Research progress and hotspot evolution analysis of wildfire disasters in national park communities

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Abstract. In recent years, wildfire disasters have had an essential impact on national park communities' social, economic, and ecological structure, which has gradually become the forefront of academic attention. Therefore, to review the research history of wildfire disasters in national park communities, this paper used CiteSpace and Bibliometric R analysis tools to conduct a detailed analysis of 328 kinds of literature in the Web of Science database from 2002 to 2023. The data showed that the number of papers published was rising, and the subjects involved included ecology, botany and zoology. However, there is still a need for increased collaboration among the collaborating groups of authors, institutions, and countries. From the perspective of the research content, it mainly focused on the mathematical model and established a comprehensive database to simulate and predict wildfire disasters. Finally, we predict a future research direction using keyword clustering and burst detection -the management framework for wildfire disaster risk prevention. The key points include improving the governance mode of the country, community and enterprise and improving the simulation and prediction ability of mathematical models. This study provided a reference for promoting wildfire hazard risk identification and management in national park communities.

Keywords: Wildfire Hazards 1, National Park communities 2, Bibliometric R 3

1. Introduction

As global climate warming accelerates, deforestation and human activities exacerbate, wildfires have become a progressively serious threat worldwide [1,2]. Wildfire hazards can be caused by lightning, volcanic activity [3], natural triggers, or human causes [4](such as arson, bonfires, discarded cigarettes, or burning debris) that alter natural environmental systems (Earth systems) and affect socioeconomic systems[5,6]. National park communities are particularly vulnerable to increasing wildfire hazards due to their proximity to wildfire-prone areas [7]. These communities rely heavily on the park's natural resources for their livelihoods, including tourism [8]、livestock [9]、hunting [10]、agriculture [11] and forestry [12]. Wildfire-induced alterations in national parks' natural systems inevitably impact their socioeconomic development.

Therefore, in order to prevent wildfires from having more negative impacts on animal husbandry, agro-forestry production and transportation, human health and natural ecosystems around communities in national parks, different national park communities have proposed different wildfire disaster management strategies based on their unique geographic environments and management policies [13]. For example, Yellowstone National Park in the United States has implemented a policy that allows natural wildfires to burn, protecting its ecosystem that depends on wildfires [14].In contrast, Kakadu National Park in Australia uses prescribed burning practices early in the dry season to reduce fuel loads and prevent serious wildfire danger later in the dry season [15].In Spain, the Peneda-Geres National Park uses a community-centred approach to encourage local communities to manage natural ecosystems traditionally to reduce fire risk [16]. Wildfire disaster management varies widely among national park communities [17,18]. These management differences reflect the role and

impact of wildfires in natural ecosystems and the critical role that national park communities play in meeting diverse social needs and addressing the daunting challenges of global climate change. To clarify the impact mechanism of wildfire disasters on national park communities and different wildfire disaster management measures in national park communities will be more conducive to improving the adaptability of national park communities to cope with wildfire disasters, strengthening the operation of community social and economic system, and alleviating the contradiction between people and land in national parks to a certain extent.

Significant progress has been made in studying the ecological impact of wildfires, and the characteristics, ecological models, occurrence patterns and overall impact on the Earth system of wildfires have been studied in depth [19]. However, applied research on wildfire hazards in national park communities still needs to be more comprehensive to specific disciplines. Lack of a comprehensive way to enhance understanding. Therefore, our study will use CiteSpace and Bibliometric R to conduct a detailed and systematic review of the global literature on wildfire disasters in national park communities from 2002 to 2023 in order to identify key research areas and address literature gaps and provide a reference for safeguarding the national park community economy, residents ' health, etc.

2. Materials and Methods

This study used the Web of Science Core Collection (WOSCC) database to collect relevant literature from 2002 to 2023. The deployed search algorithm is shown in Table 1, and 1,184 academic papers were generated. However, since the keyword ' community ' contains multiple meanings in English retrieval, it is necessary to use the citation topic filtering method to screen out the topic literature with a high correlation with the research content of this paper. After reviewing the relevant literature, this study finally selected the literature under the four themes of ' pasture ', ' 1594 forest fire ', ' deforestation ', and ' ecosystem services ', a total of 328 papers.

Table 1. The National Park Community Wildfire Study from 2002-2023 is presented in the WOSCC database

Serial number	Search formulation	Retrieving results
1	TS=("wildfire" OR "forest fires" OR" hill fire" OR "fire" OR "mountain fires" OR "forest fire in the mountains" OR "bush fire" OR "wildfires")	135332
2	TS=("National Park " OR "National Parks" OR" protected areas" OR "protected area" OR "natural protected area" OR "nature reserve" OR "protected field" OR "protected fields" OR "shelter" OR "protective ground" OR "protected cultivation")	90953
3	TS=("community" OR "communities" OR "community farmers" OR "local community" OR "local residents" OR "community resources" OR "community resource" OR "community resilience" OR "Indigenous communities")	1224859
4	DT=(Article OR Review)	31116871
5	LA=(English)	45690970
6	#5 AND #4 AND #3 AND #2 AND #1	1148
7	#5 AND #4 AND #3 AND #2 AND #1 and 3.40.838 Rangelands or 3.40.1598 Forest Fires or 3.40.635 Ecosystem Services or 3.40.627 Deforestation	328

Cite Space is a free Java application for visualizing and analyzing literary trends [20,21]. This study uses Citesapce to draw a trend map of interdisciplinary flow. It combines EXCEL and origin software to draw a trend analysis map of the number of publications and the publication team (author, institution, country).

Bibliometrix R Package is an open-source R-based tool developed by Aria [22] and is famous for its scientific mapping ability. In addition, it also provides a variety of toolkits that provide full-process bibliometrics and visualization of scientific literature [23]. This study uses the Bibliometrix R Package to draw the publication team cooperation clustering map, Bradford's law map, strategic map, keyword clustering and burst detection map.

3. Results

3.1. Trend analysis of the number of published documents

The WoSCC database records academic research on the impact of wildfires on national park communities that began in 2002. As shown in Figure 1, annual publications are generally on the rise. 2013 and 2022 are essential nodes on this timeline, and academic output has increased significantly in these two periods. We divide the period into four independent stages according to the growth and citation rates. The first stage (2002-2011) is the embryonic stage of research in this field, characterized by a limited number of publications (less than 15 per year) and fluctuations in a small area. The next stage, the second stage (2011-2016), indicates increased publications. However, in contrast, the number of citations is decreasing. As we enter the third phase (2016-2020), we see continued publication growth, with a slight increase in citation rates, indicating a steady growth in research prospects. The last stage, the fourth stage (2020-2023), is remarkable for its continued increase in publications and peaked in 2021. Paradoxically, this period also led to a decline in the citation rate.

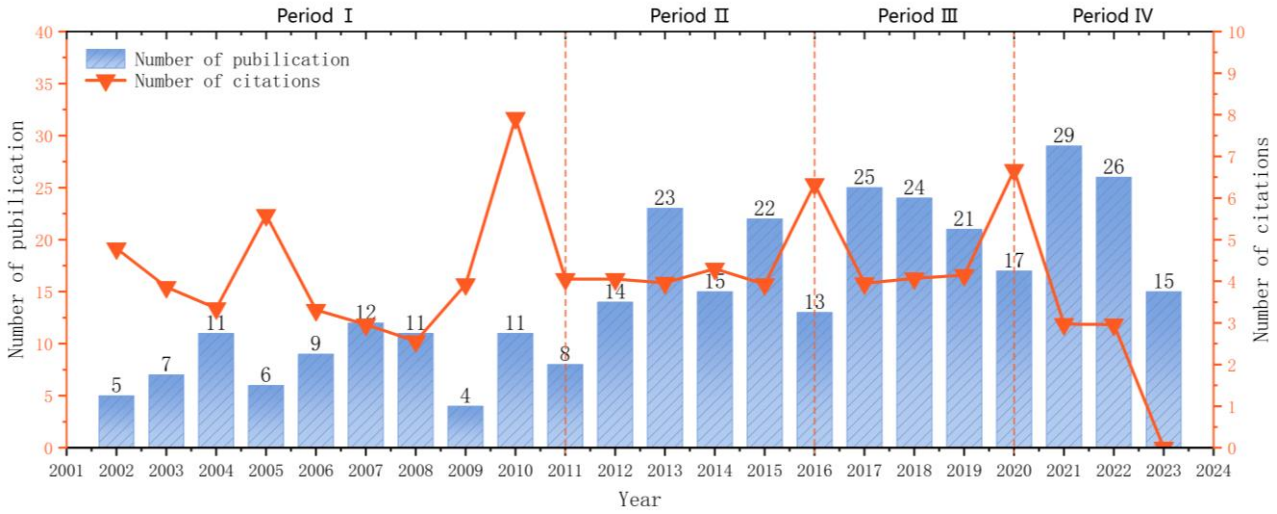


Figure 1. Annual Trend of Papers and Citations Related to Wildfire Disaster Research in National Park Communities

3.2. Inter-disciplinary flow trends and Bradford's Law

As shown in Figure 5, we can intuitively find the interdisciplinary knowledge pedigree and theme evolution from the inter-disciplinary flow trend map. The map on the left shows the research publications, while the map on the right lists the references and links according to the citation relationship[24]. The double-map superposition of the research on the impact of wildfires on national park communities shows a main citation path. The ecology, geography and marine group journals are cited in the plants, ecology and zoology journals. The Z value is 6.555832, and the f value is 27708, which reflects that the research on the impact of wildfires on national park communities involves multidisciplinary integration. However, only one isolated citation path also shows that the research on the impact of wildfires on national park communities needs to be further strengthened in future development—interdisciplinary integration and application.

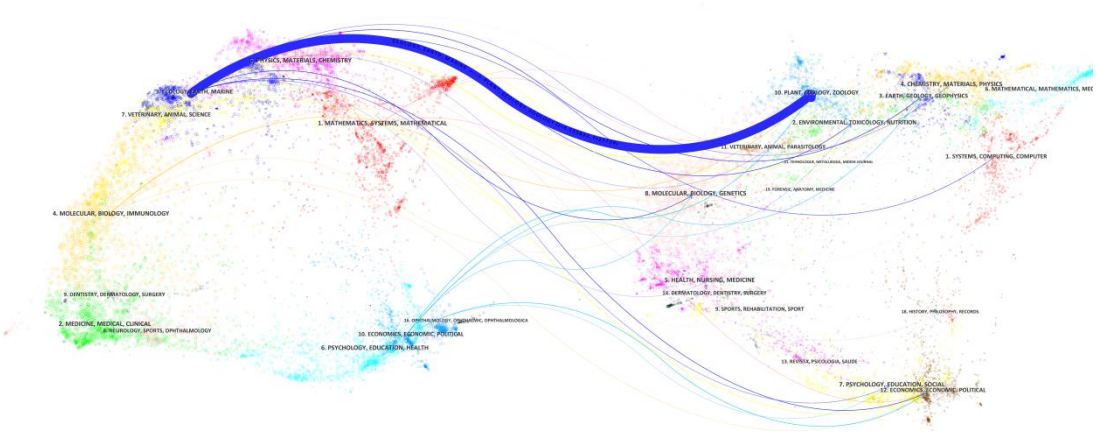


Figure 2. Double map overlay of a National Park Community Wildfire Hazard research publication

According to Bradford's law, the core source journals in this field can be determined [25] (Figure 6). The top ten active journals are AUSTRAL ECOLOGY, INTERNATIONAL JOURNAL OF, JOURNAL OF ECOLOGY, AFRICAN JOURNAL OF ECOLOGY AND JOURNAL OF ENVIRONMENTAL, BIOLOGICAL CONSERVATION, ECOLOGICAL APPLICATIONS, ECOLOGY, APPLIED VEGETATION SCIENCE, HUMAN ECOLOGY, JOURNAL OF APPLIED ECOLOG, KOEDOE, LANDSCAPE ECOLOGY, PLOS ONE. From the published journals, the research on the impact of wildfires on national park communities is multidisciplinary and cross-disciplinary. This study combines ecology, botany, zoology, environmental science, geography, social economics, sociology, and psychology.

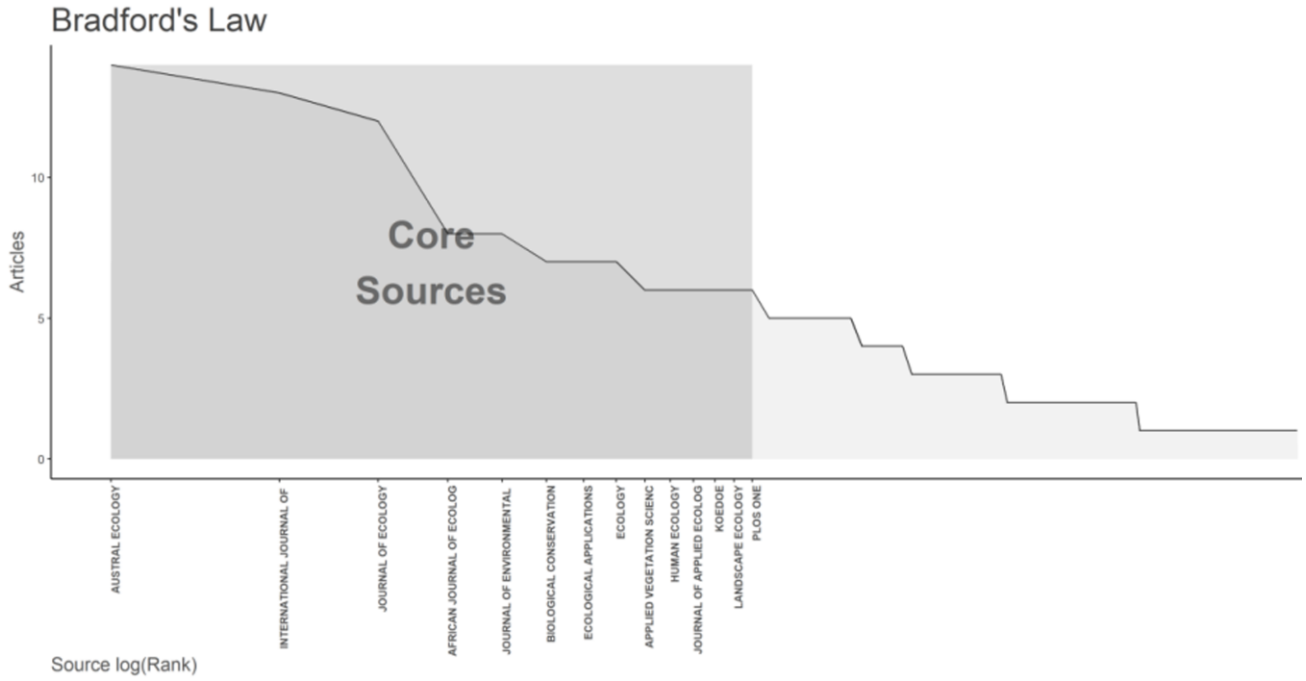
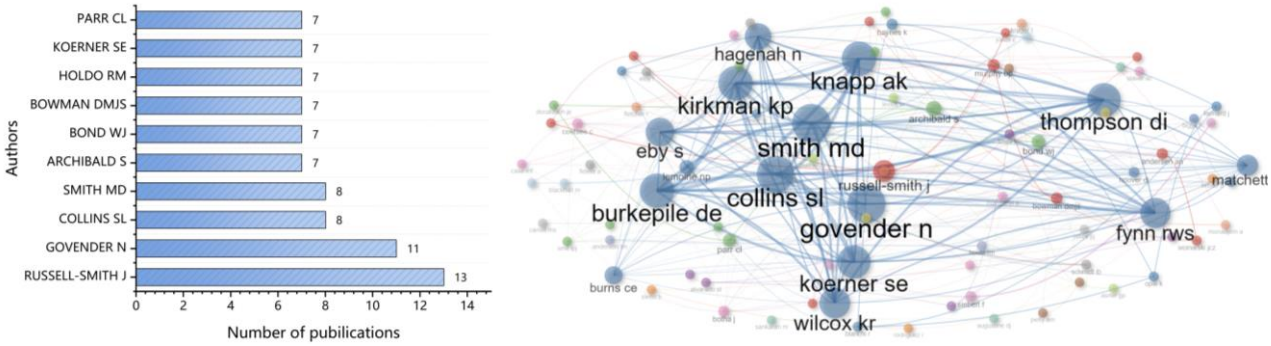


Figure 3. Bradford 's law

3.3. Analysis of the publishing team

According to the number of papers published by the authors (Figure 2a), the top three authors with the highest number of papers were RUSSELL-SMITHJ, GOVENDER N., and COLLINS SL. They wrote 13,11 and 8 research papers on the impact of wildfires on national park communities, respectively. Parr c.l. and Russell-Smith J started this research journey back in 2002. GOVENDER N began to publish his research on the impact of wildfires on national park communities in 2007 but

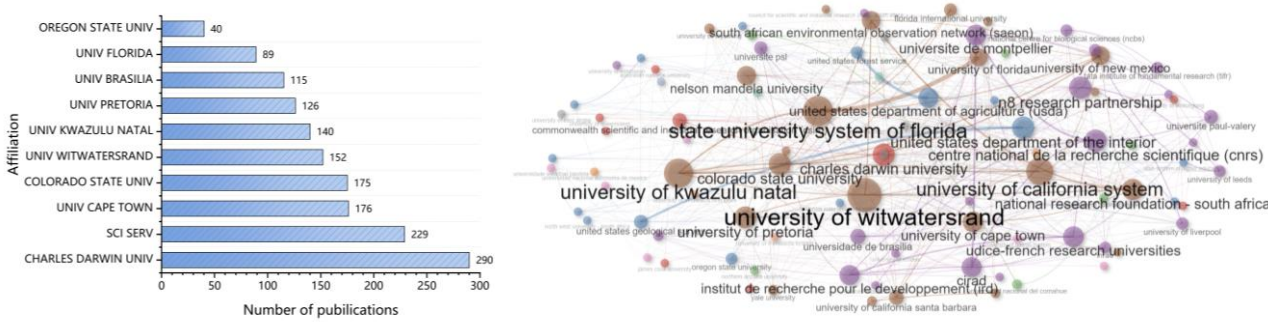
has received 587 citations. From the author's cooperative clustering map (Figure 2b), the cooperation between authors is relatively weak, and there are two significant clusters, among which GOVENDER N.and RUSSELL-SMITHJ, burkepilede and others have the most significant cluster profile and the closest connection.



(a) (b)

Figure 4. Author analysis. (a) Top 10 most productive authors; (b) Author collaborative clustering map

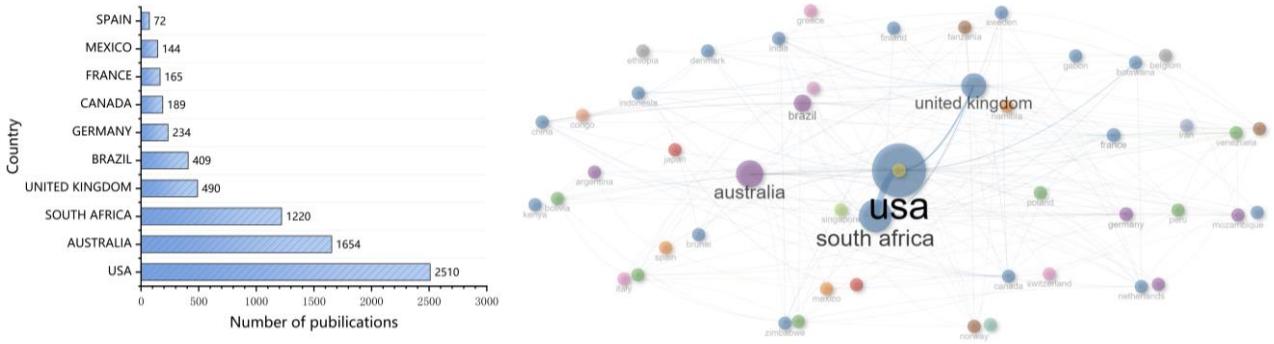
From the perspective of the number of papers published by the organization (Figure 3a), CHARLES DARWIN UNIV was ranked first, with 290 papers published. SCI SERV (n = 229) and UNIV CAPE TOWN (n = 176) were followed. From the perspective of the institutional cooperation clustering map (Figure 3b), a relatively affluent relationship has been formed among institutions, with a total of 4 significant clusters. The University of Witwatersrand, the University of Kwazulu Natal and the State University System of Florida have the most significant cluster profile values closely related to high-volume institutions such as Charles Darwin University.



(a) (b)

Figure 5. Institutional analysis. (a) Top 10 most productive institutions; (b) Institutional cooperation clustering map.

According to the number of national publications (Figure 4a), the United States, Australia, and South Africa are the central countries for research on the impact of wildfires on national park communities. The United States published 2510 articles, and Australia and South Africa published 1654 and 1220, respectively. From the national cooperative clustering map (Figure 4b), it can be seen that there are two significant clusters with large dispersion and relatively weak cooperation among countries. The cluster contour values are composed of the USA, South Africa, and the United Kingdom, which are the largest, followed by Australia and Brazil, and the two are closely related.



(a) (b)

Figure 6. Analysis of country contributions.(a) Top 10 most productive countries; (b) Country Cooperative Cluster map

3.4. Research trajectory evolution analysis

Our study uses a strategic map (Figure 7) to track the evolution of wildfire hazard research in national park communities. According to the citation rate of publications, it is divided into four time ranges: 2002-2005, 2006-2008, 2009-2020 and 2021-2023. The research topics are divided into four quadrants according to centrality and density: Niche Themes (professional, limited research), Motor Themes (necessary, developed research), Emerging or Decling Themes (slow, backward research) and Basic Themes (necessary, backward research)[26,27]. Each map circle represents a topic cluster (up to 5 tags are displayed), and the size of the circle is determined by the frequency of keywords [28].

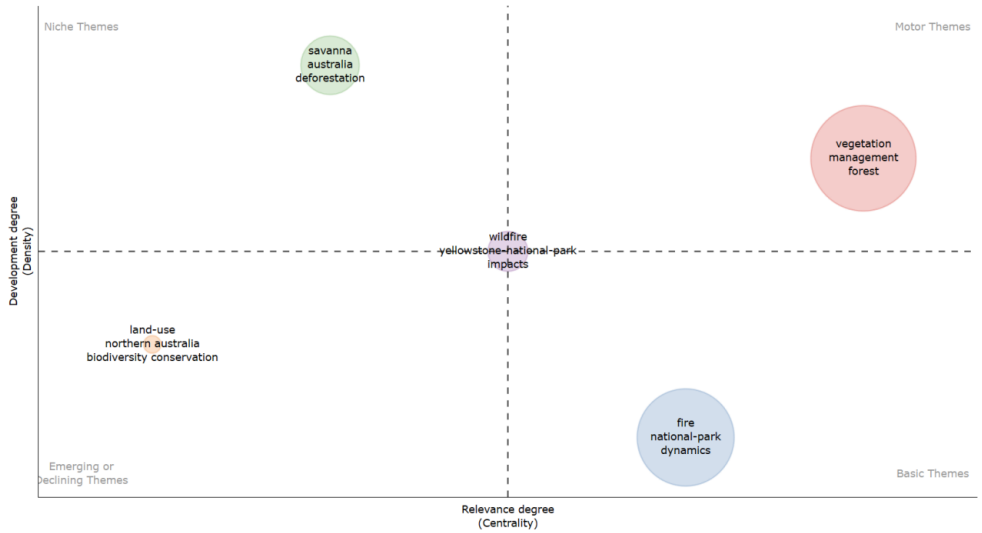
The first stage (Figure 7a): From 2002 to 2011, the research was in the initial stage, with weak links between keywords and the study area generally concentrated in tropical savanna. The keywords "vegetation", "management", and "forest" are the focus of this stage. The research and development process is as follows: William J. Bond[29] et al. began to explore the impact of wildfire disasters on grassland ecosystems and forest succession in 2003. Subsequently, Manrique Prada [30], T. Vigilante [31] and others found in 2004 that the destruction of grassland vegetation by wildfire would indirectly lead to biodiversity loss and further affect the economic situation of community pastures. Since then, more scholars have focused on implementing the wildfire management system. P Sava-dogo [32] explored wildfire hazards and fire management in national parks in 2007 and pointed out that wildfire management requires adaptive management based on understanding the risks posed by different protected area biota. Subsequently, R. A. Bradstock[33]、Patrik Krebs[34] and R.M. Roman-Cuesta [35] conducted dozens of case studies on "wildfire management" in 2010-2011. This means that "wildfire management" has become an essential fundamental concept in the current field of discipline.

The second stage (Figure 7b), from 2012 to 2016, is the initial outbreak period of the literature. The focus of this stage is ' regimes ', ' patterns ' and ' forest '. The research and development process is as follows. Clay Trauernicht et al.[36] began to explore the relationship between wildfires, indigenous communities and animals in 2013. They pointed out that the reduction of species in national parks was attributed to indigenous communities stopping the burning of wildfires. Reducing interference with nature by restoring indigenous culture would be conducive to the sustainable development of national parks. Subsequently, Aaron M. Petty [37]and Christopher E Gordon[38] et al.conducted a more in-depth study on wildfire management schemes in indigenous communities from 2015 to 2016 based on this study. They pointed out that the current wildfire management system needs a more comprehensive and inclusive scheme, and the diversity of wildfire types should be recognized through legislation. In addition, sustained cooperation with indigenous communities must be maintained, leveraging their expertise in planning and implementing wildfire management strategies.

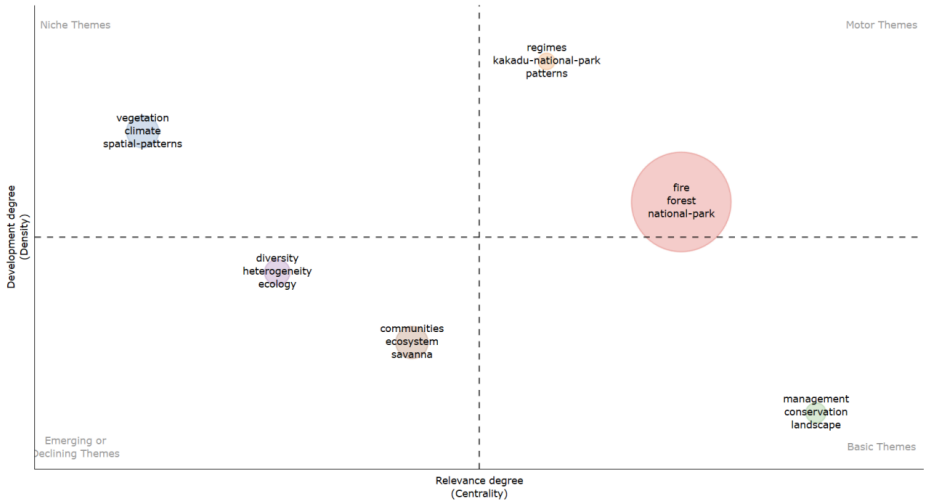
The third stage (Figure 8c): From 2017 to 2020, there are few studies on wildfire disasters in national park communities. Clusters represented by ' vegetation ' and ' management ' are still the focus

of future research but have yet to be paid attention to. The themes of ' dynamic ' and 'climate change' are gradually becoming the focus of this period. The research and development process is as follows. Since 2018, Swanni T. Alvarado[39] and others have continued to focus on the wildfire management system of national park communities and the impact of wildfire disasters on human assets and vegetation communities. However, in 2019, research hotspots gradually focused on land use research. Palaiologos Palaiologou[40] and others explored the impact of wildfires on the classification of indigenous community land use after the spread of wildfires with further research. Sandra Oliveira [41] explores the potential risks and impacts of community exposure to wildfires in national parks from 2020.

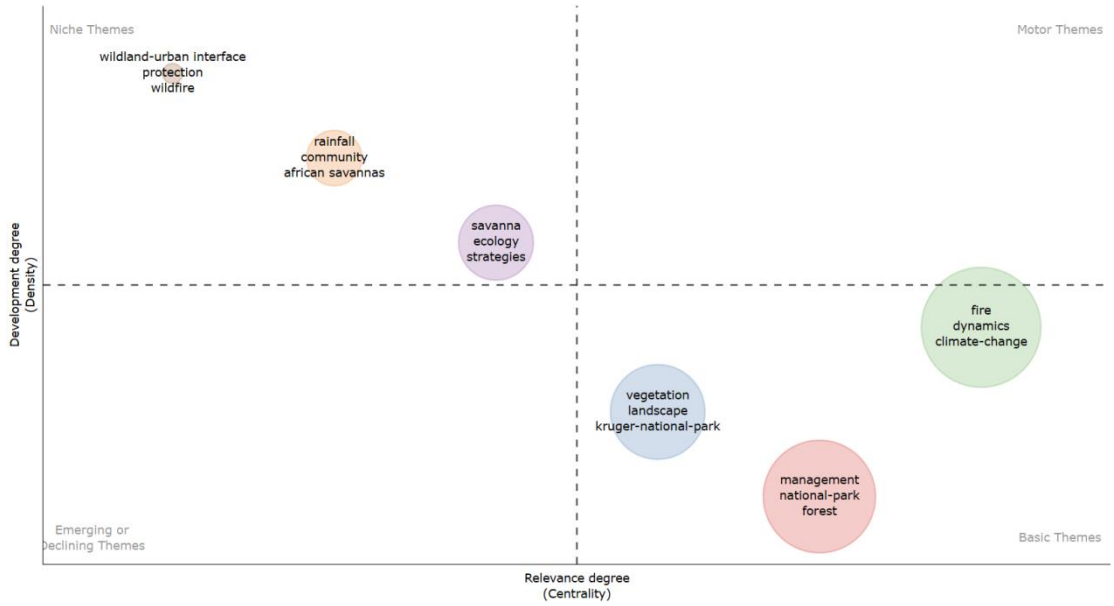
The fourth stage (Figure 8d): From 2021 to 2023, the research direction of wildfire disasters in national park communities has changed significantly. ' Rainfall ' has become the focus of current research, and the attention to ' management ', ' vegetation ' and ' dynamic ' has gradually declined to become basic research. The research and development process is as follows. Fermin Alcasena [42] and Willem A. Nieman [43] began to pay attention to the simulation and prediction of wildfire disasters in national parks in 2021. They provided a reference for the application and practice of wildfire management by quantifying the impact of wildfires on communities and natural areas. However, with the acceleration of global climate deterioration and warming in 2022, more and more scholars have begun to pay attention to the research between wildfire disasters and carbon. Monica L. Noon [44] and others have explored the link between wildfires and ' non-recyclable carbon ' in the context of climate change since 2022, noting that 23.0 % of non-recyclable carbon is currently in national parks and indigenous peoples and local communities manage 33.6 %.



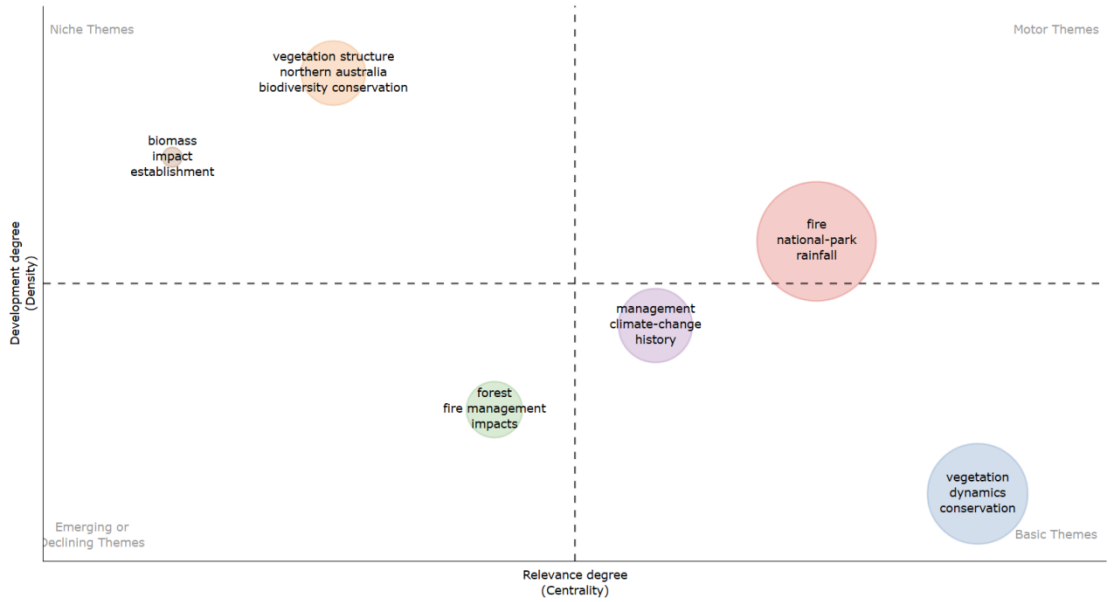
(a)



(b)



(c)



(d)

Figure 7. Strategy map for publications related to wildfire research in National Parks communities (2011-2023) (a) 2002-2011; (b)2012-2016; (c) 2017-2020; (d)2021-2023

Our analysis shows that critical areas of wildfire hazard research in national park communities include basic theoretical research on wildfires and their subsequent cascade hazards, the Development of a comprehensive framework for wildfire disaster risk research and management, The study of the interaction mechanisms between wildfire hazards and the natural environment, social dynamics, and human behaviour in national park communities; Advances in wildfire hazard prediction simulations and the establishment of extensive databases.

3.5. Analysis of research hotspots

3.5.1. Keyword aggregation

Keyword clustering can reflect the research focus of a field. The following Topic Dendrogram Analysis diagram [45] can be obtained using the Factorial Analysis method of the bibliometric R package in R language set to Multidimensional Scaling. The results(Fig 8) show that there are 8 clusters, among which cluster one branch has the longest distance and is an essential branch of this

study. The main content of cluster 1 comprises related studies such as "national parks". Cluster 2 is the second branch, mainly composed of "wildfire management" and other related studies. The main contents of Cluster 3 and 4 are composed of "large. herbivores" and "Kruger.national.park", respectively. Cluster 5 is divided into "response" and "community" and other related studies under the evolution of disciplines; Cluster 6 is composed of six branches, including "history", "model", "forest", "wildfire", "management" and "protection", which is essential basic knowledge of wildfire disaster research in national park communities. Cluster 7 branch distance is the shortest and belongs to the future research focus, mainly composed of "biodiversity" and other related research; Cluster 8 is the most abundant branch system, which is the essential basic knowledge of this study. The main content is composed of related studies on "biodiversity", "national park" and "community". The 8 clusters are divided into four groups (Table 2).

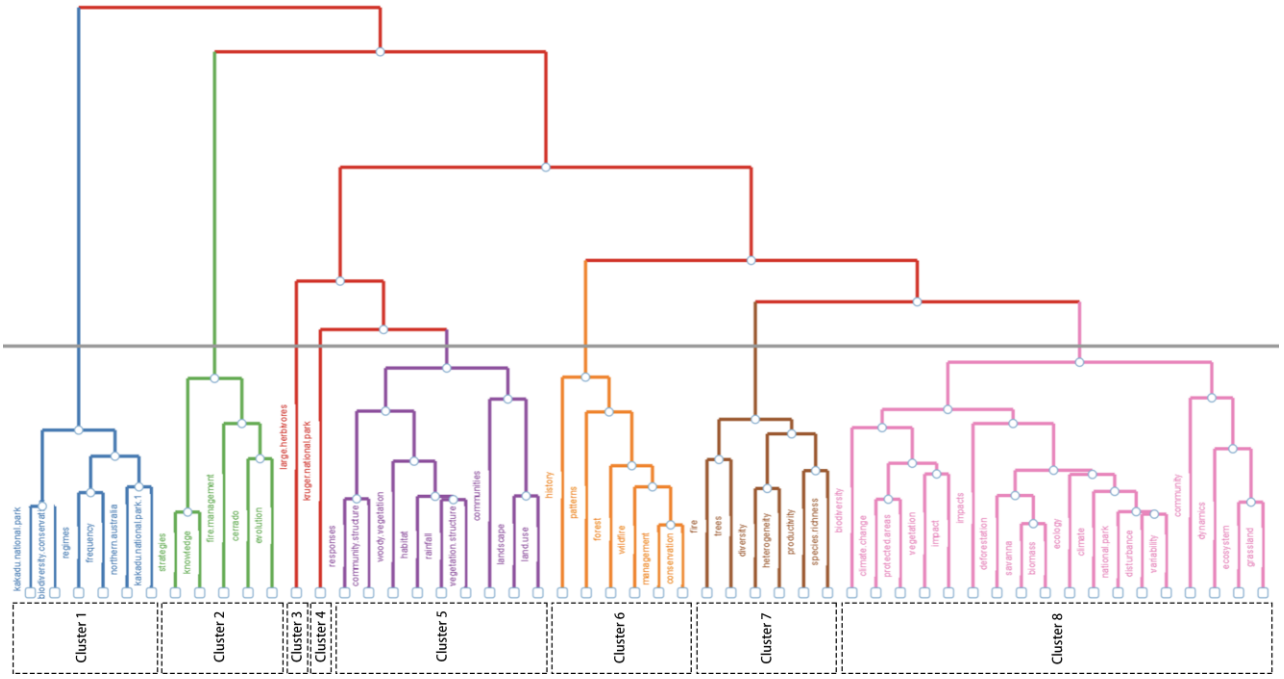


Figure 8. Time line distribution of cluster analysis for keywords

Through the comprehensive analysis of keyword cluster map and cluster classification, we found that the current research focus on wildfire in national park communities is mainly concentrated in the following four aspects: The first area is wildfire management, where improving understanding of wildfire mechanisms, risk assessment, and ecological impacts to inform improvements in community wildfire management policies and prevention strategies in national parks is critical. The second area focuses on the impacts of climate change, emphasizing the importance of addressing human health and developing a comprehensive wildfire disaster management framework to mitigate risks and strengthen the management of national park communities. The third area explores the ecological impact of wildfires, exacerbated by global warming and frequent drought conditions. Wildfires have significantly altered the national park's forest ecosystem, affecting tree populations, forest structure, and biodiversity. However, moderate wildfires can make a positive contribution to forest regeneration. Therefore, studying the ecological effects of forest wildfires on the stability of national park ecosystems and biodiversity conservation is essential. The fourth field investigates the origins of wildfires, both manufactured and natural. Conducting risk assessments and identifying sources of wildfire risk are key prevention strategies for proactively managing such disasters.

Table 2. Classification of keyword clusters

Category	Clustering result
Wildfire disaster management	Cluster 2、Cluster 6
Climate change impact	Cluster 8
Ecosystem	Cluster 1、Cluster 3、Cluster 4、Cluster 7
Social economy	Cluster 5

3.5.2. Critical Burst Detection

Keyword burst detection reflects the dynamic change of keywords in this field over time, and the number of citations of some keywords increases sharply in a short period, enabling us to find some essential key nodes[46].In Fig 9, the X-axis arranges the distribution time of keywords in yearly intervals, and the Y-axis arranges the distribution time according to the intensity of the keywords' sudden occurrence (the more significant the circle, the higher the sudden occurrence). We found that the "Kakadu National Park" citation burst out in 2004, the first to appear in 2003. The most recent citation eruptions are "forests", "policy", "livelihoods", and "establishment", with forests having the widest citation eruption duration from 2004 to 2023. The shortest citation outbreak of "policy" is from 2020 to 2021. In addition, we found that 2015, 2016 and 2017 had the highest keyword burst, with "vegetation" (frequency: 83), "dynamic" (frequency: 44), "savanna" (frequency: 32), "management" (frequency: 70), "forest" (frequency: 70), and "vegetation" (frequency: 83) is the keyword with the highest citation rate.

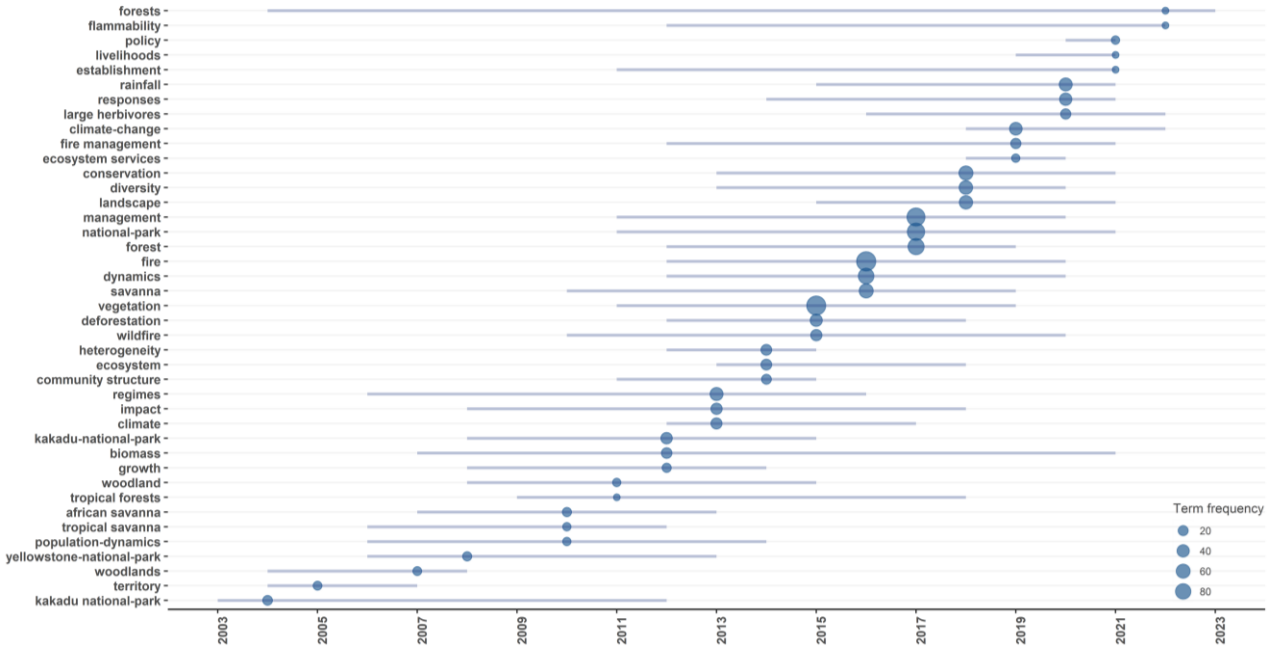


Figure 9. National Park Community wildfire Research Keyword outbreak trend graph

In summary, future research on wildfire hazards in national park communities should focus on three main areas: First, forests are critical natural resources in national parks and are increasingly affected by wildfires. Developing adaptive management policies considering ecological and community needs is critical to strengthening ecological balance and community livelihoods. Second, as social and economic activity intensifies, wildfire disasters increasingly threaten the health and property of people living in national park communities. Strengthening community resilience, reducing vulnerability, and integrating socio-economic strategies with ecological considerations are critical to effectively mitigating and managing wildfire hazards. Third, establishing a targeted wildfire management system tailored to local socio-economic and ecological conditions is critical to the sustainable development of national park communities.

4. Discussion

4.1. Research status

The current status of research is described by publication volume, author, institution, country, and journal [47]. The number of publications on wildfire hazards in national park communities increases yearly, especially on climate change, highlighting the rising importance and breadth of research perspectives in the field. Despite the increase in publications, citation rates have decreased, meaning that current research still needs to improve its ability to address and track current and emerging issues. Addressing wildfire hazards in national park communities requires a broad approach, including effectively advancing the science of wildfire management and enhancing national park communities' resilience[48-50]. Collaboration between researchers and community managers is critical to promoting safe, sustainable communities [51,52].

An analysis of the field's publishing teams (authors, institutions and countries) shows two core groups of authors, four core groups of institutions and two core groups of countries worldwide. Each team's diverse disciplinary expertise and unique research base have significantly deepened our understanding of the theoretical and practical dimensions of wildfire hazards in national park communities. However, the current situation is characterized by limited cooperation between institutions and States, and there are still many independent authors, institutions and States. This fragmentation hampers the potential for interdisciplinary collaboration and integration within the field. Effective response to complex wildfire hazards requires an integrated multidisciplinary approach that integrates ecological, human geography, and socioeconomic insights. Building more comprehensive research teams is critical to developing sustainable wildfire management strategies to respond to global disasters. In addition, given that indigenous communities are often the principal inhabitants of national parks, understanding local cultures and languages is critical in wildfire research to prevent information asymmetries resulting from poor communication [53,54]， so authors from different institutions and countries have less collaboration across institutions and countries due to lack of local cultural awareness and language exchange. Further outreach is needed in the future. In addition, the geographical distribution of the study is mainly concentrated in savannas and montane forests in Australia, South Africa and Brazil, suggesting that plain and montane types of national parks are more vulnerable to wildfire hazards. This is mainly due to the differences in the natural geographical location, climatic conditions, economic conditions, living environment and management system of different national park communities[55-57]. National park communities can be divided into "plain communities", "plateau communities", and "mountain communities" according to their geological properties. Each community type has unique geomorphological, climatic and ecological characteristics, which bring different challenges and opportunities for wildfire disaster management. Among them, studies on "plain communities" are mainly concentrated in South Africa[43,58] and Australia [59,60]. In contrast, studies on "plateau communities" and "mountain communities" are primarily concentrated in Brazil [61,62], and the corresponding wildfire disaster management systems and policies are adjusted according to specific community types. It can effectively improve the ability to identify and control wildfire disasters, thereby strengthening the resilience of communities.

4.2. Study future trends

Through keyword co-occurrence clustering and keyword burst detection analysis, we find that in the context of climate change, people are increasingly concerned about the impact of wildfire disasters on forests[63]、management policies [64,65] and community livelihoods [66]. Since the occurrence of wildfire disasters is complex and variable, it is critical to understand the interactions between the various factors that contribute to wildfire disasters [67]. Therefore, it is imperative to establish a comprehensive community wildfire disaster risk management system in national parks, clarify the meaning and formation mechanism of wildfire disaster risk and explore the complex interaction between various factors. Second, strengthening community resilience and risk assessment, particularly regarding climate change adaptation and risk reduction, is critical to proactively

responding to wildfire hazards in national park communities. In addition, wildfires have severely impacted the health of national park communities [68]， as well as their infrastructure, agricultural and social ecosystems [69] and agricultural and social ecosystems [70]. Encouraging the community sector to use its experience in disaster prevention and mitigation and developing rational and effective wildfire management policies are essential to strengthen wildfire disaster management in national parks. Finally, from the perspective of sustainable development, the research and development of integrated technology of wildfire prevention platforms [40] has become the focus of wildfire disaster research in national park communities.

5. Conclusions

In summary, the research hotspots related to wildfire disasters in national park communities in the past 21 years have always been dynamic and difficult to control accurately. Based on the existing literature, this paper uses Citespace software and Bibliometric R Package to analyze the time change of the number of papers published in this field, the team of papers, the trend of inter-disciplinary flow, the journals of papers published, the development process and hot spots and draws the following conclusions.

(1) The analysis of the published papers shows that this study is divided into four stages: 2002-2011, 2012-2016, 2017-2020 and 2021-2023. Since 2002, the number of published papers has continued to increase and peaked in 2021, but the citation rate has decreased. This indicates that the current research attention is relatively high. However, the ability to solve and track current and emerging problems still needs to be improved, and it deserves more in-depth research in future development.

(2) An analysis of the trends in inter-disciplinary flows and core source journals in this field shows that research is interdisciplinary, with the central core areas being ecology, botany, zoology, and related fields such as environmental science, geography, psychology, sociology, and socioeconomic.

(3) The analysis of the publishing team showed an increase in the number of collaborative studies. Some international scholars have formed relatively stable teams. However, the group concentration of authors, institutions and countries worldwide is small, scattered and weakly related. RUSSELL-SMITHJ, GOVENDER N. and COLLINS SL became the lead authors in the field. The institution of CHARLES DARWIN University has the most significant number of publications, and the research area is mainly concentrated in the plains, plateaus and mountains of Australia, South Africa and Brazil.

(4)The development of research in this field has gone through different stages: Exploring the basic theory of wildfire disaster (2002-2011); Development of a wildfire disaster risk framework and management system (2012-2016); Analyzing the interaction mechanism between wildfire disaster and natural environment, social dynamics and human behaviour (2017-2020)； Promote the construction of wildfire disaster simulation, prediction and comprehensive database (2021-2023). These developments mark a shift from basic theoretical research to a more holistic, technology-oriented approach.

(5) Future research hotspots are mainly reflected in the following aspects: Establish a comprehensive community wildfire disaster risk management system for national parks and clarify the meaning and formation mechanism of wildfire disaster risk; Strengthen the resilience of communities and conducting comprehensive risk assessments; Encourage the community sector to use its own experience and knowledge to participate in disaster prevention and mitigation actively; Strengthen the research and development of integrated wildfire disaster prevention business platform technology.

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