



RESEARCH ARTICLE

Impact of climate change and drought on land cover: A literature overview from Web of Science Core Collection

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Abstract

Climate change driven by natural and anthropogenic factors significantly affects land cover dynamics and accelerates land degradation and desertification worldwide. Drought, as a major consequence of climate change, increasingly threatens ecosystem stability and sustainable land management. Therefore, this study aimed to perform a bibliometric analysis of global research on the impacts of climate change and drought on land cover using publications indexed in the Web of Science Core Collection database. The literature search was conducted on June 8, 2025 using the keywords “climate change”, “drought” and “land cover”. An initial dataset of 2937 publications was identified and filtered by language (English), document type (Article) and publication period (2016–2025), resulting in 732 articles for final analysis. VOSviewer and MapChart applied for bibliometric visualization and network analysis. The results indicated that publication output peaked in 2021, accounting for 14 % of total publications, while Chinese researchers led the field with a 14.8 % contribution. The Journal of Hydrology emerged as the leading publication source and Environmental Sciences and Ecology dominated the subject areas with 85.6 % coverage. The findings highlight growing interdisciplinary interest and reveal important geographical and thematic research gaps requiring stronger international collaboration.

Keywords: bibliometric analysis; climate extremes; land degradation; remote sensing

Introduction

The consequences of climate change are becoming increasingly concerning globally (1). The Earth's surface temperature has increased more rapidly faster during nighttime by 0.204 °C every 10 years, which is 1.4 times the rate of growth during the daytime as a consequence of climate change (2). One clear indicator of climate change is the impact on water availability in the world (3, 4). Global forest conditions is intrinsically connected to climate change (5). Climate extremes, especially drought, have become more frequent and intense in recent years as a result of climate change and increased human activity, having a significant impact on the composition and functioning of ecosystems on the Earth (6).

Drought is an inevitable phenomenon occurring in numerous areas globally, including both humid and rainy locations (7). It is characterised as a water deficit relative to baseline conditions (8). The process has a significant impact on the ecosystem, such as harm to plants, deterioration of landscape function, forest disruption, loss of biodiversity and soil erosion (9). Drought is a periodic phenomenon characterised by poor moisture levels and decreased rainfall throughout a season or year and is acknowledged as a natural hazard (10). Previous researchers classified droughts into

five categories: meteorological, hydrological, agricultural, ecological and socioeconomic (11). Ecological and agricultural droughts are regarded as among the most detrimental factors affecting the Earth's land surface, leading to significant alterations in soil systems. Currently, these factors negatively impact global land cover and land use system and lead to changes on earth surface.

Land cover is an essential characteristic of the necessary ecosystem-based data within the framework of global environmental transformation (12). Land cover has experienced substantial changes due to escalating human activity and climate change including drought, which has emerged as a central concern in prominent international research initiatives (13). Changes in the landscape exert significant effects on water supplies and impose considerable stress on biodiversity and ecosystem services (14). The advent of agriculture, the land cover of each country has gone through considerable change (15). Additionally, fast urbanisation has been shown to cause significant land-cover change (16).

Even with the rising amount of academic literature on the effects of climate change and drought on land cover, most of the past research has concentrated on specific cases or regional evaluations applying remote sensing and meteorological

information. However, there is still a need for a complete, quantitative review of how this subject studied has progressed around the globe. Key issues related to geographical distribution of research, prevalent subject areas, important sources of publication have yet to be sufficiently tackled. To address this gap, a bibliometric study and literature analysis are needed to map and assess scientific production trend, leading authors contribution, engaged universities' contribution, co-authorship and keyword network analysis as well as the funding organisations' support in this subject. Considering this fact, this review aimed to offer a valuable information on the impact of climate change and drought on land cover studies for the last 10 years.

Materials and Methods

The current research applied bibliometrics and literature analysis to examine the present condition of drought impact on land cover as global climate change forces to transform ecosystem on earth surface. A search was conducted in the Web of Science Core Collection on June 8, 2025, using the Boolean search query: ("climate change") AND ("drought") AND ("land cover") since they accurately represented the research's primary concepts and aims and enabled the targeted collection of appropriate literature. The search was conducted in the title, abstract and keyword fields to confirm that the obtained papers were relevant. This database was chosen for its accessibility, extensive research coverage and academic quality. The incorporation of other databases as Scopus and PubMed may expand the literature coverage. However, access restrictions to specific subscription-driven databases, such as Scopus, may differ among institutions and nations. PubMed was excluded due to its major emphasis on biological and health-related published material, which is less congruent with the multidisciplinary ecological focus of this study. The initial search returned 2937 publications, which were subsequently filtered by language ("English"), document type ("Article") and the research period (2016–25). The selection requirements were English-language research articles produced between 2016 and 2025 on climate change, drought and land cover dynamics. The final analysis did not include conference papers, reviews, book chapters, non-English publications, or unrelated investigations. The period spanning 2016–25 was chosen to encompass the most recent decade of scientific advancement in this topic. This duration corresponds to a period of fast improvement in observing land use and land cover, climate modelling and sustainability-oriented agricultural and environmental research. It also correlates to the post-Paris Agreement period, when worldwide focus

on climate change adaptation and land degradation increased. The final number of articles consisted of 732 published papers, which were screened for further analyses by publication trend and research areas, outstanding authors and universities, notable journals and significant funding sponsors. Additionally, VOSviewer was used to visualise co-authorship and keyword network analysis and the MapChart online platform was utilised to map countries contribution. To encourage methodological transparency, specified threshold criteria and clustering techniques were used throughout the investigation. In the keyword co-occurrence analysis, the minimum limit was set at 10 repetitions per keyword, providing 425 keywords divided into seven clusters. For co-authorship analysis, researchers with at least 3 articles were selected, resulting in an interconnected network of 22 scientists spread across 16 clusters. For network creation and visualisation, we used VOSviewer's association strength normalisation technique and standard aggregation level. Before analysis, data purification and standardisation procedures were carried out to increase dataset consistency and dependability. Duplicate entries were eliminated, names of authors with spelling variants were standardised, institutional affiliations were unified where applicable and synonymous keywords were combined to reduce discrepancies in the bibliometric network analysis.

Results

Publication trend

The number of articles is a significant measure which describes the ongoing trends in the field of research. It is evident that research interest in selected topic is progressively increasing and peaked in 2021, accounting for 14 % of total publications (Fig. 1). However, since 2022, the number of articles produced by researchers has dropped gradually. The observed drop in publication production after 2021 does not necessarily imply a loss of scientific interest, but rather a change in research emphasis and data availability cycles. From 2018 to 2021, worldwide interest in climate change, drought and land degradation surged because of unprecedented droughts, COP26 policy talks and increased financing for environmental studies. It is important to note to mention that data collection for this review was performed in June, 2025 and, that is why only academic works printed up to June were chosen for investigation and provided just 5.3 % of total publications. This suggests that the total research output for the full 2025 calendar year would likely exceed the publication level observed in 2024 results.

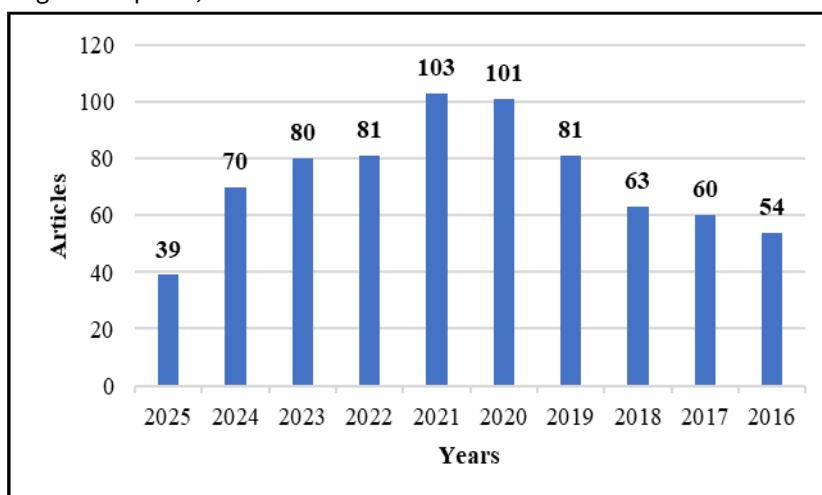


Fig. 1. Yearly scientific production.

Top authors

Authors provide a vital function in the development of a certain study topic in any field. A total of 200 authors participated in the production of 732 articles and Fig. 2 visually demonstrates top researchers. It is important to note that all active researchers are from China and their contribution seems to be great to this field where Wang, Y occupies the leadership. Today, China, having one of the largest areas in the world, faces a lot of natural challenges consisting of desertification, drought and land degradation. That is why the country focuses heavily on climate and land degradation research to provide sustainability of agriculture and food security. As a result, government policy prioritises research funding for climate adaptation, environmental restoration and sustainable land management which proves the leadership of researchers.

Top journals

Journals have a significant effect on the development of specific research issues. A total of 199 journals produced 732 articles in English for the study period. The top journals were selected based on a minimum threshold of 13 published articles and the results are presented in Fig. 3. The top journals accounted for 28.8 % of the total publication, with the “Journal of Hydrology” emerging as a leading source, contributing 7.5 % of all published articles. The shortlist includes sources devoted to climate, earth and meteorology, as keywords in the search include “climate change”, “drought” and “land cover”. Academic journals have an important role in spreading scientific information and influencing the research agenda on climate and drought-related land cover change. Leading journals facilitate multidisciplinary cooperation, methodological development and policy-focused discourse. Their exposure and citation impact assist to shape future research and raise worldwide understanding of ecological sustainability challenges.

Top subject areas

Subject areas are undoubtedly used as a basis for the progress of research topics. This review identified 72 subject areas actively participating in the production of 732 scientific articles. The top 3 subject areas were selected for further analysis, as presented in Fig. 4. Environmental Sciences Ecology dominated in this search as its prevalence underscores the multidisciplinary character of research on the impacts of climate change and drought on land cover. Most of the research in this discipline concentrates on ecosystem reactions, vegetation changes and land degradation processes, which are key issues in environmental science. Meteorology Atmospheric Sciences was included as atmospheric processes, such as increasing temperatures, precipitation fluctuation and evapotranspiration cycles, play a crucial role in climate change and drought. Changes in land cover have an immediate effect on species environments, environmental development and ecological adaptability, hence Biodiversity Conservation is the third main subject area identified.

Top institutions

The evaluation of institutions is mostly based on the level of quality of publications made by their researchers. A total of 197 institutions were actively involved in the production of 732 scientific articles between 2016–25. The best 10 institutions which contributed more to this research (Fig. 5). Chinese Academy of Sciences outnumbered other institutions and produced 11.8 % of total publications, followed by the University of Chinese Academy of Sciences with 6 % share. Totally, there are four American and six Chinese institutions which performed the best results. Chinese institutions are at the forefront of research due to significant support by the government, vast research facilities and national priority in land degradation, while American institutions have deep expertise in climate science and ecosystem management as well as significant government

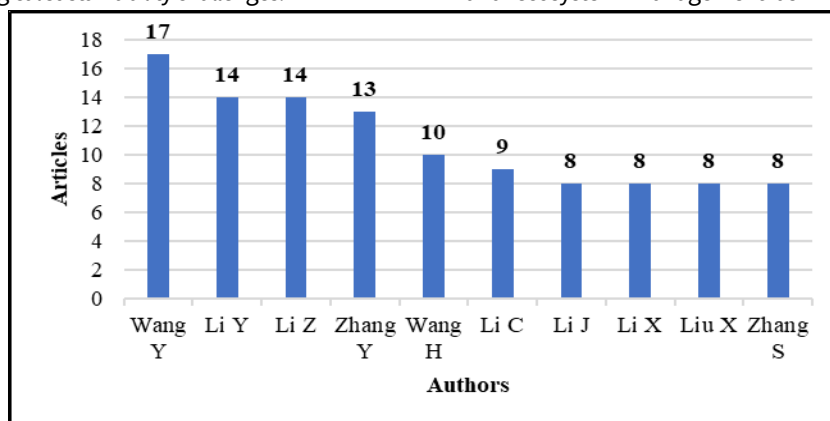


Fig. 2. Most influential authors.

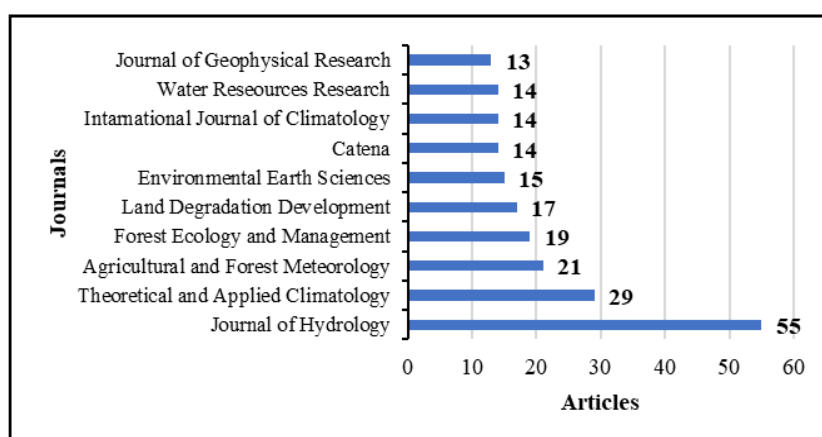


Fig. 3. Most influential journals.

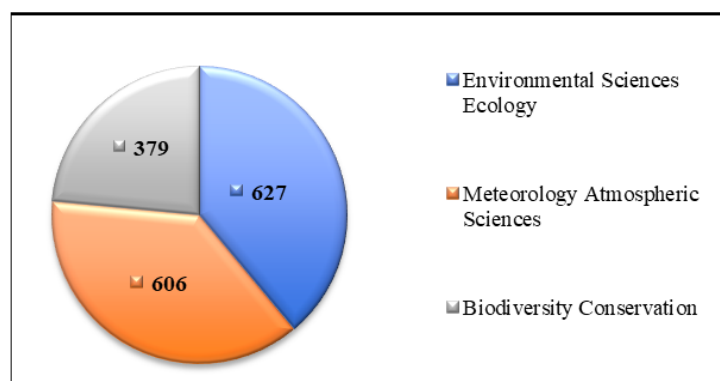


Fig. 4. Most important subject areas.

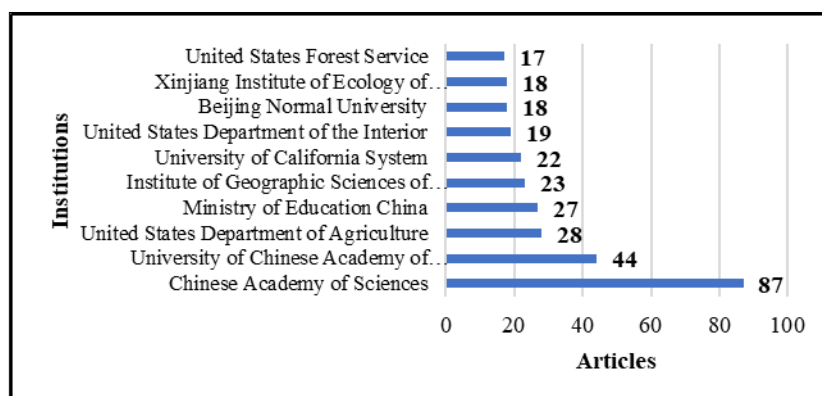


Fig. 5. Most productive institutions.

funding programs and multidisciplinary collaboration across environmental, agricultural and atmospheric sciences.

Funding sponsors

Research funding is an essential part of any scientific research activity in the world. A total of 200 funding sponsors are involved in this research and top 10 of them selected for further investigation, as shown in Fig. 6. The contribution of top institutions is 39.2 % and the National Natural Science Foundation of China outperformed others and contributed 16.6 % to total number of articles. There are four Chinese, three European, two Brazilian and one American financial supporter included in the shortlist. Chinese financial sponsors take the lead in this study field since national policy heavily prioritises climate adaption, land reclamation and ecological stability while the involvement of European, Brazilian and American funding sponsors highlights the topic's global importance -Europe's dedication to climate adaptation and sustainable agriculture, Brazil's susceptibility to droughts and deforestation and the United States' leadership in climate research all support financing activities in this field of study.

Top countries

Countries play an important role in scientific research by proactively promoting it. The most active countries, as demonstrated in Fig. 7 promoted 94.2 % contribution to total publication while China occupied the leadership and produced almost one-third of all total publications and followed by the United States and Iran, with 26.6 % and 6 % share respectively. Contribution of other states vary between 2.4–6 %. Selected topic covered 4 continents in the world where most countries are economically developed states. The leadership of the above-mentioned countries is characterised by their considerable scientific competence and firsthand experience with climate-related land degradation. China has national priority and the United States has long-standing expertise, but Iran, which is experiencing severe drought and desertification, is focusing on land degradation research to support national adaptation plans.

Keyword co-occurrence

Keyword occurrence analysis can provide valuable insights into the theoretical structure and topic progression of research focusing on

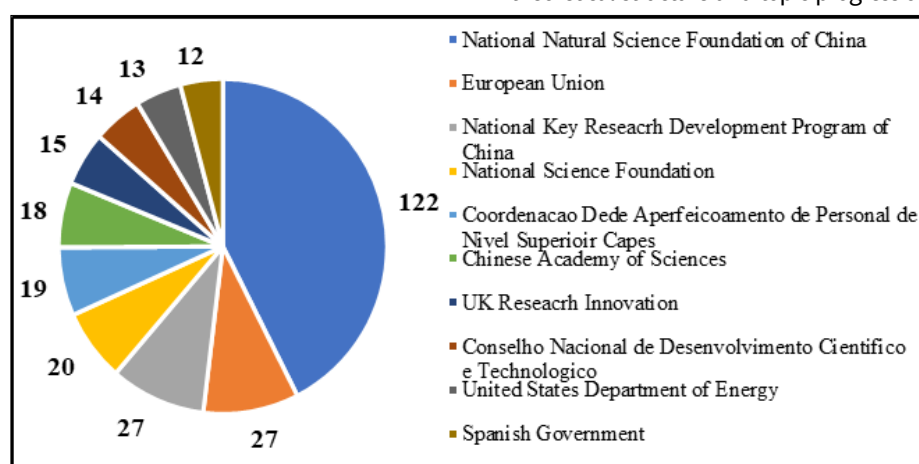
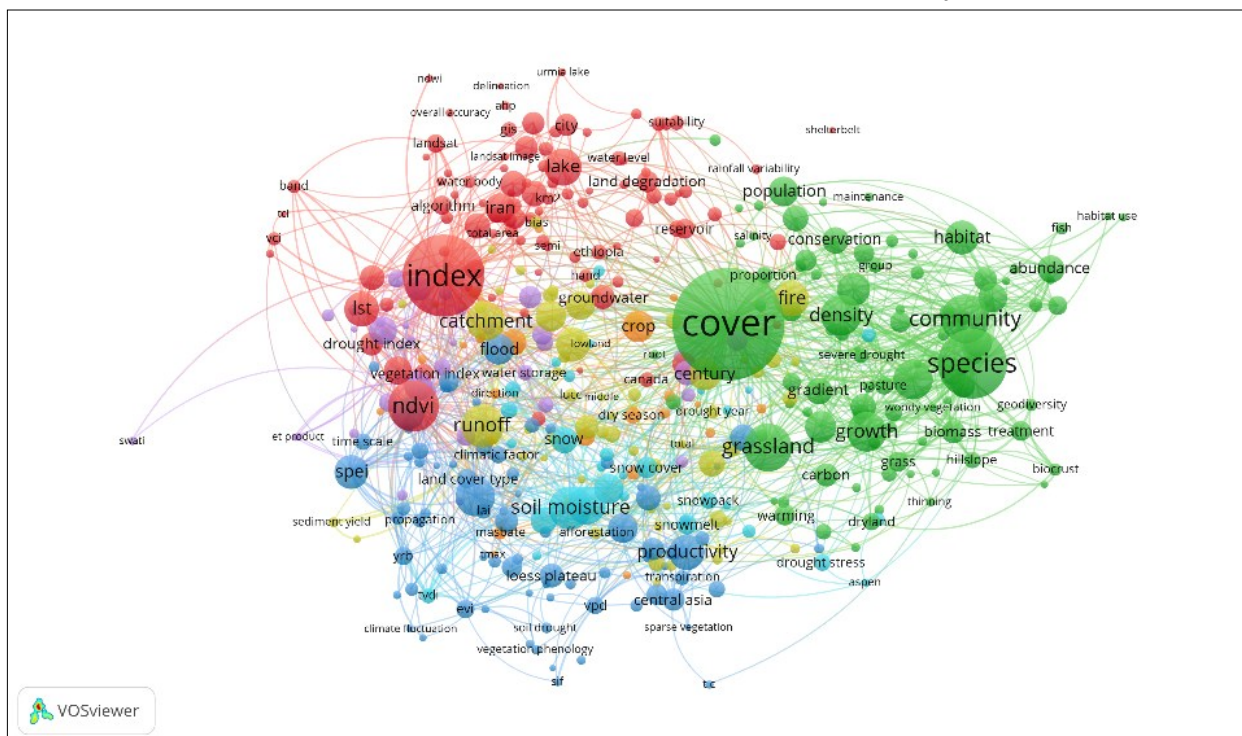


Fig. 6. Most prominent funding sponsors.

the impact of climate change and drought on land cover. Evaluating the frequency of author-supplied keywords reveals the principal study themes. The network visualisation was created using VOSviewer software based on the title and abstract fields and the full counting approach (Fig. 8). A minimum occurrence threshold of 10 was used to pick terms. From the total of 22109 retrieved phrases, 708 met the threshold criterion and the 425 most relevant terms were chosen for further visualisation and analysis. The developed bibliometric network identified 7 theme clusters that represent significant research directions in climate change, drought indices, vegetation dynamics, hydrological processes, biodiversity, ecosystem response and land degradation. The network picture generated by VOSviewer depicts groups of closely related phrases such as "cover" (495), "index" (317) and "species" (252), indicating the strong conceptual linkages between environmental,

Co-authorship analysis

A co-authorship study was conducted to evaluate collaboration among scholars involved in studies on the impact of climate change and drought on land cover. The co-authorship network was constructed using VOSviewer using bibliographic data, with authors serving as the unit of analysis and the full counting approach used (Fig. 9). The dataset included 3468 researchers. To strengthen the trustworthiness and readability of the collaboration network, a



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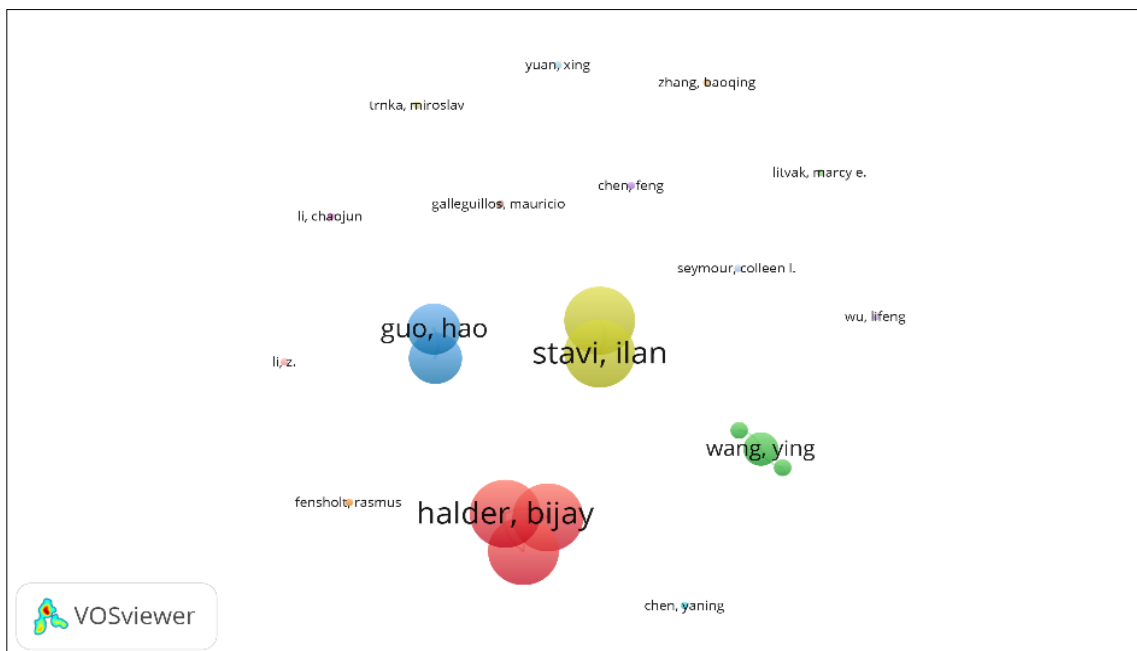


Fig. 9. Co-authorship network analysis.

minimum of three articles per author was set. Therefore, 22 authors satisfied the threshold criterion and were added as "items" in the final network visualisation, with each item representing each individual author in the co-authorship network. These items were divided into 16 clusters based on the strength of co-authorship ties as recognised by VOSviewer. Cooperation intensity was assessed using the total link strength metric, with stronger links indicating more occurrences of co-authored publications and greater levels of scientific interaction among researchers. The network recognised Bijay Halder, Ivan Stavi and Hao Guo as the most active researchers in terms of co-authorship and working together activity.

Discussion

The bibliometric analysis demonstrated a consistent increase in scientific significance in the effects of climate change and drought on land cover over the past decade, with publication production reaching its peak in 2021. This publication maximum represents the growing worldwide recognition of climate-related land degradation, ecological instability and water shortages following the Paris Agreement. Previous researchers found similar trends of publication growth in climate-related topics and who emphasised the rapidly growing scientific and policy significance of climate adaption research worldwide (17, 18). Particularly, the years 2020–21 overlapped with enhanced global climate negotiations, increasing ecological investment efforts and an increase of extreme drought cases in various regions of the earth. These reasons are believed to have sparked increased scientific interest in comprehending vegetation structure, land degradation procedures and resilience of ecosystems in the face of changing climate. The same conclusion was provided by previous researchers who noticed a rising global study focus on drought-related climate change effects (19). As a result, a rise in publications throughout this time frame reflects not only academic enthusiasm but also the growing policy importance of climate resilience and responsible land management studies.

The supremacy of China and the United States in publishing productivity demonstrates the direct link between academic output,

scientific facilities, national ecological interests and financing accessibility. China's dominance can be attributed to massive restoration of the environment projects, national investments in climate change adaptation and extreme vulnerability to degradation and drought-associated difficulties. In a similar way the United States has developed competence in hydrological science, remote sensing and environmental observation, backed up by robust organisational and technical capabilities. Nevertheless, the spatial density of publications creates possible prejudices in the academic scene. Many drought-prone areas, particularly in Africa, Central Asia and parts of South America, continue to be under-represented despite serious ecological damage. Similar geographical differences in environmental and climate-related studies have also been highlighted in earlier reports (20). Therefore, investigations undertaken in economically developed nations with a larger research capability may have an excessive effect on worldwide scientific knowledge of climate-land connections. This disparity emphasises the necessity for broader regional coverage and greater global cooperation in future research.

The major significance of the Journal of Hydrology indicates how hydrological viewpoints shape the present research strategy in this subject. This power indicates that scientific investigation is largely concerned with water accessibility, evapotranspiration patterns, drought indicators, watershed patterns and remote sensing-based ecological surveillance. Latest research verified the increasing dominance of hydrologic modelling, Geographic Information Systems (GIS) technologies and Earth observation methodologies in climate-land interaction investigations (21, 22). Additionally, another researchers emphasised the need of assessing hydrological resilience under climate and land-use change scenarios (23). Since these methods can deliver useful quantitative information into climate-induced land cover shifts, they can also restrict focus to socioeconomic elements, regional adaption tactics and policy-focused studies. As a result, future research must encourage deeper incorporation of hydrology, ecological science, agriculture, social sciences and environmental issues to gain a more complete knowledge of climate-associated deterioration of land.

The keyword co-occurrence assessment reveals that vegetation dynamics, drought monitoring, land degradation and remote sensing technologies provide the conceptual foundation of contemporary study. The broad use of satellite observations and GIS modelling demonstrates the growing importance of technical methods in assessing ecological reactions to climate pressure. Identical results were confirmed by previous researchers, who highlighted the growing use of bibliometric visualisation, Earth observation technology, machine learning and vegetation prediction in climate-relevant ecological research (24–26). Remote sensing-based monitoring techniques have grown more significant for assessing drought severity, vegetation stress level and ecosystem reactions on local and worldwide levels. Previous studies also indicated the increasing importance of spatio-temporal drought observation and vegetation stress evaluation under climate change scenario (27). Still, topics including sustainable land management, climate change adaptation policy, socioeconomic susceptibility and resilience in communities have received minimal consideration. This result shows that present research is primarily driven by biophysical and ecological evaluations, while practical modification and managerial components require more scientific focus.

This investigation also found moderate levels of international scientific cooperation through co-authorship analysis of networks. Although collaborative networks keep on expanding, they are still concentrated within a small number of institutions and nations. Increasing collaboration with academics from under-represented and drought-prone areas could considerably boost the regional implementation of scientific results while also strengthening information sharing. Greater worldwide cooperation would also help to develop land management and climate resilience measures that are tailored to regional circumstances.

Some technical limitations related to the bibliometric methodology should be recognised. Firstly, the research was based solely on the Web of Science Core Collection database, which may not include all relevant publications indexed in other international or regional databases. Secondly, just English-language papers were evaluated, which could exclude relevant studies published in local languages. Thirdly, citation-based measures may add bias as previous articles and more prominent journals tend to attract more references, regardless of their practical importance. Relevant methodological constraints and database limitations have been highlighted in earlier reports which emphasised the impact of database coverage, citation methods and keyword standardisation on bibliometric results (19, 28). Furthermore, bibliometric analysis focuses on publication trends and scientific networks rather than directly evaluating the methodological quality or real-world efficiency of investigations. Considering their shortcomings, bibliometric approaches are nonetheless very useful for identifying key research trends, prominent authors and future academic orientations.

In general, the outcomes show that studies on climate change, drought and land cover are moving toward more comprehensive evaluations of ecological reactions and ecological viability. Nonetheless, significant research gaps exist, notably in unrepresented geographic locations, multidisciplinary integration, adaptation-focused analysis and policy implications. Further studies should concentrate on sensitive locations, improve the

incorporation of environmental and socioeconomic views and create realistic options for sustainable land management in the face of accelerated climate change. Related prospective study targets have been emphasised by previous researchers, who emphasised the significance of merging ecological sustainability, water resource management and land-use adaptation techniques under changing climate scenarios (29, 30).

Conclusion

This bibliometric analysis indicates that research on the effects of climate change and drought on land cover has increased significantly over the previous decade, demonstrating the increasing worldwide significance of ecological sustainability, ecosystem resilience and land degradation concerns. The publishing peak in 2021 suggests that climate-related land cover change is becoming a more pressing scientific and policy problem, particularly considering exacerbated drought events, environmental degradation and worldwide climate adaption efforts. The analysis revealed that scientific production is strongly concentrated in countries with advanced research infrastructure and substantial financial support, particularly China and the United States. While these countries play a leading role in advancing climate and land degradation research, the underrepresentation of highly vulnerable regions such as Africa and Central Asia highlights an important imbalance in the global scientific landscape. Addressing this gap will require broader international collaboration, improved access to research funding and greater inclusion of locally relevant environmental challenges.

The prevalence of hydrology-focused publications and remote sensing-based research methodologies indicates that current investigations prioritise biophysical and technological evaluations of climate-land relationships. Future research, however, should go above solely ecological evaluations and consider socioeconomic susceptibility, adaptation strategy, sustainable farming and resilience in communities. Expanded cross-disciplinary cooperation will be required to establish successful responses to climate-related land degradation. This study also demonstrates that bibliometric analysis is an effective method to determine scientific patterns, significant authors and new research objectives. Nonetheless, restrictions such as database coverage, language limits and reference bias must be addressed when evaluating the results.

In summary, upcoming studies needs to concentrate on enhancing global collaboration, optimising spatial visualisation, combining sophisticated geospatial technologies with socioeconomic evaluation and developing environmentally friendly land management tactics capable of increasing ecological resilience in the face of climate change. Such activities will help to promote more equitable scientific progress while also supporting evidence-driven environmental initiatives and adaptation strategies around the world.

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Authors' contributions

GK was responsible for data collection, formal analysis, software and validation, as well as conceptualisation, methodology, data curation, bibliometric analysis, visualisation, writing the original draft and supervision. TB contributed to methodology support, interpretation of results and writing review and editing. NK was involved in literature screening, data verification and writing review and editing. BA contributed to visualisation, network mapping and technical support for bibliometric tools. RD contributed to conceptual discussion, critical revision of the manuscript and final approval. All authors have read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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