

Review

Tourism Management in National Parks: Development, Aspects, and Conceptual Framework

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Abstract: Outdoor recreation in national parks has significantly driven the growth of tourism globally. Research on tourism management in national parks has grown due to increasing scholarly interest in the field. This paper presents a bibliometric review of the development, aspects, and applications of national park tourism management. Data were collected from the Web of Science core collection database, and a total of 3438 research articles from 1980 to 2022 were selected and analyzed using VOSViewer (Version 1.6.19). We here analyze and visualize the co-occurrence of research keywords with temporal overlay and cluster analysis. We also present a content analysis and conceptual and management frameworks by examining multiple aspects of tourism management to offer detail aspect-based management implications. These can assist various park stakeholders, scholars, and associated collaborative efforts with the issue of how to best manage national park tourism in the context of an uncertain future and increasing conflicts of interests.

Keywords: tourism management; national park; bibliometric review; content analysis; management implications; conceptual framework



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1. Introduction

As the global tourism sector has grown rapidly, so has associated academic research and the development of research methods to support tourism inquiries [1,2]. The origin, history and development of tourism are therefore of great interest and importance. Although the word “tourism” first appeared in 1877, the history of tourism can be traced back to ancient Greece and Rome, where leisure travel with access to nature and facilities was already emphasized [1,3]. In the 17th century, young European nobles traveled to countries like France and Italy as part of the “Grand Tour,” seeking to immerse themselves in history, art, and culture. This practice is often seen as the origin of modern tourism, which became popular among the wealthy and spread to America by the late 18th century. From the 19th to the 20th century, the Industrial Revolution, the mass production of cars, and the advent of air travel further fueled the expansion of tourism [4]. In 1946, the World Tourism Organization (UNWTO) was established to promote sustainable tourism development, tourism education and market knowledge. Nowadays, tourism is one of the world’s largest sectors, contributes trillions of dollars to the economy and provides economic benefits for livelihoods [5,6]. The UNWTO defines tourism as:

“a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors (which may be either tourists or excursionists; residents or non-residents) and tourism has to do with their activities, some of which involve tourism expenditure”. [7] (p. 1)

This definition of tourism helps to frame the research that follows, and encompasses multiple social, cultural and economic elements. It also facilitates the tourism trends analysis by recognizing the diverse motivations and activities of visitors, as well as associated impacts on various stakeholders.

Over the past two decades, national parks and other protected areas have been one of the most important drivers for the growth of tourism, especially for nature-based tourism (NBT) [8–10]. Nature-Based Tourism (NBT) focuses on travel where the natural environment is the main attraction or setting for visitors, and it plays a crucial role in national park tourism [11,12]. National Parks are defined as large natural or near-natural areas that support substantial large-scale ecological processes, and offer environmental and cultural activities that provide visitors with scientific, spiritual and recreational opportunities [13]. The natural and landscape beauty and the provision of visitor services in national parks have attracted increasing numbers of tourists that seek natural recreation and participation in outdoor activities (i.e., nature-based tourists) [14–16]. Protected areas can enhance tourist experiences by providing educational programs that promote environmentally responsible behavior and contribute to the protection of the park’s ecological and scientific values [17,18].

In the context of national parks and protected areas, visitor management is defined as an administrative action with the goals of preserving the quality of park resources and enhancing visitor experiences [19]. It broadly includes four strategic approaches, including (i) managing the supply of tourism and activity opportunities, (ii) managing visitation demand, (iii) managing park resources, and (iv) managing the impacts of visitor use [20,21]. It is important to manage tourism in national parks for several reasons. From an economic perspective, tourism activities can provide substantial economic support to the local, regional, or national economies. Tourism can also provide employment and concession opportunities for local communities, and may play roles in reducing poverty and inequality [22,23]. From a sociocultural perspective, tourism can influence residents’ lifestyles, experiences, values systems, and cultural identities. For example, tourism, particularly international tourism, might standardize local cultures to make them more broadly appeal to global audiences; the resulting loss of authenticity, adaptation to visitor demands, and industrial structure may degrade local culture and heritage [24,25]. Lastly, from an environmental perspective, effective tourism management and educational programs can help to reduce the negative impacts of visitors and associated behaviors on national parks’ ecosystems, biodiversity, soil, water resources, and air quality, by encouraging environmentally responsible awareness and behavior [19,26,27].

Although tourism management-related research has expanded in scope and has become more prevalent, earlier tourism literature was mostly focused on specific issues [28], such as visitor experience and behavior, tourism and local community, and marketing and branding. Most national park tourism-related studies have been case studies; research has tended to be exploratory and focused on a specific national park or region, so as to provide certain management implications and recommendations. A bibliometric review has the ability to identify broader research trends, research gaps, and emerging blind spots from a holistic perspective, thus providing research guidance and helping inform future research priorities. By synthesizing the quantitative results, it can provide an essential foundation for developing a conceptual framework that can guide future studies and

tourism management decisions. Additionally, a recent bibliometric review on national park tourism management on a global scale is lacking, and so it will be useful to develop a conceptual framework that applies these contexts and activities more generally. Given the significance of managing tourism in national parks, as mentioned earlier, it is important to examine how tourism research has engaged with this topic to outline the implications and applications for both scholars and practitioners. Therefore, the objective of this study is to analyze the development, research trends, and key aspects in national park tourism management from a global perspective. We adopted a bibliometric review in this study. Traditional literature reviews tend to be descriptive, and may not include a structured process for identifying all of the relevant literature. Bibliometric reviews are used in this study to track the tourism management research keyword network, trends, and researchers' connections. It was chosen as our review method for the following reasons. Bibliometric reviews can identify the development trends and patterns of selected topics, especially in cross-disciplinary collaborations. It also offers a reproducible method for comprehensively analyzing literature, identifying influential papers, authors, and journals, thereby reducing bias or and the risk of overlooking, and increasing the reliability of the review process.

To guide our analysis, a research framework was developed that outlines the process of bibliometric analysis (Figure 1). This framework includes: (i) determining research objectives and defining research questions, (ii) formulating review criteria, (iii) collecting literature based on search strings, (iv) extracting key findings and information based on criteria, and (v) synthesizing findings and structuring the national park stakeholders' relationship framework.

To complement the bibliometric analysis, we employed content analysis to obtain a more comprehensive and in-depth understanding of the topics. Content analysis is a method for determining the presence of specific keywords, themes or concepts within given text data [29], and typically has four steps: (i) information collection, (ii) descriptive analysis, (iii) category/aspect identification, and (iv) information evaluation and interpretation [28,30]. The goal of content analysis is to develop a conceptual framework and overview of the organizing relationships between different aspects of past literature on national park tourism management. The application of content analysis can reveal patterns among keyword indexes, and can be employed to organize multiple elements/characteristics of topics in light of the broader context of a research area [28,31]. The use of content analysis allows us to qualify and analyze the current presence, meanings of and relationships between keywords and concepts regarding national park tourism management.

The integration of bibliometric and content analysis provides the foundation for formulating our research focus and guiding questions. Accordingly, three research questions have been developed to frame this study:

1. What is the development and scope of the tourism management research in national parks regarding the numbers and journals of publications, the study areas, co-occurrence networks and the connections of keywords and authors?
2. What are the trends, topics and associated research findings related to tourism management in national parks?
3. What are the conceptual frameworks and applications of tourism management in national parks in relation to stakeholders that can be developed based on existing research and theoretical foundations?

This review paper holds research significance for several reasons. By using content analysis, we develop a tourism management framework that reflects the current development and degree of connection of tourism management in national parks. The framework can provide a better and more holistic understanding and guidance for tourism man-

agement in national parks and other protected areas. We address tourism management questions that cannot be addressed by individual case studies. For example, some case studies focus specifically on a single aspect of tourism management, such as visitor experience with selected study areas, whereas a bibliometric review can identify and examine diverse research fields and their connections globally [32,33]. Additionally, we highlight the strengths, research gaps, and emerging blind spots of research on national park tourism management. By identifying the areas that have not received attention and emerging blind spots, this study also provides a management framework that serves as a practical roadmap for future research addressing ongoing and urgent challenges, and can guide more inclusive and adaptive tourism management practices in national parks.

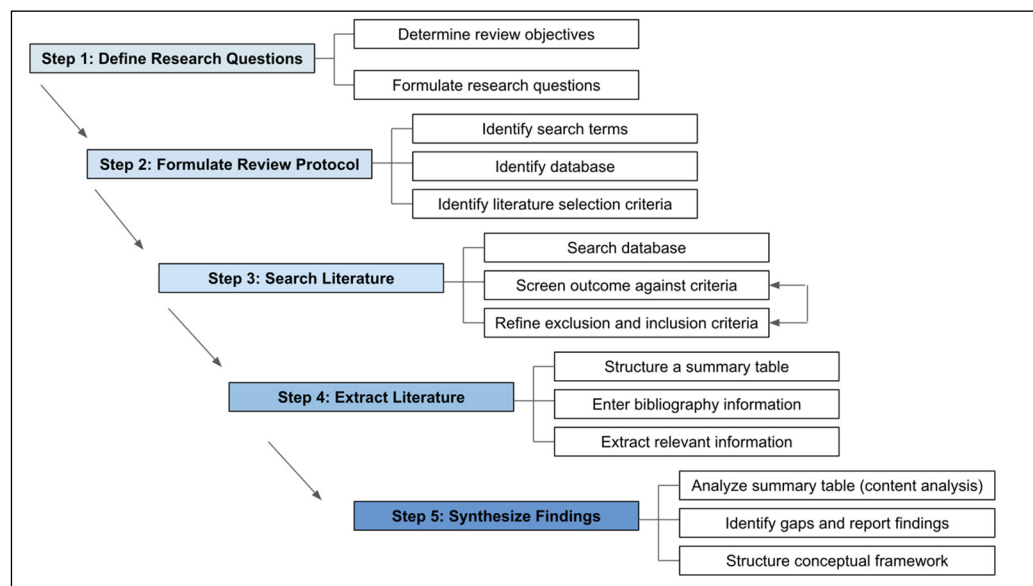


Figure 1. Bibliometric review on the national park tourism management process (adapted and developed from Pickering and Byrne [34]).

2. Materials and Methods

2.1. Data Collection

Data were collected from the Web of Science Core Collection database, which is widely recognized for indexing high-quality scholarly publications across multiple disciplines [35]. To ensure comprehensive and relevant literature coverage, the search strategy was developed through an iterative and multi-phase process involving both theoretical guidance and expert validation.

First, we conducted an extensive literature review of existing publications on tourism management in national parks to identify key themes, terminologies, and trends. A preliminary search string was developed to reflect the core concepts and keywords in the national parks context.

Second, we conducted structured expert consultations to improve the precision and relevance of the keywords and search string. Overall, six experts were consulted. The expert panel included one monitoring specialist from Parks Canada with extensive national park field-based experience; two researchers with PhD degrees in national park management and stakeholder management, respectively; one university professor specializing in protected area recreation and management; and two researchers affiliated with environmental non-governmental organizations. These experts reviewed and provided feedback on the initial list of keywords and the search string structure to ensure the search strategy effectively captured the core dimensions of the research topics while minimizing irrelevant results.

Third, we implemented several pilot searches. During the refinement phase, the keyword combinations and formula were iteratively tested and adjusted to optimize both the coverage (capturing all relevant record) and specificity (minimizing noise) of literature retrieval, ensuring a solid foundation for subsequent analysis.

The final keyword search was formulated in the form of Topic Searches as follows: (“national park”) AND ((“tourism management”) OR (“ecotourism”) OR (“visitor experience”) OR (“visitor satisfaction”) OR (“nature based tourism”) OR (“sustainable tourism”) OR (“visitor service”) OR (“tourism development”) OR (“tourism planning”). We applied this search string to the Web of Science (WOS) core collection and found 3495 publications. After screening this search to exclude opinion articles, editorial materials, book reviews, meeting abstracts, data papers, new items, and notes, we identified 3438 unique pieces of literature for data processing. These document types were selected as they represent peer-reviewed, validated sources of scholarly knowledge. The metadata of the selected Web of Science database was exported as text files and imported to the VOSViewer for detailed analysis.

2.2. Data Processing and Analysis

VOSViewer [36] was used to process the obtained publications. VOSViewer is a software tool intended for constructing and visualizing keywords and author networks. It also offers text mining functions that can be used to visualize co-occurrence networks of keywords in content analysis, as well as a cluster analysis function for keyword classification [36]. This approach was used in our bibliometric review for several reasons. Firstly, VOSViewer visualizes and identifies the bibliometric structure and the author network of our topic, and is especially useful when applied to large amounts of literature [37,38]. Secondly, VOSViewer enables the mapping and clustering of the terms, visualizations of the density of the research keywords, and citation impacts within a particular interest topic [38]. Lastly, the temporal overlay function provided by VOSViewer was used to analyze the keywords with the date of publication and represented network items on a temporal gradient, which gives a temporal perspective in terms of how the research topic evolves [39,40], as well as what is the most recent topic within national park tourism management. In this study, VOSViewer was used to analyze the authors’ network, the co-occurrence keyword network map with temporal overlay, and keyword occurrence by cluster.

A descriptive analysis of the number of publications by year, countries with a distribution map, and scientific journals was also conducted to give a basic background of TM in national parks research. A bibliometric analysis within each topic of TM was specifically performed via individual keyword occurrence network analyses.

2.3. Construction of the Conceptual Framework on Stakeholder Analysis

A conceptual framework is defined as the identification of assumed relationships among key constructs, justified through prior research, tentative theories, or established theoretical and empirical literature [41]. The conceptual framework of national park tourism management was developed to systematically illustrate the relationships among core stakeholder groups. We followed the adapted guidelines proposed by Waldt et al. [42] for constructing conceptual frameworks in social science research, supplemented by established practices from prior bibliometric studies involving conceptual framework development.

The first step involved selecting relevant topics and identifying stakeholder types. This classification was guided by stakeholder theory and informed by a literature review within the context of national park management. Based on the study conducted by Carroll and Buchholtz [43], and adapted to the national park context by Zhang et al. [44], stakeholders were categorized into three groups, including core stakeholders (park managers,

concessionaires, and local community), strategic stakeholders (visitors), and environmental stakeholders (scholars, experts and NGOs). These include all institutions, organizations, and individuals involved in the pre-development and post-maintenance of national park areas (NPAs). A literature review was then conducted to identify relevant concepts and variables, based on established theoretical frameworks such as tourism governance and adaptive management to inform the analysis. After that, by integrating quantitative key-word co-occurrence data with qualitative thematic synthesis, the basic components (boxes, arrows, and lines) were constructed. This was achieved by mapping the numerous elements across the three categories: stakeholders, practices, and performance measures in the tourism value chain. Lastly, to enhance clarity and practical relevance, the draft framework was reviewed by the expert panel. Feedback was used to refine the relationship pathways, thus reducing the complexity and enhancing a holistic view. Furthermore, a tourism management framework was developed to integrate applications for both scholars and practitioners, grounded in the study's findings.

3. Results

3.1. Numbers of Articles Published from 1980–2022

As illustrated in Figure 2, the number and distribution of publications on tourism-related topics in national parks have increased significantly since 1980; there was a notable increase in publications in 2018 and steady growth after. Since 2018, the number of articles published accounted for approximately 37% of all published articles. Because the earliest paper available in the Web of Science database was published in 1980, we chose that for the start year for our analysis.

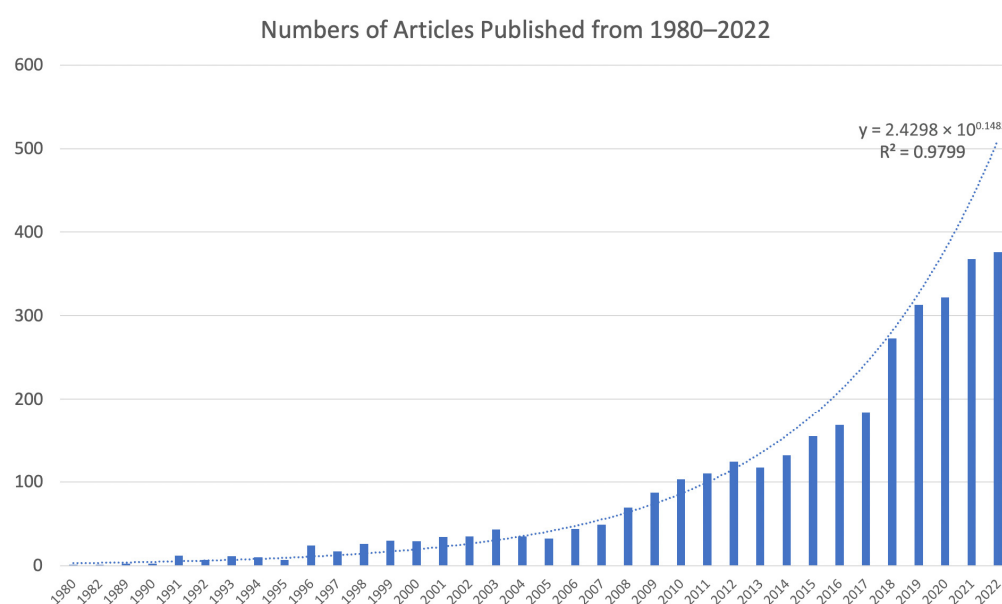


Figure 2. Numbers of articles published by years from 1980 to 2022.

3.2. Country and Region Classification

Based on Figure 3, the United States of America (USA), China, and Australia were the top three countries that had the highest number of publications related to national park tourism management. The total number of publications from the USA was substantially higher than that of other countries or regions, with a total of 937 publications. The number of publications among countries shows no apparent relationship between developing and developed countries, or between publication numbers and geographic regions. Figure 4 presents the distribution of the number of publications by country or region; Asia Pacific

Areas, North America, Western Europe, and South Africa offered the most publications about national park tourism.

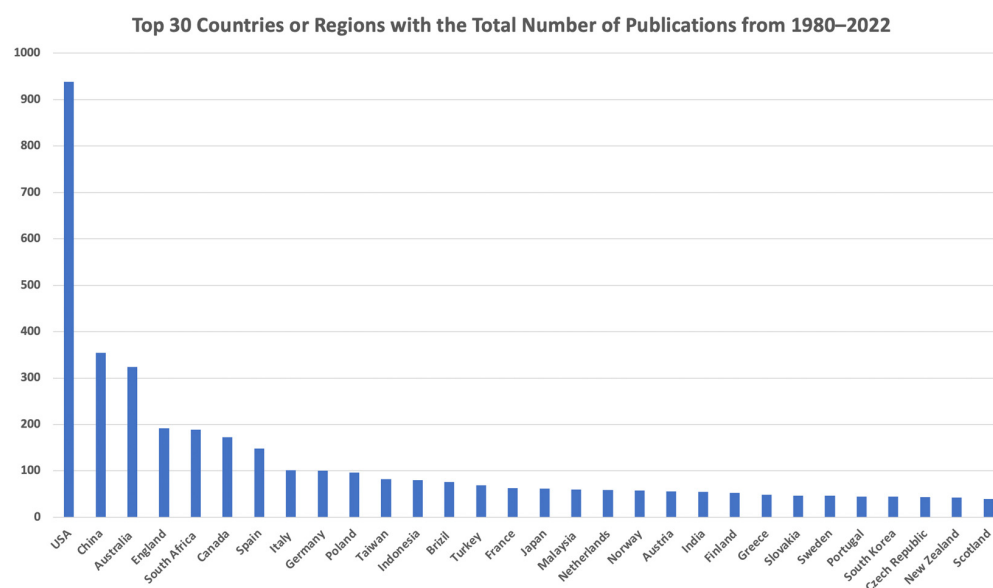


Figure 3. Top 30 countries or regions by total number of publications.

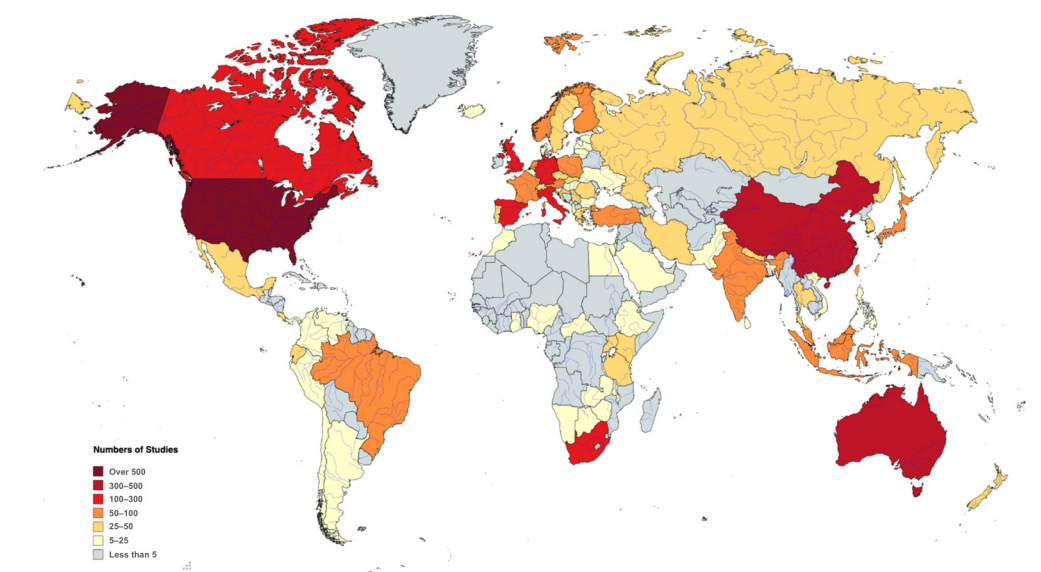


Figure 4. Distribution map of numbers of publications by countries or regions.

3.3. Author Network and Collaboration Analysis

Figure 5 shows the author network map for the selected 3438 articles. The author network has various applications in knowledge diffusion, social network structure and conflict of interest identification, academic influence tracking, and literature synthesis enhancement [45,46]. The node size shown in the figure proportionally corresponds to the weight of the item, which in our case is the frequency of occurrence. The topics and keywords in the total literature are further analyzed below (Section 3.5).

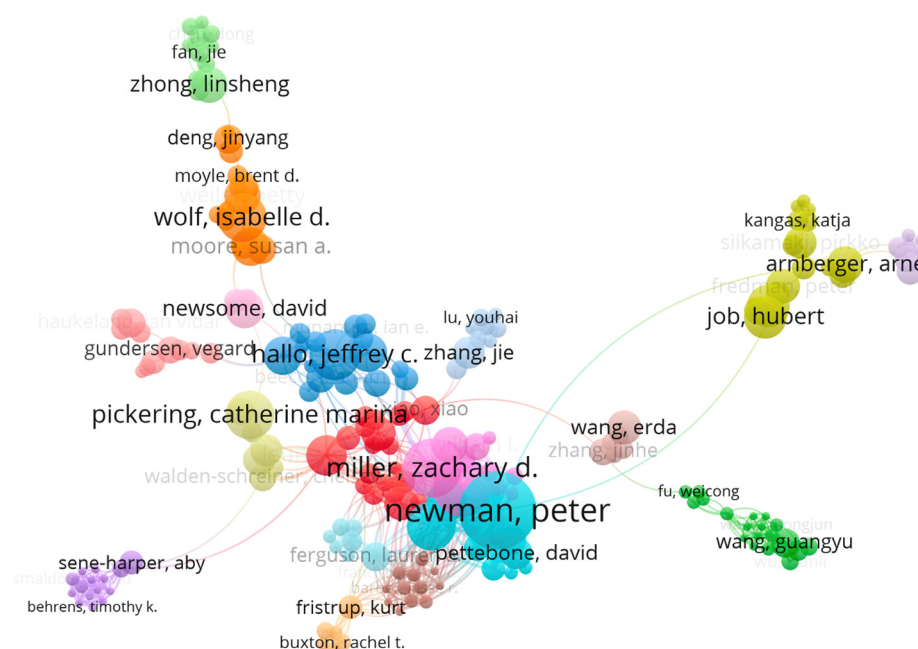


Figure 5. Authors network map generated by VOSViewer. This figure visualizes authors' collaboration. The size of each node (author name) proportionally corresponds to the frequency of occurrence.

3.4. Keyword Co-Occurrence Network Map and Cluster Analysis

Figure 6a visualises the keyword co-occurrence using cluster analysis. The size of each keyword (node) proportionally corresponds to its occurrence in the selected literature. The 94 keywords were grouped into four clusters (Table A1). Cluster 1, as shown in red in Figure 6a, represents the research topics and keywords of tourism, conservation, biodiversity, and wildlife. In this cluster, studies mostly focus on the impacts of national park tourism development on park biodiversity, wildlife, and the ecosystem, as well as park carrying capacity. This cluster includes keywords such as “biodiversity”, “climate change”, “ecosystem”, “effect”, “population”, “risk”, “species”, “threat”, and “wildlife”. The second cluster (green) represents research conducted into sustainable tourism development. Associated keywords include “development”, “protection”, “stakeholder”, “sustainable development”, and “sustainability”. Cluster 3 (blue) represents the research topics and keywords of local community, conservation, and tourism. Studies in this cluster mainly analyze the relationship between visitors and residents, as well as the environmental, social, cultural, and economic impacts of national park tourism on local community. This cluster includes keywords such as “attitude”, “benefit”, “challenge”, “community”, “conservation”, and “conflicts”. Lastly, the fourth cluster, displayed as yellow nodes, contains studies focussing on visitor experience and behavior. Research identified in this cluster addresses the relationships between national park visitor services, infrastructure, facilities, nature, activities, visitors' overall experience and satisfaction, and visitor demand and behavior. Keywords in this cluster include “behaviour”, “experience”, “preference”, “visitor experience”, “satisfaction”, “service” and “questionnaire”.

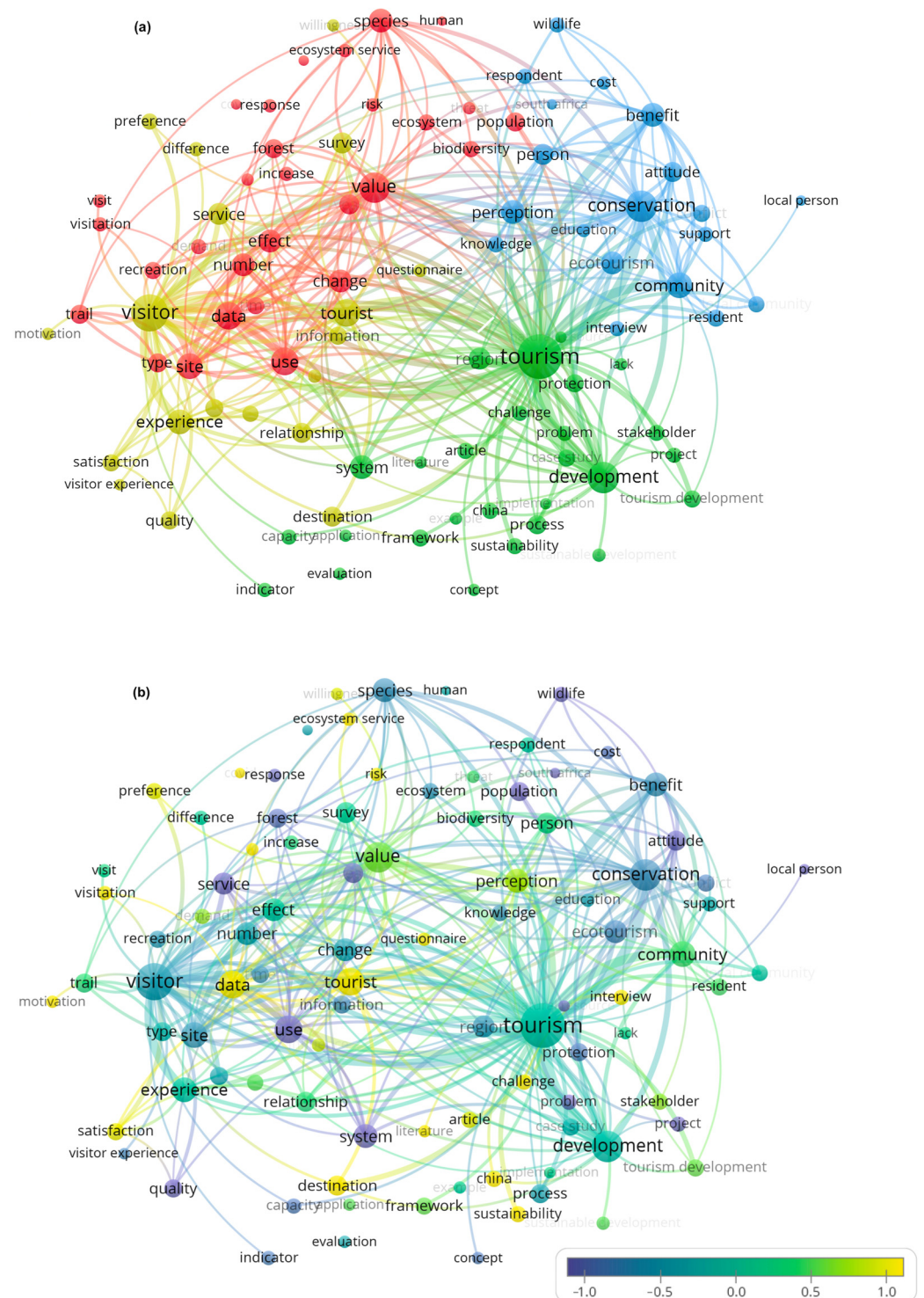


Figure 6. Co-occurrence network map based on literature keywords. (a) Keyword clusters identified by VOSViewer: local community and tourism (blue), visitor experience and behavior (yellow), conservation and tourism development (red), and sustainable tourism development (green). (b) The temporal evolution of keywords. Older topics (purple) focused on population, wildlife, and local people, while recent studies (yellow) focused on data, stakeholders, climate change, and sustainability.

Figure 6b illustrates the temporal changes (from oldest to most recent) of topics and keywords related to national park tourism management; this demonstrates the dynamic nature of how the national park tourism management research topics have developed since 1980. We applied overlay visualization in VOSviewer using the average publication year as the overlay score. The scores were mean-centered by selecting the “subtract mean”

option, which adjusts each keyword's average publication year relative to the overall mean. The resulting values were then normalized to a scale ranging from -1 to 1 , representing the temporal distribution of keywords from earlier to more recent appearances. A color gradient was applied, with purple indicating earlier publications and yellow representing more recent ones. Based on Figure 6b, research related to keywords such as "local person", "population", "service", and "wildlife" was distributed over the -0.1 – -0.5 range, which indicates older research articles. National park tourism management research began addressing topics/themes such as "visitor experience", "conservation", "sustainable development" and "stakeholder". The most recent articles (represented in yellow) are more focused on keywords such as "COVID", "ecosystem service", "sustainability", "climate change", "risk" and "data". Figure A1 presents a detailed timeline illustrating the evolution of keywords over time.

3.5. Thematic Focus and Representative Authors

Table 1 shows the topics, presentative researchers, and detailed aspects regarding national park tourism management literature. It is worth noting that none of the articles that were added after the initial screening included the authors of this paper. Six publication elements were identified based on a comprehensive review of the publications' titles, including (i) visitor experience, (ii) zoning and planning, (iii) budgeting and operation, (iv) tourism and conservation, (v) tourism and local community, and (vi) big data and machine learning in tourism management. Each theme addresses a core aspect of tourism management in national parks. Detailed analysis identifying six prominent research topics was conducted using VOSViewer keyword co-occurrence analysis. This analysis aims to provide an overview of key aspects of tourism management, which are subsequently integrated into the roles and perspectives of each stakeholder for further analysis. By embedding these identified themes within stakeholder-specific contexts, this study offers more practical and actionable insights aligned with their respective responsibilities. In addition, this analysis can further support stakeholders by clarifying the specific dimensions of each theme, thereby assisting in guiding which aspects should be considered in decision-making.

Table 1. Topics and associated detailed aspects generated by VOSViewer for tourism in national park-related research.

Topics	Examples of Authors	Detailed Aspects and Information
Visitor experience	BD Taff, P Newman, AD' Antonio, C Monz, WL Rice, ZD Miller, LA Ferguson, RE Manning, JC Hallo, MTJ Brownlee	visitor satisfaction, tourism development, assessment, interpretation, place attachment, visitor management, outdoor recreation, sustainable management, visitor perception, segmentation, transportation system
Zoning and planning	Y Zhuo, R Cao, Z Wang, W Zeng, T Zhang, B Ma, Q Li, Y Xie, G Hu	recreation planning, stakeholder mapping, mediate wildlife disturbance, human presence, accessibility
Budgeting and operation	I Ruiz-Mallén, MC Sánchez-Gonzalez, E Garcia Frapolli, C Raymond, M Metzger	sustainable tourism, development, good governance, challenge, sustainability, institutional analysis, impact, review, resilience

Table 1. Cont.

Topics	Examples of Authors	Detailed Aspects and Information
Tourism and conservation	P Newman, BD Taff, C Monz, KM Frstrup, A Barros, Y Leung, C Pickering	nature conservation, biodiversity, ecotourism, biodiversity conservation, ecotourism development, sustainability, challenge, willingness, national park, protected area
Local Community	CA Chapman, C Boodman, J Hartter, SK Jacobson	conflict, benefit, local person, assessment, ecotourism development, stakeholder, governance, sustainability
Big data and machine learning in tourism management	E Di Minin, A Hausmann, V Heikinheimo, H Tenkanen, T Toivonen	social media data, COVID, artificial intelligence service, visitor monitoring, crowdsourced geospatial data, recreation, insight, accessibility, evaluation, big data land use change, geotagged photographs, aerial photographs

3.5.1. Visitor Experience and Satisfaction

To provide a deeper understanding of each research theme identified in Table 1, we further analyzed the co-occurrence network results from a theme-specific perspective. The following subsections (Sections 3.5.1–3.5.6) analyze each theme individually, accompanied by visualizations or tables that illustrate the underlying keyword relationships, topic structures, and research focuses. We begin with visitor experience and satisfaction, which is one of the most frequently studied areas within the literature on national park tourism management. Figure 7 shows the co-occurrence network map of keywords for the theme of visitor experience and satisfaction.

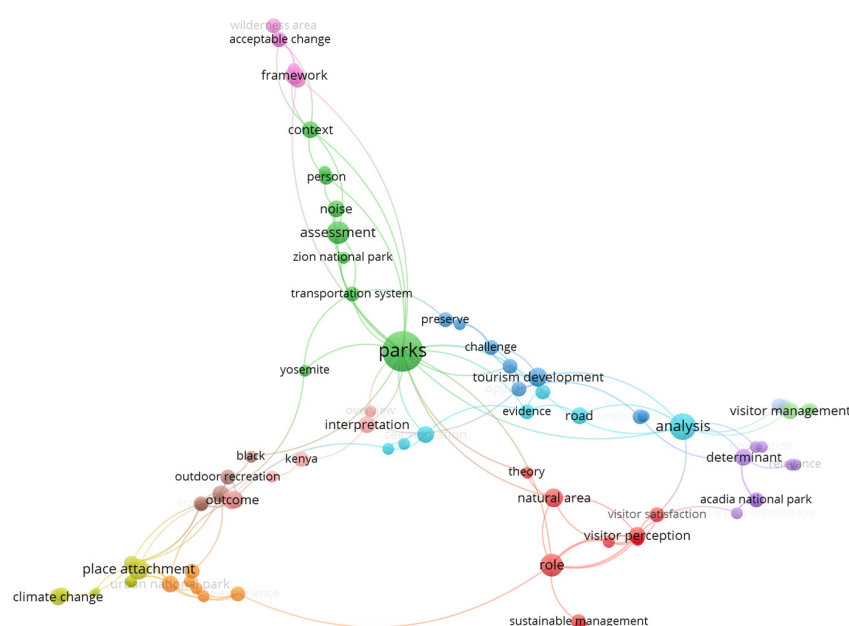


Figure 7. Co-occurrence network map of keywords found in publications for visitor experience. Key clusters include visitor satisfaction (red), transportation system and park accessibility assessment (green), place attachment (yellow), visitor demographics and segmentation (teal), determinants of satisfaction (purple), and limits of acceptable change (pink).

Based on the cluster results generated by VOSViewer, further analysis was conducted and refined to present visitor research focus and detailed dimensions from the aspect of visitor satisfaction and experience. Table 2 was constructed through a two-step method. First, we extracted and categorized high-frequency keywords related to visitor satisfaction and experience from the VOSviewer co-occurrence network (Figure 7). Then, we reviewed the titles and abstracts of representative studies associated with each keyword cluster defined by VOSviewer to derive detailed thematic dimensions.

Table 2. Research focus and detailed dimensions for the research theme of visitor demographics and satisfaction in national parks.

Research Focus	Detailed Dimension
Visitor satisfaction and sustainable tourism management	Visitor satisfaction level for national park's infrastructure, services, facilities, and activities; visitor expectation, perception and experience; environmental, economic and socio-cultural aspects of tourism development
Visitor transportation system and facility assessment	Transit system and alternatives; park accessibility assessment, demand driven planning and management; spatial and temporal distribution of use; transit system noise and soundscape alteration; level of service (LOS)
Place attachment and experience use history (EUH)	Place identity and dependence; visitor perception of social and environmental conditions; depreciative visitor behavior; emotional connection with the site; revisit intention; social bond; past behavior
Visitor demographics and segmentation	Visitor gender; age; residential status; source of knowledge; travel motivation; transportation; duration of stay; visit times; travel group composition; education and employment status; visitor travel behavior; intention to recommend or revisit; marketing and targeting group
Visitor satisfaction determinants	Impacts of visitor demographics and park infrastructure, facilities, services and activities' quality on visitor overall experience; importance and performance analysis
Management and monitoring effectiveness and acceptable change	Limits of acceptable change (LAC); tourism development zone; sustainable tourism development; adaptive management; inventory resources and social condition; smart tourism destinations (STD)

3.5.2. Planning and Zoning

The second research theme focuses on spatial and regulatory dimensions of park management. Zoning is helpful for identifying priority areas for visitor use and for ecosystem protection. VOSViewer generated two clusters for land-use planning and zoning in national parks, including (i) human impacts on wildlife conservation and (ii) recreation planning (Figure 8). It is worth noting that wetlands are identified as a central and individual node in this network, indicating the distinct connection of this to other related sub-topics, such as “human presence” and “accessibility”. This implies those sub-topics are pertinent in discussions regarding wetland environments.

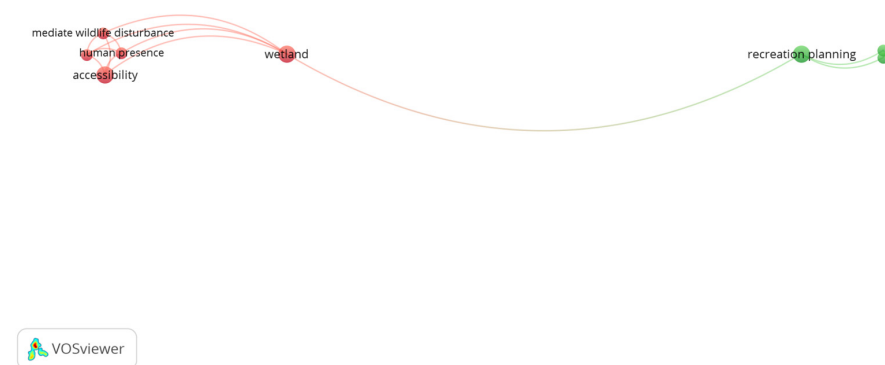


Figure 8. Co-occurrence network map of keywords of aspect zoning and planning. Key clusters include human impacts on wildlife conservation (red) and recreation planning (green).

3.5.3. Tourism Management, Governance and Operation

Following the spatial considerations of zoning, the third aspect within national park tourism management focuses on institutional arrangements and managerial mechanisms that support park operations. Governance and operations research addresses how decision-making structures, stakeholder roles, and concession policies influence the delivery of park services and long-term sustainability. The co-occurrence network results (Figure 9) illustrate some key elements of tourism management in national parks: sustainable tourism development, good governance, impact analysis, stakeholder engagement, adaptive management, monitoring and evaluation. National park tourism management activities include governance, operation, and budgeting, which also involve different park stakeholders, such as visitors, local communities, the government, travel and third-party agencies, and NGOs.

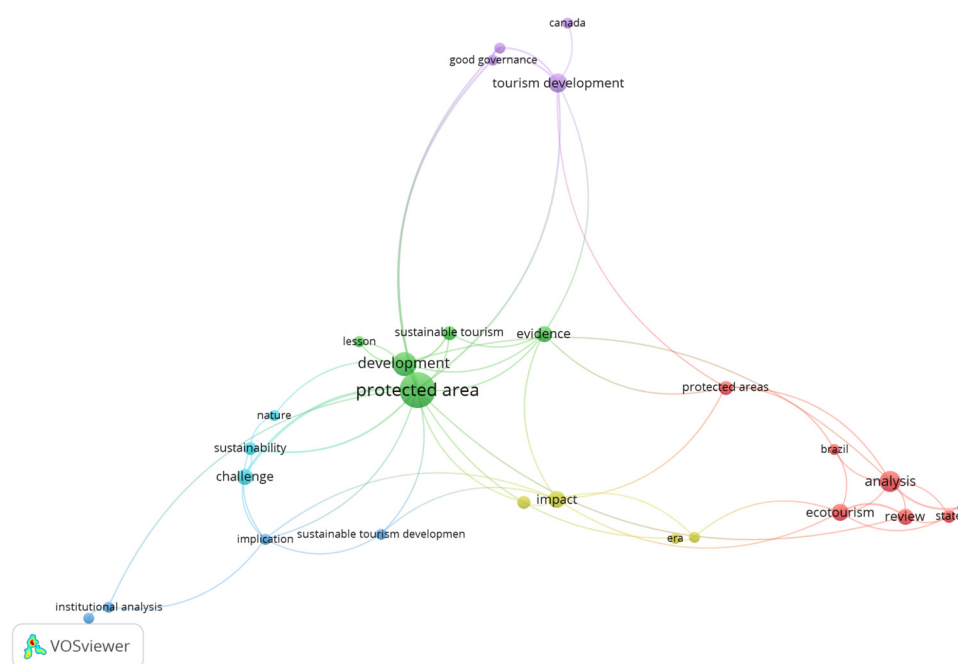


Figure 9. Co-occurrence network map of keywords found in this review with respect to tourism governance and operation. Key elements include sustainable tourism (green), governance (purple), impact analysis (yellow), stakeholder engagement and institutional analysis (blue), adaptive management (teal) and ecotourism monitoring and evaluation (red).

3.5.4. Tourism and Conservation

The next theme relates to the intersection of tourism development and conservation objectives. This research cluster examines how tourism contributes to or conflicts with ecological preservation, particularly in relation to biodiversity, natural resource protection, and visitor impacts on sensitive ecosystems. Figure 10 displays the convergence of conservation and tourism, highlighting the dual role of tourism as both a threat and a contributor to conservation. Key terms include biodiversity, ecosystem pressure, and conservation funding. The co-occurrence map of keywords related to tourism and conservation in national parks identified three important elements: (i) tourism and nature conservation, (ii) tourism and biodiversity conservation, and (iii) ecotourism development and conservation application (Figure 10). Table 3 further summarizes the positive and negative environmental impacts of tourism across core natural components, such as wildlife, ecosystems, water and air, and soil. It is worth noting that tourism development, particularly ecotourism, can have positive impacts on park conservation. Based on the bibliometric review, tourism can bring economic benefits, which may be used to support conservation and biodiversity protection activities and projects. Tourism development in national parks can increase

environmental awareness, shift local mindsets and promote environmentally responsible behaviors amongst visitors and local residents. Visitors can support ecosystem monitoring by reporting illegal activities such as wildlife poaching and human–wildlife conflicts.

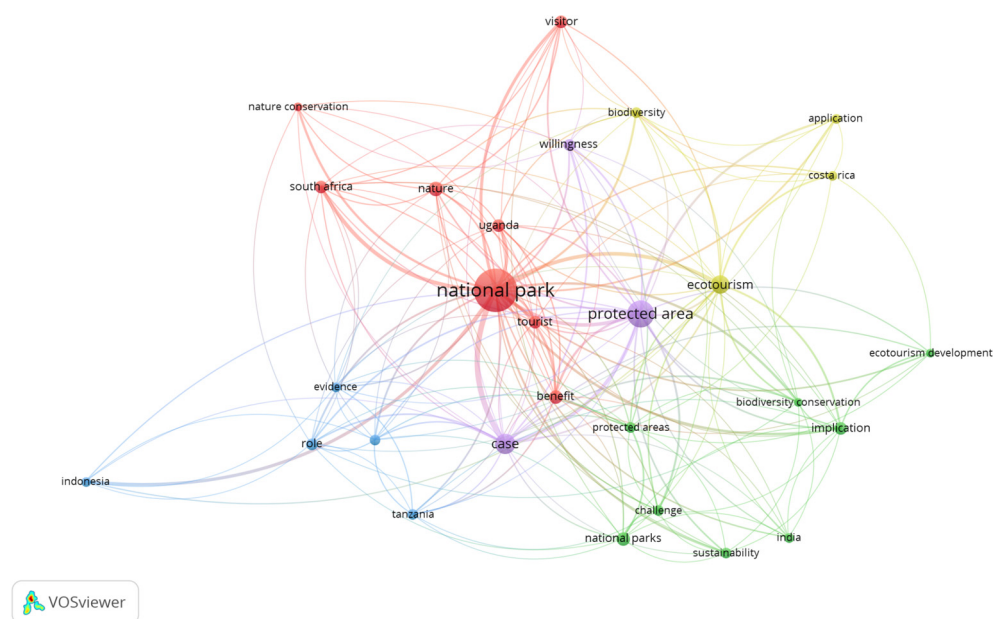


Figure 10. Co-occurrence network map of keywords found in research from the point of view of tourism and conservation. The main clusters include tourism and nature conservation (red), tourism and biodiversity conservation (yellow), and ecotourism development (green).

Table 3. Impacts of tourism on national park conservation separated by natural components.

Component	Negative Impacts of Tourism	Positive Impacts of Tourism
Wildlife	- Visitor activities might change wildlife behavior - Human–wildlife conflicts (e.g., roadkill) - Habitat fragmentation, destruction, or degradation caused by the tourism development - Temporal or spatial displacement from resources (such as food and water) - Introduction of non-native species - Pressure on endangered species - Overfishing and undersized fishing	- Funding for wildlife conservation and research opportunities - Wildlife monitoring and management by visitor self-report - Public awareness and education
Ecosystems	- Tourism-related infrastructure and facilities construction (e.g., hotels, visitor centers, resorts) have direct impacts on the environment - Potential fire hazards and forest fires	- Increase in public interests and funding in ecosystem conservation - Promotion of conservation ethics - Ecosystem-friendly infrastructure and facilities' development (e.g., ecological corridor)
Water and air	- Increased demand for fresh water - Increased litter and sewage - Potential oil and fuel release - Air pollution due to transportation emissions (planes, motorcycles, trains and ships) - Change water course - Decrease in water and air permeability	- Funding for water conservation and infrastructure for water management - Public awareness and promotion for sustainable practices and clean energy solutions

Table 3. Cont.

Component	Negative Impacts of Tourism	Positive Impacts of Tourism
Soils	- Damage to sand dunes/reefs - Soil compaction or erosion - Loss of organic matter and total nitrogen contents - Reduction in soil macro-porosity - Increase in runoff	- Funding for soil conservation - Creation of buffer zones - Soil monitoring and research

3.5.5. Tourism and Local Community

The fifth theme is orientated towards the local community perspective. The co-occurrence network map of keywords (Figure 11) reveals that studies of national park tourism and local communities typically include the following elements: (i) benefits of tourism and development on local communities; (ii) conflicts and potential solutions; (iii) residents' perceptions of tourism; (iv) community participation and stakeholders' involvement; and (v) impacts' assessment and sustainable development.

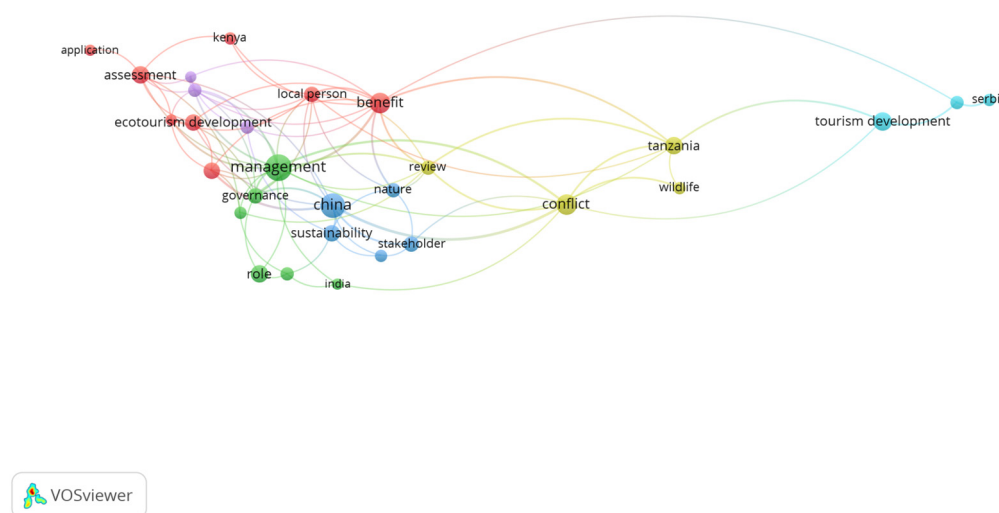


Figure 11. Co-occurrence network map of keywords related to tourism and the local community. The main clusters include the benefits of tourism, regarding benefits for the local community (red), conflicts and potential solutions (yellow) and stakeholder engagement (blue).

3.5.6. Big Data and Machine Learning

The final thematic cluster reflects the integration of technology and innovation in tourism management (Figure 12). One of the major research topics within this area is the use of social media data to conduct visitor monitoring. Currently, social media big data have been used in tourism research to (i) estimate visitation rates and home locations of visitors, (ii) explore spatial and temporal patterns of visitation, and (iii) analyze visitors' experiences, behaviors, preferences, and perspectives.

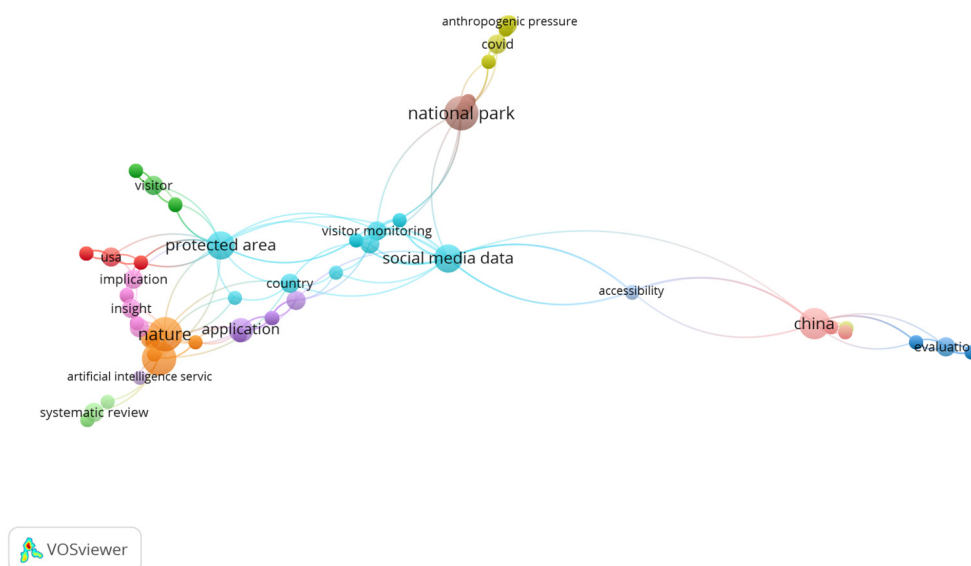


Figure 12. Co-occurrence network map of keywords related to big data and machine learning in national park tourism management. Primary research topics include social media data for visitor monitoring (teal), anthropogenic impacts on environment (yellow), and artificial intelligence application (purple).

4. Discussion

4.1. Strengths, Gaps, and Emerging Blind Spots in the Current Research on Tourism Management in National Parks

A bibliometric analysis can identify and reveal the strengths, limitations, and knowledge gaps of current research by understanding the structure, dynamics, and prevalence of the selected research topic [47–49]. While the research on tourism management in national parks has shown significant progress in various aspects such as the integration of emerging technologies, there are still some critical gaps and blind spots that need to be addressed.

One of the key strengths of the national park tourism management research is its growing number of publications and responsiveness to emerging global challenges. The results show that the associated publications have increased steadily since 1980, with a significant rise in 2018, indicating a recent rise in academic interest in this field. This result is also consistent with those of previous tourism-related bibliometric analyses [50–52]. For example, a bibliometric analysis by Silva et al. [52] revealed that research on protected areas and nature-based tourism published between 2011 and 2021 accounts for 81.82% of all publications over the past three decades. This growth may be explained by an increase in awareness of the importance of biodiversity conservation and sustainable park management [52].

In addition to this quantitative growth, the results for the evolution of research themes also reveal shifts in research interests and focus. Earlier studies emphasized foundational elements and topics related to national parks such as “population”, “local people”, “service” and “wildlife”. Over time, national park tourism research has expanded to include more integrative and contemporary topics related to local environments and sustainability, such as “visitor experience”, “conservation”, and “sustainable development”. Recent research shows a shift towards global challenges and priorities, as well as emerging technologies, with keywords such as “COVID”, “climate change”, “sustainability” and “data”, which increasingly highlight technological innovation and the global sustainability agenda. Previous research also highlighted the increased integration of AI and big data in tourism research [53–55]. This shift represents not only a technical advancement, but also an expansion in analytical capacity in the current research.

However, several research gaps in the spectrum of national park tourism management studies are still evident. Firstly, the global distribution map (Figure 4) of tourism management studies in national parks reveals clear spatial disparities in the research landscape. There is a persistent overrepresentation of case studies from well-known, well-funded and easily accessible parks, predominantly in North America, China, and Australia, such as the Yellowstone and Banff National Parks. Limited research attention has been paid to emerging or under-researched regions in Africa, Southeast Asia, Central Asia, Eastern Europe, and Latin America. This is also consistent with a previous study on nature-based tourism in protected areas [52]. This disparity suggests that current global understandings of tourism dynamics, management strategies, and stakeholder engagement in national parks are disproportionately informed by experiences in well-known and high-profile national parks, which has limited the transferability and generalizability of findings. However, smaller and less well-known national parks, often operating with limited resources and visibility, are especially in need of research attention and context-specific management guidance to ensure their sustainability and long-term resilience.

Additionally, the literature lacks longitudinal and cross-regional comparative studies that monitor visitor behaviors in and impacts on national parks. The most existing research focuses on individual parks or park groups within close geographical proximity, with limited surveys conducted from a continuous temporal or broader regional perspective. Previous studies also pointed out that using promising probabilistic tools and mathematical approaches to examine and explain visitor experience has been largely overlooked in the tourism field [56,57].

This study also reveals the emerging blind spots that need to be urgently addressed. The meaningful integration of Traditional Ecological Knowledge (TEK), cultural values, and community-led management remains underdeveloped, despite their importance for inclusive decision-making processes and sustainable development. Also, the ethical concerns around the use of social media big data for visitor management have received little attention and practical assessment. Recent research has suggested the critical need for a robust framework guiding ethical data management and governance within the tourism and hospitality fields. Without clear standards for responsible data practices, research in certain areas may be constrained in scope, volume, and quality, potentially leading to reduced awareness and engagement from both scholars and practitioners [58–60]. Another blind spot is related to the algorithmic bias and representativeness of social media data, as well as the applications of big data in decision-making processes. To address these research gaps and emerging blind spots, future research should focus on (i) research in underrepresented national parks and social groups such as local indigenous communities, (ii) developing more longitudinal and cross-cultural comparative research, (iii) examining the ethical dimensions of big data use, and (iv) integrating mixed methods approaches such as using ground surveys to validate and calibrate social media big data to enhance their representativeness and ensure they complement each other effectively.

4.2. Interpretation and Implications of Key Research Themes

Visitor experience is one of the most important elements in national park management, as high levels of visitor satisfaction may contribute to the building of visitor loyalty, tourism sustainability, destination competitiveness, local community support and economic development [23,61,62]. The co-occurrence network map of keywords related to this research theme is consistent with those from previous bibliometric studies on tourism management, with keywords such as “visitor satisfaction”, “tourist segmentation”, and “visitor behavior” occurring frequently [52,63]. However, while many studies provide detailed case-based assessments of visitor satisfaction in national parks, there is limited research

synthesizing these insights across diverse national park in different governance system and environmental contexts. Also, studies have yet to fully address gaps in longitudinal visitor behavior, social media engagement patterns, or satisfaction among national parks in underrepresented regions.

Regarding the planning and zoning theme, our result is consistent with the IUCN definition of national parks, which refers to a large natural or near-natural area that protects ecological and biological systems and species and provides recreational opportunities for visitors [13]. However, the specific zoning system or scheme varies among different countries or national parks, with similarities. The overall goal of a national park zoning system among different countries is to preserve natural and cultural resources, while providing recreational and educational opportunities for people. However, specific regulations vary by virtue of the unique environmental, social, and cultural resources of countries and national park management systems. Based on the keyword co-occurrence results, “wetlands” emerge as a central topic of interest because they serve as a critical link between recreational activities and wildlife conservation. Wetlands are ecologically sensitive areas where increased human accessibility can result in direct or indirect impacts on wildlife. Consequently, they become key focal points for managing recreational activities and planning conservation strategies to balance ecological integrity and human use in the context of park planning and zoning. This central positioning highlights the dual relevance of wetlands in both conservation-focused and recreational planning research areas.

Other important aspects of tourism management include governance, operation, and budgeting, which also involve different park stakeholders, such as visitors, local communities, the government, travel and third-party agencies, and NGOs [64–66]. Governance plays a crucial role in achieving sustainable tourism outcomes through coordinated and inclusive decision-making processes [66–70]. Traditional top-down approaches are increasingly challenged by stakeholder conflicts, highlighting the need for inclusive engagement, transparency, and shared decision-making [65,71,72]. Tourism operation includes all services and activities in national parks, including those managed under concession agreements [73]. Concessions enable private sector participation to support visitor experiences and generate revenues when government capacity is limited [74]. Previous studies have found that concessions can support infrastructure, job creation, conservation, community involvement, and adaptive management [75–78]. For example, Yellowstone National Park supports five primary concessionaires that operate accommodations, restaurants, shops, and medical facilities in the park. With respect to conservation, the National Park Service works closely with park concessioners through the Yellowstone Environmental Coordinating Committee (YECC) to provide a comprehensive strategy for park sustainability [79]. Tourism budgeting includes financial planning for park operations, infrastructure, staff, education, and conservation. Comprehensive budgeting supports sustainability by integrating impact assessments, financing mechanisms, pricing strategies, and community engagement [80].

The fourth identified topic is tourism and conservation. Tourism, as a form of development, can be a source of environmental impacts [19]. Theoretically, this research theme is usually regulated by the park mandate and the concept of carrying capacity, which together guide decision-making to balance conservation with visitor demand. Emerging models like Tourism Carrying Capacity Assessment (TCCA) and Limits of Acceptable Change (LAC) are increasingly used to inform site-specific strategies that regulate tourism’s impact on the local environment. Despite the recognition of tourism’s impacts, there remains a lack of integration between conservation biology and tourism planning in much of the existing literature. Future research should focus on how to meaningfully integrate ecological indicators with tourism development through interdisciplinary collaboration.

Another research theme is tourism and local communities in national parks. Often, there are communities within and adjacent to national park areas, and the relationships between national parks and local communities and Indigenous peoples represent an important consideration that affects the effectiveness of national park management [81]. Based on the results of keyword analyses, most research emphasizes tourism's impact on local communities, such as tourism's potential to boost local economies through job creation and infrastructure development, aligning with the real-world relationship between tourism and local communities. For example, tourism in Banff accounts for 90% of the town's economy [82]. Additional benefits include cultural exchange and environmental awareness [83–85]. However, tourism may also raise living costs, cause economic dependency, alter traditional livelihoods, and generate environmental degradation, congestion, and the loss of authenticity [86]. Social and cultural impacts include increased crime, lifestyle changes, and the erosion of heritage due to commercialization [87].

Lastly, with the development of new technologies, national parks have started to incorporate big data and artificial intelligence (AI) into tourism management activities [88–90]. The global use of social media such as X (Twitter), Facebook, Instagram, and Flickr has increased dramatically, and millions of users have generated billions of posts each year on these platforms [91]. National park visitors' social media posts may include photos, texts (captions), and metadata such as timestamps and geotagged coordinates. These data can be used to investigate and understand visitors' behaviors, and can provide evidence of visitors' spatial and temporal patterns within the national parks [92,93]. Another research focus within this area is the application of machine learning (ML) in national park tourism management. For example, Tourism Jasper has been using artificial intelligence to help optimize service operations and enhance visitor experience in Jasper National Park. Tourism Jasper has been building a marketing-orientated dataset with visitor geolocation and demographics data, movement data, hotel occupancy data and financial data in an almost real-time fashion. This machine learning and artificial intelligence information supports monitoring, adaptive management and predictive analytics [94]. Tourism Jasper have also used AI to optimize the opportunity for seasonal hiring and other tourism-related industries' operation, as well as mitigating the negative impacts of tourism on local ecosystems.

Machine learning is a transformative technology, and has been rapidly developing over the past decade [95,96]. Machine learning is usually used in the context of big data in the field of tourism [97]. Artificial intelligence (AI), machine learning (ML), deep learning (DL) and big data are usually connected and mentioned as part of the concept of "smart tourism" [98]. The co-occurrence network map of keywords related to big data and machine learning (Figure 13) indicates that AI and big data-related tourism research have also been applied in the context of (i) environmental impacts and anthropogenic pressures of tourism, (ii) the accessibility of visitor services analyses, (iii) the applications, insights, and implications related to tourism management, and (iv) tourism management evaluations. This is consistent with the literature on big data analytics and sustainable tourism [99]. China has published the most articles related to big data and machine learning in national park management, which is also consistent with the previous research on the related topics [99].

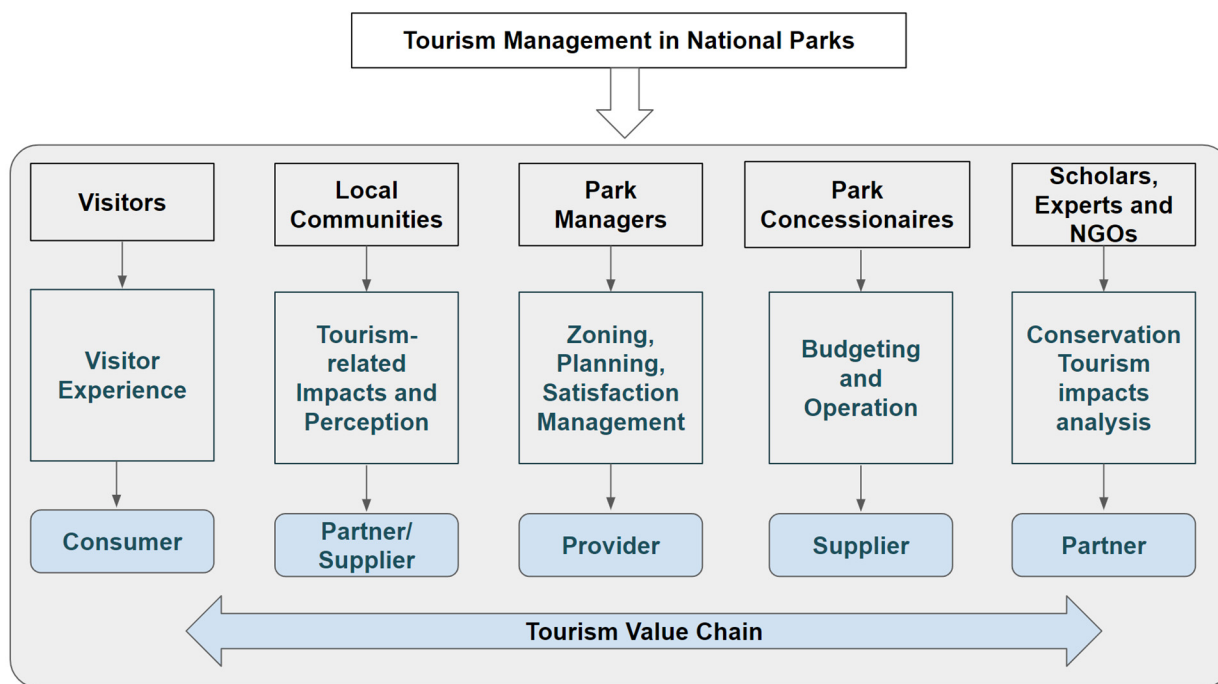


Figure 13. Conceptual framework of the national park stakeholders and tourism value chain.

4.3. Regional Diversity and Patterns in National Parks Tourism Management Under Different Governance Models

Tourism management in national parks varies significantly across global regions due to differences in governance models. There are three main types, including direct federal (central) control, local autonomy, and joint management. The United States and Canada represent countries that have adopted the federal control governance system with a top-down model for national park management, characterized by a centralized structure led by a national-level agency, such as the U.S. National Park Service (NPS) and Parks Canada. In this model, the central government plays a dominant role in developing policies, regulations, and operational standards, while state/province and local agencies operate under a hierarchical framework. These agencies must follow the federal laws and policies, ensuring consistency, stability, and a unified national park identity and mandate [100–102]. This system provides a robust framework for park protection, management, and sustainable development. In the context of national park tourism management, the centralized governance model allows for standardized visitor services, facility and infrastructure development, and conservation practices. However, it may limit the flexibility of local agencies to adapt tourism management strategies to regional needs or emerging visitor trends.

Countries such as Germany have adopted an autonomous model for national park management. In this system, there is no unified central or national agency; instead, each national park is managed by its respective regional authority. While the federal government provides overarching guidance, each state is responsible for park management and operations [102]. This model offers high administrative flexibility, allowing regions to develop park-specific tourism management strategies [103]. As a result, tourism management can be more adaptive and community-oriented, with services and experiences aligned to regional conditions. However, the absence of a unified national agency can result in fragmented policies, inconsistent visitor service and infrastructure standards, and the unbalanced development of a coherent tourism identity. Funding constraints combined with a lack of national coordination can make it difficult to support large-scale initiatives and build a unified tourism strategy [104].

Between the centralized and autonomous models is the joint management approach, represented by countries such as the United Kingdom, Australia, and South Africa [105–107]. This hybrid model combines centralized oversight with a degree of local autonomy. A national-level authority is responsible for setting unified management policies, regulatory frameworks, and funding mechanisms, and for projecting a cohesive national identity. At the same time, regional park agencies retain moderate decision-making power, enabling them to establish context-specific administrative structures and exercise flexibility in operational level management. In terms of tourism management, the integrated model allows for consistency in service standards and national branding while enabling localized adaptation to visitor needs, cultural contexts, and ecological conditions. However, aligning national policies with local priorities can be complex and challenging. Differences in interpretation, priorities, or implementation may lead to conflicts, inefficiencies, or delays in tourism-related initiatives.

4.4. National Park Tourism Management Conceptual Framework

The conceptual framework was constructed against the theoretical background of tourism management in national parks (Figure 13). To connect and bridge the conceptual framework with practical application, stakeholders are taken as the core of our conceptual framework classification because the successful integration of national park management depends on stakeholder interactions [108]. Collaboration between park stakeholders in tourism management can reduce conflicts, encourage meaningful decision-making processes, and assist in achieving park management mandates and objectives [109]. It is important to understand the roles of each stakeholder and their relationships in order to conduct effective practices [110], as well as to identify the management implications and recommended actions for each stakeholder group. Because a tourism value chain is defined as a system of different stakeholders involved in collaboration to provide visitors with the best experience that a destination can offer [111], it is important to involve key stakeholders in collaborative planning and operation in national park tourism management.

Under the context of tourism management in national parks, five stakeholder groups were identified and analyzed, including (i) visitors, (ii) local communities, (iii) park managers, (iv) park concessionaires, and (v) local ecologists, social scientists, and NGOs. Our conceptual framework illustrates the relationships between stakeholder groups and research areas, and identifies the different roles they play in the tourism value chain. The implementation of these management applications should take into account the diversity of governance systems across national parks, drawing on the earlier discussion of regional variations as a reference.

Visitors, as the primary consumers in the tourism value change, are strategic stakeholders whose satisfaction, behaviors, and perceptions are influenced by certain conditions, and who are central to adaptive management approaches. Our study highlights how visitor satisfaction is co-constructed through interactions with service providers, the physical environment, and other stakeholders. By integrating visitor experience theories and frameworks, such as expectancy-confirmation theory, which suggests that satisfaction is influenced by the extent to which visitors' expectations are met or exceeded [112], managers can better design, evaluate, and adapt services to improve visitor outcomes and long-term engagement. In assessing service quality, it is of great significance for a park that other stakeholders follow the visitor experience management framework, such as SERVQUAL [113] and ECOSERV [114], which provide structured approaches to evaluate service delivery across tangible and intangible dimensions, including reliability, responsiveness, assurance, empathy, and environmental responsibility. Additionally, the Theory of Planned Behavior (TPB) can provide a lens to understand pro-environmental actions

by linking attitudes, social norms, and perceived control with behavioral outcomes [115]. Together, these frameworks support a dynamic and evidence-based visitor management approach that endows park managers with adaptive planning, enhances experience quality, and achieves sustainable park management.

Park managers are a core stakeholder group, and play a critical role in park zoning, planning, tourism satisfaction management, budgeting, operation and supervision [43,44]. This stakeholder group also plays a critical role in balancing tourism development with local conservation efforts, mediating conflicts and distributing benefits between tourism activities and local communities, and overseeing the development of park concessionaires in alignment with environmental sustainability goals. Therefore, environmental communication plays a vital role in the responsibilities of park managers, facilitating the translation of complex ecological knowledge into accessible messages that engage visitors and other stakeholders. Drawing on principles from environmental communication theory [116], park managers can enhance public understanding, foster stewardship behaviors and stakeholder engagement, and improve alignment among stakeholder interests.

Local communities are another core stakeholder group that share the same land base with park visitors, with mutual cultural, economic and social interests. A previous study highlighted the challenges involved in managing the relationship between local communities and visitors in national parks [44,84,117,118]. Therefore, solving the conflicts through a collaborative process such as community-based co-management (CBCM) is important. Community-based co-management (CBCM) is a collaborative approach whereby multiple stakeholders share decision-making, planning, rights, and responsibilities in natural resource management. It also fosters community participation and enhances community ownership and stewardship in national park governance [119].

Park concessions are part of visitor services and facilities' operations, and play the supplier role in the tourism value chain. They also have a benefits-sharing relationship with visitors and local communities. Previous research has recommended areas of focus for management regarding concessionaires in national parks, including variety, natural experience, retail benefits and experience, price regulations, and visitor satisfaction [120]. Lastly, local ecologists and social scientists, cultural heritage professionals, and NGOs, as environmental and social stakeholders, provide knowledge and theoretical references to assist in park planning and land utilization, and ensure the utility, feasibility and efficiency of scientific results [109].

In summary, at the consumer end, visitors shape demand and provide feedback that influences service quality and park planning. Local communities serve as both partners and suppliers, offering local services and cultural experiences while also being impacted by tourism. Park managers act as providers, overseeing zoning, planning, and visitor satisfaction to coordinate the overall tourism system. Park concessionaires, as key suppliers, deliver operational services such as accommodation, food, and recreation. Scholars, experts, and NGOs function as partners in the chain by supplying research, monitoring, and conservation insights that guide evidence-based decision-making. This value chain highlights the interdependencies among stakeholders, whereby inputs (e.g., policy, services) flow toward creating visitor experiences, and outputs (e.g., feedback, impacts) inform continuous and adaptive improvement. Stakeholder collaborations across the chain ensure more sustainable and adaptive national park tourism management.

We offer several recommendations to strengthen stakeholders' relationships with national park tourism management, and to support the use of machine learning and big data in assisting different stakeholders in decision-making and monitoring (Table 4). Visitors can drive economic benefits and employment, but their activities also impact local social, cultural, and ecological environments. Their experiences can be managed from a

bottom-up adaptive perspective, while proactively mitigating negative impacts on local social, cultural, and ecological environments. From the residents' perspective, successful management should actively involve local communities as authentic co-creators of visitor experiences, promoting their engagement and participation in adaptive tourism planning and management partnerships. Park managers should facilitate visitor services, adopt collaborative approaches with stakeholders, and use structured top-down planning and zoning methods to resolve conflicts, regulate activities, and manage park resources and services sustainably and effectively. Concessionaire partnerships can be encouraged to enrich visitor experiences by offering high-quality commercial services, promoting local culture, and engaging local communities while contributing responsibly to park operations and budgeting. Lastly, it is recommended to incorporate big data and AI techniques to assist in decision-making. Specifically, these tools can assist in estimating visitation rates, analyzing visitor experiences and behavior patterns, modeling visitation patterns and impacts, and planning sustainable tourism strategies.

Table 4. Proposed recommendations for stakeholders' relationships in national park tourism management.

	Visitors	Local Communities	Park Managers	Park Concessionaires
Visitors	-	Provide employment Generate economic revenue Impacts on local social, cultural and ecological environment	Bottom-up adaptive visitor experience management	Provide economic benefits, participation and involvement
Local Communities	Provide local authenticity Experience co-creator (supplier)	-	Bottom-up adaptive management in tourism planning	Co-partnership, provide employee support
Park Managers	Provider and facilitator for visitor services and activities, planning and zoning	Collaboration in tourism planning and management, top-down decision-making process, solving conflicts	-	Governance, operation and budgeting, provision of employment, support, supervision and regulation
Park Concessions	Supplier for visitor experience	Promote local food and culture, co-partnership, local community engagement	Provide commercial services, support, operation and budgeting	-
Big Data and Machine Learning	Estimate visitation rates, explore spatial and temporal patterns of visitation, analyze visitor's experiences	Assist in local environment conservation, provide insights for economic revenue and planning of tourism	Provide the environmental impacts and anthropogenic pressures of tourism, and accessibility of visitor services analysis	Provide information on patterns of visitor preferences, behaviors and activities

Lastly, we constructed a tourism management framework for national parks by synthesizing the results from the bibliometric analysis and content analysis, illustrating the roles of both scholars and practitioners in tourism management and how they complement each other (Figure 14). This framework emphasizes the importance of integrating research and practitioners to ensure the adaptive, sustainable, and inclusive management of visitor use, park resources, and emerging technological opportunities and challenges. This is structured with three main components, including theoretical advancement, operational management, and collaboration with adaptive management. In the stage of theoretical advancement,

scholars' roles include identifying research gaps and building theoretical foundations that support adaptive management in national parks. Park managers therefore translate literature and theory into practice through governance, monitoring, and evaluating. Lastly, the continuous integration of scholars and practitioners with various stakeholders can ensure the relevance of research and facilitate adaptive management. As national parks face increasing pressures from increasing demand, technological shifts, and climate change, this integrative framework offers a path toward sustainable park management.

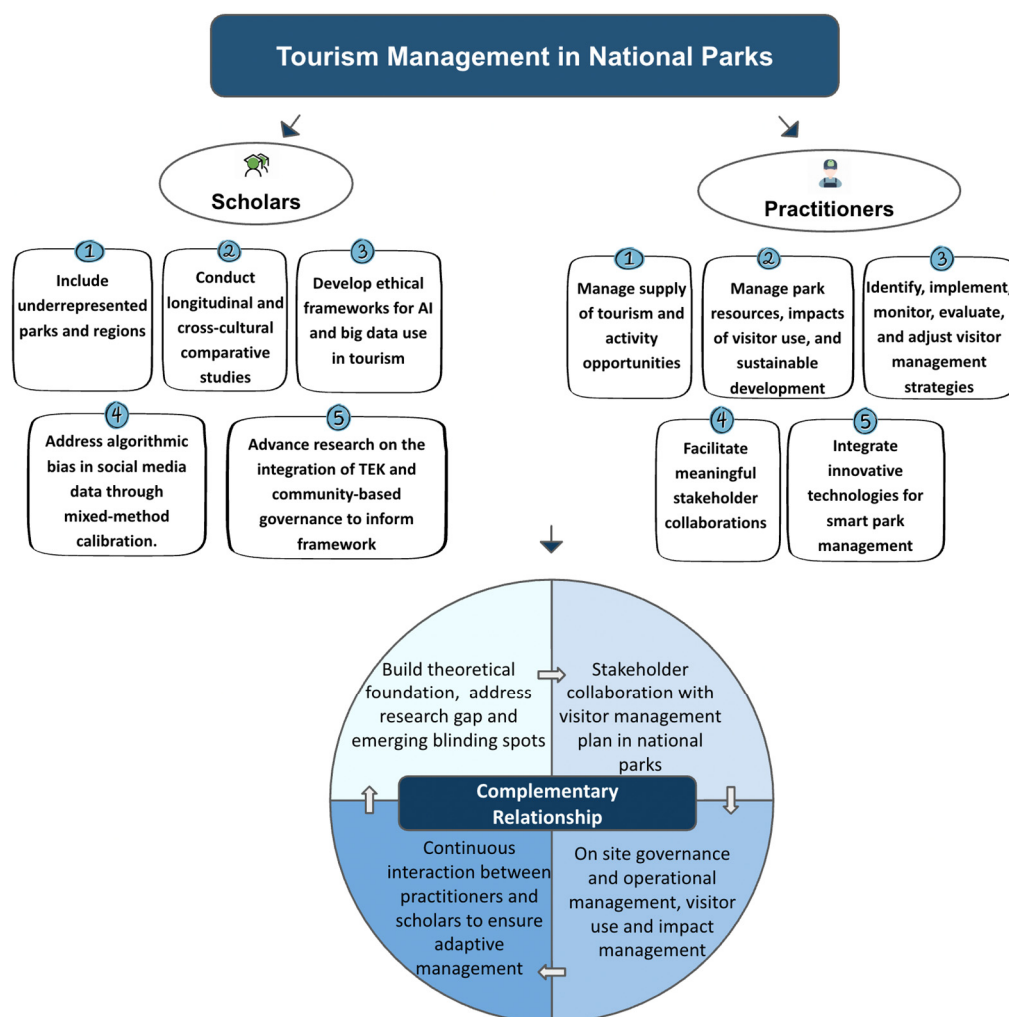


Figure 14. Integrated framework of tourism management in national parks.

5. Conclusions

This paper provides a bibliometric review with a content analysis of literature on national park tourism management on a global level, as well as a conceptual framework to provide management recommendations and implications for park stakeholders. The results show that the level of annual publication has been increasing since 1980. The United States, China and Australia were the top three countries that had the most publications. Four research clusters were identified, including tourism and conservation, sustainable tourism development, local community and tourism, and visitor experience and behavior. Over time, research emphasis has evolved from population- and community-level concerns to more integrative topics such as stakeholder engagement, climate change, and sustainable tourism practices, as well as the integration of emerging technologies and increased responsiveness to global challenges.

This review has also proposed a conceptual framework and detailed management recommendation for each stakeholder with the concern of how we can best manage national park tourism in an uncertain future and with increasing conflicts of interest. For park stakeholders, our findings emphasize the necessity of a strategic collaboration framework that can minimize conflicts and foster sustainable and adaptive tourism practices. Park managers play a critical role in zoning, planning, budgeting, and supervising tourism and concession activities. Implementing data-driven decision-making through AI and big data can significantly enhance management efficiency and visitor satisfaction. For local communities, their socio-cultural, economic, and ecological environments are directly impacted by tourism development and activities. On the other hand, they are also the co-creators of the tourism experience. Therefore, effective engagement and adaptive management strategies are crucial for balancing tourism development and community benefits. Park concessions, as providers of visitor services, need to integrate local cultural and ecological aspects into their offerings to enhance visitor experiences and support local economics. Lastly, government agencies must consider the broader implications of national park tourism management, including policy development that supports sustainable practices and stakeholder collaboration. Government agencies can facilitate the incorporation of advanced technologies such as AI for better monitoring and predictive analytics, which can inform policy decisions and ensure the protection of natural resources. Overall, effective tourism management relies on participatory models like community-based co-management and the use of environmental communication to align diverse interests among stakeholders.

This review highlights the dynamic evolution of research topics in national park tourism management. Based on the analysis on research gaps and emerging blind spots, future research should continue to explore the integration of emerging technologies and their implications on tourism management with clear standards on the use of social media big data and ethical regulations. Additionally, there is a need for more cross-disciplinary studies that address the complex interactions between visitors, local communities, and the natural environment, particularly in underrepresented national parks in Africa, Southeast Asia, Central Asia, Eastern Europe, and Latin America. Further investigations into the long-term impacts of tourism on biodiversity and climate change will be essential for developing resilient and adaptive management strategies, with the meaningful incorporation of Traditional Ecological Knowledge (TEK). Also, investigating the long-term impacts of COVID-19 on national park tourism, along with applying lessons learned to enhance preparedness for future health crises, is crucial for guiding future research directions. Lastly, there is an urgent need to develop an ethical, mixed-methods framework to support longitudinal and cross-regional analyses of visitor behavior and tourism management. This approach should integrate social media big data with ground survey methods to enhance data representativeness, mitigate algorithmic bias, and ensure methodological complementarity.

In summary, this study underscores the importance of a holistic and collaborative approach to tourism management in national parks. By synthesizing the results from bibliometric reviews and content analyses, we provide a robust framework for understanding and managing the diverse challenges and opportunities in this field. Stakeholder engagement, technological integration, and policy support are critical for achieving sustainable tourism and conservation goals in national parks worldwide. Lastly, further work should also focus on providing more recommendations for national park planning and government policy in the context of likely future extrapolation. This review recommends strategic stakeholder collaboration, adaptive management practices, and the integration of big data and AI-driven decision-making to improve management effectiveness. Future research should incorporate the ethical integration of emerging technologies, cross-disciplinary studies in underrepresented parks, and the meaningful incorporation of TEK. One limitation of

this study is that, as a bibliometric review, it primarily relies on metadata (titles, abstracts, and keywords) to provide a broad overview of research trends, which may overlook the detailed insights offered in full texts. To address this, a future systematic review will be conducted to provide a more in-depth analysis based on a smaller set of selected articles through comprehensive full-text review.

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Appendix A

Table A1. Keyword occurrence by cluster generated by VOSViewer.

Cluster 1 (Red) Tourism and Conservation, Biodiversity and Wildlife	Cluster 2 (Green) Tourism Development	Cluster 3 (Blue) Local Community and Tourism	Cluster 4 (Yellow) Visitor Experience and Behavior
biodiversity	application	attitude	destination
change	article	benefit	difference
climate change	capacity	community	experience
COVID	case study	conflict	implication
data	challenge	conservation	influence
demand	China	cost	information
ecosystem	concept	ecotourism	manager
ecosystem service	development	education	motivation
effect	evaluation	interview	preference
forest	example	knowledge	quality
human	framework	local community	questionnaire
increase	implementation	local person	relationship
individual	indicator	perception	satisfaction
number	lack	person	service
population	literature	resident	survey
recreation	natural resource	respondent	tourist
response	problem	South Africa	visitor
risk	process	support	visitor experience
site	project	wildlife	willingness
species	protection		
threat	region		
time	stakeholder		
trail	sustainability		
type	sustainable development		
use	system		
value	tourism		
visit	tourism development		
visitation			
year			

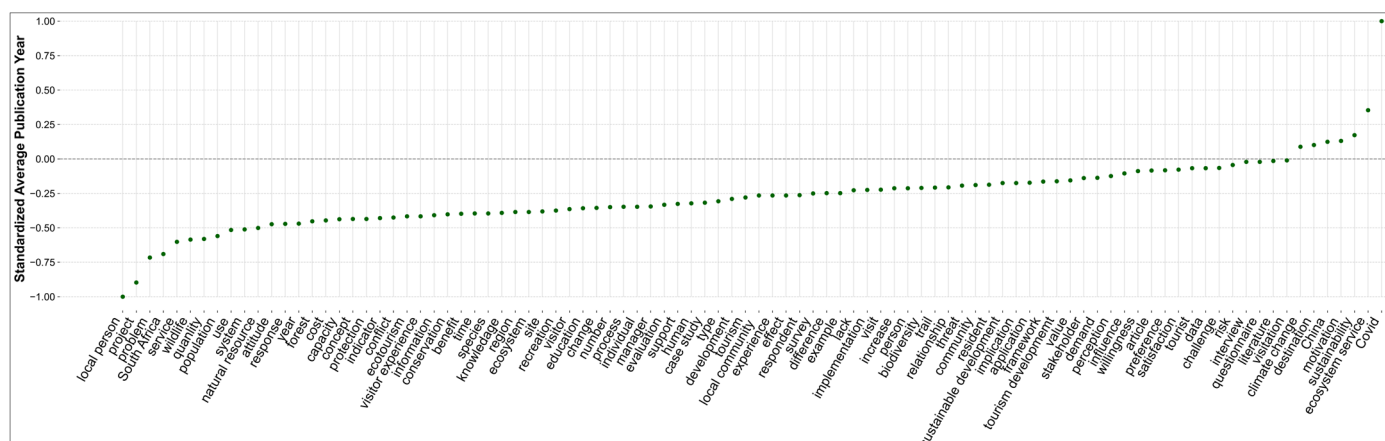


Figure A1. Keyword evolution timeline from -1 (oldest) to $+1$ (newest).

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