research and Journal of Travel Research*, also appear on the list. The number of articles and citations for those journals is relatively stable.

The journal *Sustainability* ranks third in terms of the number of published articles among all sources. It is a multidisciplinary international academic journal published by MDPI, established in 2009, focusing on publications related to sustainable development in the fields of environment, culture, economy, education and society. However, due to its relative youth, its citation count has not yet reached a significant figure (Niñerola et al., 2019).

Out of a total of 572 journals, 64.5% only published one article, indicating that they are not specialized journals in the field of ecotourism. However, the high participation of a large number of non-specialized journals indicates that ecotourism is a multidisciplinary field that attracts interest from various research communities (Buckley, 2012).

Table 1. Ten journals with the highest number of articles in the field of ecotourism research

Rank	Journal name	Publisher	SCImago Journal Rank 2021	Number of articles	Number of citations
1	*Journal of Ecotourism*	Taylor & Francis	0.528	141	3,550
2	*Journal of Sustainable Tourism*	Taylor & Francis	2.476	68	3,489
3	*Sustainability*	Multidisciplinary Digital Publishing Institute (MDPI)	0.664	49	411
4	*African Journal of Hospitality, Tourism and Leisure*	Africa Journals	0.210	35	118
5	*Journal of Environmental Protection and Ecology*	Scientific Bulgarian Communication	0.182	34	64
6	*Journal of Environmental Management and Tourism*	ASERS Publishing House	0.238	33	82
7	*GeoJournal of Tourism and Geosites*	Editura Universitati din Oradea	0.332	31	168
8	*Tourism Management*	Elsevier	3.383	26	2,426
9	*Environment, Development and Sustainability*	Springer Nature	0.679	24	339
10	*Tourism Recreation Research*	Taylor & Francis	0.877	24	224

Source: compiled by the authors from VOSviewer.

3.3. Leading authors

The current study sample includes a total of 3,978 different authors and co-authors involved in publications. Among them, only 30 authors have successfully published five or more articles. Table 2 lists the authors with the highest number of ecotourism articles. At the top of the list is Mauricio Carvache-Franco; co-authored by Wilmer Carvache-Franco and Orly Carvache-Franco. This group of authors focuses on analyzing the sociological aspects and relationships with motivation, satisfaction and loyalty in ecotourism in nature conservation areas (Carvache-Franco et al., 2021, 2022). These scholars have only published ecotourism articles since 2018, so the number of citations is not high.

Other authors in the top 10 have fairly similar numbers of articles and citations, ranging from 7 to

Table 2. Ten authors with the highest number of articles in the field of ecotourism research

Rank	Author	Affiliations	*h*-index	Number of articles	Number of citations
1	Carvache-Franco, M.	Universidad Espíritu Santo, Samborondón, Ecuador	13	16	83
2	Carvache-Franco, W.	Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador	10	14	52
3	Walter, P.	University of British Columbia, Vancouver, Canada	18	10	351
4	Buckley, R.	Griffith University, Brisbane, Australia	45	9	245
5	Carvache-Franco, O.	Universidad Católica de Santiago de Guayaquil, Guayaquil, Ecuador	9	8	30
6	Stronza, A.	Texas A&M University, College Station, United States	22	7	670
7	Fennell, D.A.	Brock University, St. Catharines, Canada	33	7	156
8	Jaafar, M.	Universiti Sains Malaysia, Minden, Malaysia	26	7	89
9	Hamzah, J.	Universiti Kebangsaan Malaysia, Bangi, Malaysia	7	7	62
10	Er, A.C.	Universiti Kebangsaan Malaysia, Bangi, Malaysia	13	7	48

Source: compiled by the authors from VOSviewer.

Table 3. Ten authors with the highest number of citations in the field of ecotourism research

Rank	Author	Affiliations	*h*-index	Number of citations	Number of articles
1	Weaver, D.B.	QUT Business School, Brisbane, Australia	39	727	6
2	Stronza, A.	Texas A&M University, College Station, United States	22	670	7
3	Powell, R.B.	Clemson University, Clemson, United States	25	356	5
4	Walter, P.	The University of British Columbia, Vancouver, Canada	18	351	10
5	Donohoe, H.M.	Flagler College, St. Augustine, United States	13	266	5
6	Buckley, R.	Griffith University, Brisbane, Australia	45	245	9
7	Snyman, S.	African Leadership University, Pamplemousses, Mauritius	10	192	5
8	Garrod, B.	School of Management, Swansea, United Kingdom	26	183	5
9	Butcher, J.	Christ Church Business School, Canterbury, United Kingdom	14	166	5
10	Fennell, D.A.	Brock University, St. Catharines, Canada	33	156	7

Source: compiled by the authors from VOSviewer.

8 articles and from 30 to 156 citations. Their research topics are very diverse, such as the relationship between ecotourism and gender (Linh & Walter, 2014); ecotourism certification (Buckley, 2002); measuring sustainability for ecotourism (Bhuiyan et al., 2016); and community perspectives on ecotourism (Stronza & Gordillo, 2008).

The most 'efficient' authors are determined based on the number of publications, while 'popular' authors are determined based on the number of citations (Hasana et al., 2022). However, when authors are ranked by the number of citations received, there is a significant difference in order (Table 3). At the top of the list is David Weaver with 727 citations and six articles. Weaver's theoretical contributions are an important foundation for subsequent studies to inherit and evolve (Weaver, 2005a, 2005b).

3.4. Research collaborations

The current study sample includes 123 countries participating in publishing. This shows that ecotourism is receiving significant attention from many countries around the world. However, the level of interest and research outcomes vary greatly among countries with the top 10 accounting for 71.2% of the total publications and 97.1% of the total citations in the study sample (Table 4). Overall, developed countries have an advantage in terms of the number of publications. The United States has a long-standing academic community that focuses heavily on environmental and sustainability issues. In addition, there are many specialized research centers and programs that focus on ecotourism and related topics. Therefore, it is not surprising that the United States tops the list. Similarly, the United Kingdom and Australia are two other countries with a long-standing academic tradition and significant contributions to the development of ecotourism (Khanra et al., 2021).

Table 4. Ten countries by number of articles in the field of ecotourism research

Rank	Country/territory	Number of articles	Citations	Total link strength
1	United States	243	8,643	122
2	China	188	1,790	57
3	Indonesia	146	447	21
4	Malaysia	119	1,127	36
5	Australia	111	3,329	61
6	United Kingdom	97	3,303	79
7	Iran	83	874	33
8	South Africa	74	2,095	32
9	Canada	74	1,456	53
10	India	70	574	20

Source: compiled by the author from VOSviewer.

The development of ecotourism can contribute to enhancing economic development, environmental protection and promoting sustainable development in developing countries (Mbaiwa & Stronza, 2009). Therefore, there is an increasing trend for developing countries to participate in research on ecotourism. China, Indonesia and Malaysia, following the United States, have demonstrated this trend. These countries have vast and diverse ecosystems and natural landscapes, making them attractive destinations for ecotourists. This has led to significant interest in

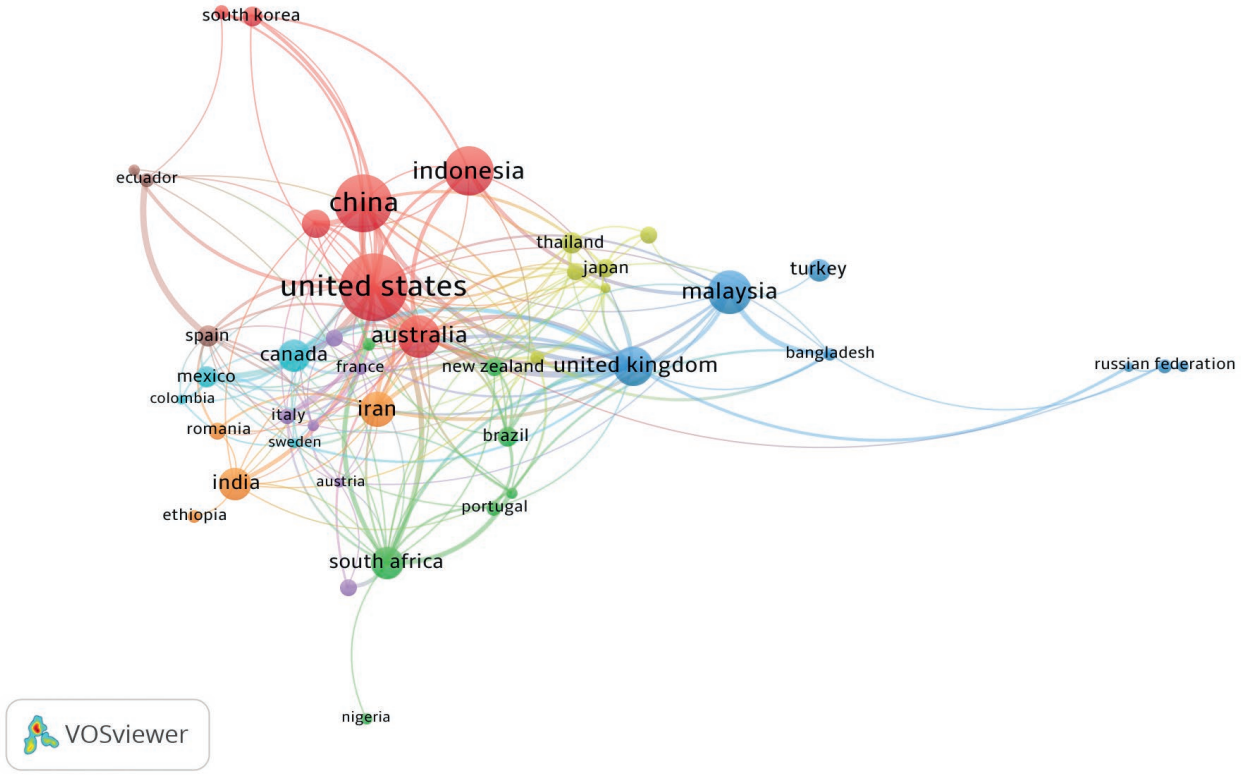

Figure 3. Co-authorship analysis among countries
Source: VOSviewer

domestic research and development of ecotourism. The main research areas on ecotourism in China, Indonesia and Malaysia focus on assessing the potential for ecotourism development (Izwar et al., 2020; Shi et al., 2015); sustainable development and management of ecotourism in conservation areas (Kaffashi et al., 2015; Marlina et al., 2020); ecotourists' experiences (Zong et al., 2017); and the development of new ecotourism products (Jaafar & Maideen, 2012).

Co-authorship analysis can help to identify the trends and nature of research collaborations in the study area and find out the presence of research groups in such terms (González et al., 2016). The total link strength shows the importance of a keyword in the field since a higher value means that it has been linked with others many times (van Eck & Waltman, 2010). From Figure 3, it can be observed that the United States and the United Kingdom are the two countries with the highest level of research collaboration. In addition, other countries also have different levels of research collaboration. For example, China has 57 co-authorships, while Malaysia and India have high levels of research collaboration with 36 and 20 co-authorships, respectively. However, there are also some countries with low levels of research collaboration, such as Ukraine with only one co-authorship and Serbia with only two. Therefore, research collaboration on ecotourism among countries is quite common, however, the level of collaboration among countries varies.

3.5. Key research themes

The network visualization map of keyword occurrences, generated using VOSviewer software, is shown in Figure 4. The size of the nodes and the words represented correspond to the weight of the nodes (keywords), which is the frequency of their appearance. The network connections display the co-occurrence of keywords that appear together more frequently in the analyzed articles; a line between two keywords indicates their co-occurrence. The distance between two nodes reflects the strength of the relationship between them – that is, the shorter the distance, the stronger the relationship. The thickness of the lines indicates the frequency of their co-occurrence while the color of the nodes represents different clusters or groups of keywords (van Eck & Waltman, 2010, 2017). As shown in Figure 3, 'ecotourism' is the largest node at the center; 'sustainable development' is the second largest. These two keywords have the highest total link strength, indicating that ecotourism and sustainable development are closely related and often appear together in theoretical research.

Identifying the most common keywords can help identify the most frequently occurring topics in this field (Garrigos-Simon et al., 2018). To identify the main research topics, 50 keywords were retrieved with a minimum occurrence limit of 30 times. These

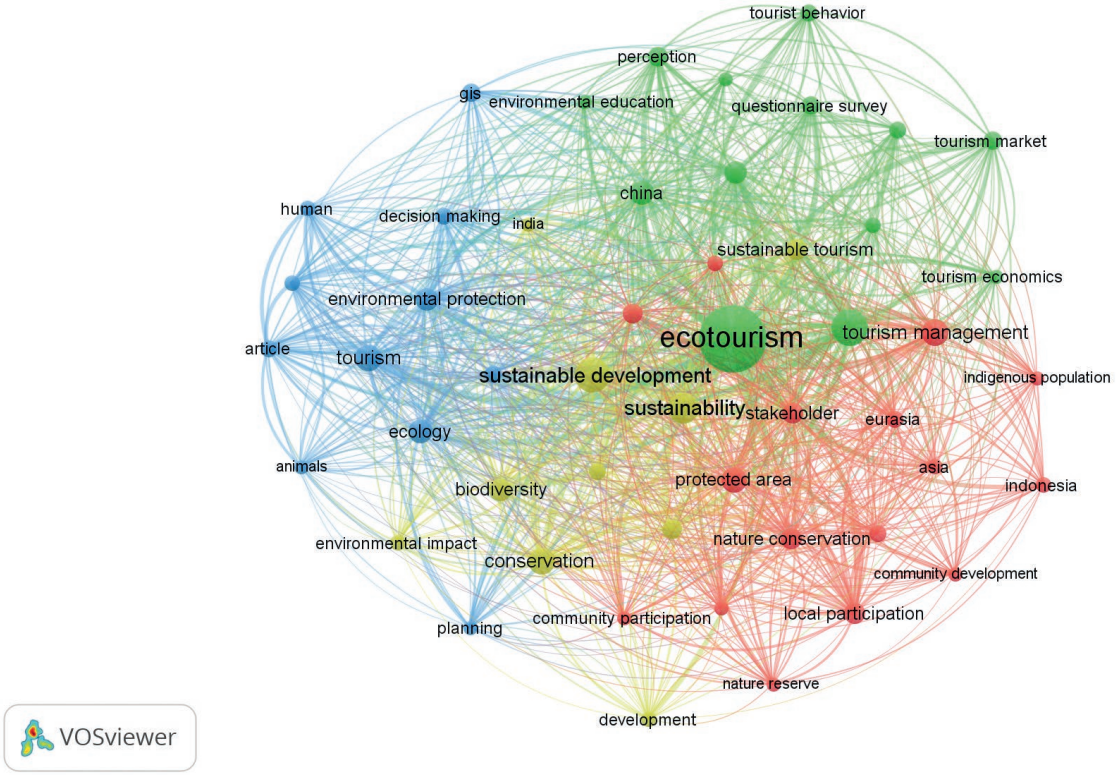

Figure 4. Network visualization of the simultaneous occurrence of keywords
Source: VOSviewer

keywords were grouped into four clusters, each with a distinct color. Four main research topics were identified from the network visualization map:

Cluster 1. Involvement of local communities and stakeholders in the management and development of ecotourism in protected areas

This is the largest cluster consisting of 16 keywords. Terms such as 'community development', 'community participation', and 'community-based ecotourism' appearing in the cluster indicate that studies have shown positive impacts of ecotourism activities, such as promoting local economic growth, creating job opportunities and income for the local community (Cusack & Dixon, 2006; Kunjuraman et al., 2022). Moreover, effective participation of stakeholders plays a significant role in the management and planning of ecotourism (Bansal & Kumar, 2013; Diamantis, 2018; Min, 2016).

Protected areas play an important role in the existence and development of ecotourism. Ecotourism in protected areas provides favorable conditions for responsible travel to natural sites, promoting environmental conservation, providing economic benefits for local communities and offering interpretation and education to tourists (Sobhani et al., 2022). Ecotourism is viewed as a sustainable lifeline for conservation areas, contributing to the conservation of local biodiversity, community development and education (Lindsey et al., 2007; Masud et al., 2017).

Cluster 2. Perceptions, attitudes and behaviors of ecotourists

The sustainable development of ecotourism depends on the behavior of tourists. As consumers of tourism services, tourist participation can impact the entire process of ecotourism development (Ren et al., 2021). Questionnaire surveys are used to collect data on tourists' awareness of ecotourism, including their attitudes towards nature, motives for participating in ecotourism activities and satisfaction with tourism services (Akbar et al., 2022; Samdin et al., 2021). This information is used to help operators and marketers adjust strategies to attract and retain tourists, as well as to develop ecotourism products and services that meet tourists' needs while promoting sustainability (de Souza et al., 2022).

Cluster 3. Using technology and environmental management to support ecotourism development planning and management

Geographic information system (GIS) technology is becoming increasingly popular and accessible, allowing researchers to analyze and visualize spatial data related to ecotourism sites. The main applications of GIS include assessing the potential and risks of ecotourism activities

(Acharya et al., 2022; Nino et al., 2017); monitoring and improving decision-making in management (Mohd & Ujang, 2016; Mukherjee, 2019); and planning for the development of ecotourism (Bunruamkaew & Murayama, 2011; Mulyadi & Nursyahputra, 2020).

The keywords 'animals' and 'ecology' also reflect the increasing concern in understanding the ecological impacts of ecotourism and how to sustainably manage these impacts. This relates to researching the ecological characteristics of ecotourism sites, evaluating the potential impacts of ecotourism activities on ecosystems, and identifying strategies to mitigate negative impacts (Ghosh & Ghosh, 2019; Tavakoli et al., 2022).

Cluster 4. Biodiversity conservation and sustainable development in ecotourism

The focus of ecotourism research is often on the creation of sustainable tourism. Terms like 'sustainable development', 'sustainability' and 'sustainable tourism' demonstrate an interest in developing tourism in a sustainable manner. Ecotourism destinations must be developed in a way that balances the economic, social and environmental needs of the local community. This involves working closely with them to ensure that tourism benefits are shared fairly, and that the impacts of tourism on the environment and local culture are minimized.

The prominence of phrases like 'conservation', 'conservation management' and 'natural resource' in the keywords suggests that research in this cluster is concentrated on figuring out efficient ways to manage natural resources in a way that supports biodiversity conservation (Anup et al., 2015; Kiss, 2004). This entails researching how ecotourism affects regional ecosystems and figuring out solutions to avoid detrimental effects while increasing the financial gains from tourism. Researchers guarantee that ecotourism remains a viable and sustainable economic activity that benefits local communities and safeguards natural resources for future generations by investigating the effects of ecotourism on regional ecosystems and proposing responsible tourist management practices (Hunt et al., 2015; Phelan et al., 2020).

The visual map of VOSviewer depicting keyword co-occurrences is the result of an analysis of the simultaneous appearance of keywords (Figure 5). According to the VOSviewer analysis, the period from 2012 to 2018 was when the keywords appeared together the most frequently. The purple nodes represent the keywords with the highest appearance rate in the early stage of the research period. The green and light yellow nodes represent the most commonly used keywords in recently published articles. The keywords 'ecotourism', 'sustainable tourism', 'sustainability', 'sustainable development' and 'biodiversity' are located in the middle of the scale (in green) due to the repetition of these keywords throughout the analyzed period.

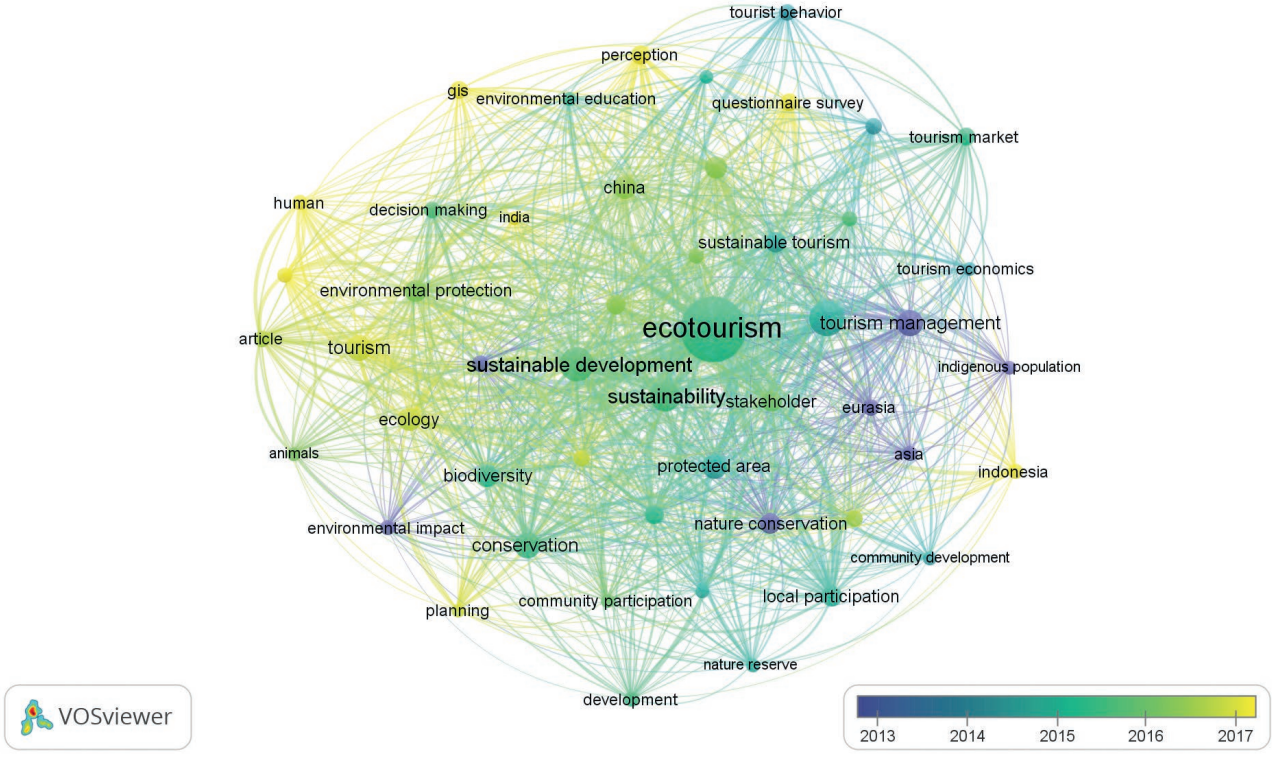

Figure 5. Keyword overlay visualization in ecotourism articles
Source: VOSviewer

The increased occurrence of keywords such as 'GIS', 'human', 'ecology', 'perception', 'questionnaire survey', 'climate change' and 'planning' in the later period indicates a growing trend in making decisions based on data, stakeholder engagement and adapting to climate change in ecotourism planning and management. Climate change is a global phenomenon that affects the environment and the natural resources that ecotourism destinations depend on (Day & Noakes, 2021). For example, changes in temperature, rainfall and sea level can alter ecosystems, wildlife behavior and biodiversity, which can then affect the attractiveness and survival of ecotourism destinations (Mkiramweni et al., 2016). As a result, researchers are increasingly focusing on understanding the impacts of climate change on ecotourism destinations and developing strategies to mitigate these impacts. This includes developing sustainable tourism activities to reduce carbon emissions and promote renewable energy, as well as identifying and adapting to changes in natural systems and resources (Ashok et al., 2022; Sitanggang et al., 2022).

4. Conclusions

Using bibliometrics analysis with the support of VOSviewer, the study provides an overview of the literature on ecotourism. The results indicate that ecotourism is an important research field, with a continuous increase in the number of academic articles and citations from 2002 to 2022. A total of 572 journals have contributed to publishing, with the *Journal of Ecotourism* topping the list, followed by the *Journal of Sustainable Tourism*, *Sustainability*, *African Journal of Hospitality, Tourism and Leisure*, and the *Journal of Environmental Protection and Ecology*. The most 'efficient' authors are Mauricio Carvache-Franco co-authored by Wilmer Carvache-Franco and Orly Carvache-Franco, while the authors receiving the largest number of citations are David Weaver and Amanda Lee Stronza.

In terms of collaboration, the study shows that most collaboration in the field of ecotourism occurs between developed countries, or between developed and developing countries, while collaboration between developing countries is still limited even though these countries have great potential for ecotourism development. Academic articles are mainly published in the United States, China, Indonesia, Malaysia, Australia and the United Kingdom. These are countries with a long-standing academic tradition or great potential in ecotourism.

The study has identified that articles in the period from 2002 to 2022 revolve around four main themes: the involvement of local communities and stakeholders in ecotourism management and development in protected areas; ecotourists' perceptions, attitudes and behaviors; the use of technology and environmental management to support ecotourism development planning and management; and biodiversity conservation and sustainable development in ecotourism. This study suggests that decision-making based on data, stakeholder participation and climate adaptation in the planning and management of ecotourism is attracting the attention of researchers worldwide.

Alongside its contributions, the study also faces certain limitations. For instance, it relies on only one database instead of utilizing various sources for information retrieval. Furthermore, the use of search algorithms geared towards articles also restricts effective searching. Additionally, the dataset solely focuses on English-language materials which leads to a potential underestimation of research conducted in other languages. It recommends that future research could be conducted by combining multiple databases (Scopus, Web of Science, Google Scholar) and visualization software to supplement and expand research results.

Declaration of competing interest
The authors declare that there are no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

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