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Climate Change and Health in the Global South A scientometric analysis

Obianuju Ilo; S Ilo; Danny Simatele

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A bibliometric review of research on climate change in Africa

Obianuju Patience Ilo [a,*,1], Stephen Sunday Emmanuel [b,2], Ademidun Adeola Adesibikan [c], Odunayo T. Ore [d,3], Ajibola A. Bayode [e,4], Hamza Badamasi [f,5], Saheed O. Sanni [g,6], Mulala D. Simatele [a,7]

[a] School of Geography, Archaeology and Environmental Studies, Faculty of Science, University of the Witwatersrand, Johannesburg, South Africa
[b] Department of Industrial Chemistry, Faculty of Physical Sciences, University of Ilorin, Ilorin, Nigeria
[c] Department of Chemistry, Faculty of Natural and Agricultural Sciences, University of Pretoria, Pretoria, South Africa
[d] Department of Chemistry and Industrial Chemistry, Kogi State University, Kabba, Nigeria
[e] Department of Chemical Sciences, Faculty of Natural Sciences, Redeemer's University, Ede, Nigeria
[f] Department of Chemistry, Federal University Dutse, Dutse, Nigeria
[g] Wastewater Treatment Research Laboratory, Department of Biotechnology and Chemistry, Vaal University of Technology, Vanderbijlpark, South Africa

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ABSTRACT

The increasing frequency and severity of climate change-related disasters have made it a dominant issue in global public policy debates. In Africa, scholarly climate change research publications have gradually evolved, reflecting growing academic engagement with the continent's unique climate challenges. This study makes a novel contribution by conducting a bibliometric analysis that not only maps the volume of scholarly output but also explores key trends, geographic distribution, keywords, leading researchers, collaboration networks, and research visibility. Using the VOSviewer visualisation tool, network maps were generated from a dataset of 662 research publications. The findings indicate that scholarly interest in this area gained momentum around 2016 and has continued to grow, with South Africa, Nigeria, and Ghana emerging as leading contributors. However, the analysis also highlights limited collaboration among authors and institutions, which may impede the coherence and impact of climate-related policy and practice. Moreover, the study identifies a disconnect between the production of climate knowledge and its practical application. To address this gap, the paper recommends that climate scientists reassess their approaches to collaboration and strengthen partnerships with media professionals to enhance the dissemination of accurate and actionable climate information.

1. Introduction

Climate change is considered the leading long-term global threat to humanity. The swift rise in climate change disasters has made it a dominant issue in global public policy debates. Such disasters have resulted in fatalities, significant physical and mental injuries, interruptions to economic activities, environmental destruction, and the displacement of communities, among other consequences (Iyke, 2024). For instance, Africa is facing notable effects from climate change, evidenced by rising temperatures, sea level elevation, shifting rainfall trends, and more severe weather events causing systemic threats to its economies, infrastructural investments, water and food supplies, public

* Corresponding author.
E-mail addresses: Obianuju.ilo@wits.ac.za (O.P. Ilo), emmanuel.s@phystech.edu (S.S. Emmanuel), adesibikana@gamil.com (A.A. Adesibikan), otore@ksukabba.edu.ng (O.T. Ore), bayodea@run.edu.ng (A.A. Bayode), amza.badamasi@fud.edu.ng (H. Badamasi), mosqit.saheed@gmail.com (S.O. Sanni), mulala.simatele@wits.ac.za (M.D. Simatele).
[1] https://orcid.org/0000–0003-3951–3826
[2] https://orcid.org/0000–0003-0896–2776
[3] https://orcid.org/0000–0002-5529–1509
[4] https://orcid.org/0000–0003-2461–6208
[5] https://orcid.org/0000–0001-5339–1111
[6] https://orcid.org/0000–0001-6086–8280
[7] https://orcid.org/0000–0002-2161–1586

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health, agricultural sector, and livelihood (World Meteorological Organisation, 2022). These challenges jeopardise the limited progress made in development and raise the risk of plunging into elevated levels of extreme poverty. Additionally, these climate-related natural disasters have a negative impact on per capita gross domestic product (GDP) growth (Khan et al., 2023). According to the African Development Bank (2019), while Western and Eastern Africa would encounter a potential reduction of 15 % in their GDP by 2050, Northern and Southern Africa would face a 10 % decrease. This is because rebuilding damaged infrastructures after climate-related disasters, such as buildings and roads, necessitates budget modifications, economic contraction, and increased government expenditures.

From a scientific perspective, it is unequivocal that the emission of greenhouse gases, mainly carbon dioxide, resulting from burning fossil fuels, is central to climate change. Rising concerns about these escalating levels of greenhouse gas emissions globally have prompted the global community to address climate change through various efforts, treaties, and agreements, such as the UN Framework Convention on Climate Change (UNFCCC) in 1992, the Kyoto Protocol adopted in 1997, and the Paris Agreement adopted in 2015. According to Mor et al. (2023), the Paris Agreement offers a more robust framework for stable and sustained international collaboration in addressing climate change due to its built-in national commitments; every country has reduction targets specified in the Nationally Determined Contributions (NDCs). Furthermore, the Paris Agreement is helping to normalise the concept of net-zero emissions, thereby transforming the goals for limiting global warming into an actionable milestone that affects current investment decisions (Malm, 2023). Nonetheless, countries are not meeting their established emission targets, leading to continued increases in temperatures. Malm (2023) argued that climate change solutions typically focus on state actions; however, international agreements have failed to compel countries to tackle the issue effectively, suggesting that solutions should be sought through other means.

Climate change has shifted from being solely a scientific issue to a multidimensional challenge encompassing socio-economic development and sustainability. Africa, despite contributing only a minor fraction of global greenhouse gas emissions, faces disproportionate impacts, including heightened risks of starvation, disease outbreaks, and climate-induced disasters linked to environmental degradation (Magesa et al., 2023; Okoliko and De Wit, 2020). Addressing these challenges requires more than scientific evidence—it demands actionable knowledge that connects research outputs to practical solutions. Global frameworks such as Article 6 of the UNFCCC and Article 12 of the Paris Agreement emphasise the importance of knowledge sharing and capacity building to enable informed climate action (Howarth et al., 2020). Knowledge mapping plays a pivotal role in this process by organising and synthesising research trends, thematic clusters, and geographic gaps, making climate information more relevant and accessible. By linking abstract scientific findings to socio-economic realities, knowledge mapping provides a foundation for tailored communication strategies that resonate with local priorities and lived experiences. This approach indirectly shapes public opinion and fosters societal engagement, ultimately supporting more inclusive and effective climate action across Africa (Wijnen et al., 2024).

Building on this, a comprehensive and integrated knowledge base—one that bridges climate research with development priorities and supports evidence-driven strategies for sustainable adaptation—is therefore critical in Africa. However, as Wehn et al. (2021) observe, Africa's climate knowledge base remains disjointed and insufficiently institutionalised. Recent bibliometric analyses have identified significant deficiencies in Africa's climate change research landscape. For example, Fekete and Subramanian (2023) discovered that research on climate-related risks in East Africa is fragmented, characterised by insufficient multi-risk evaluations and a deficiency in integrated hazard-impact analysis. Similarly, Baninla et al. (2022) noted that although climate change research output is rising in Africa, it is unevenly distributed, with numerous nations inadequately represented in adaptation and mitigation studies. These patterns underscore the need for systematic knowledge mapping to identify thematic trends, geographic disparities, and collaboration networks, thereby informing strategies to strengthen research capacity and guide evidence-based policy development across the continent.

Our research fills an essential gap in the literature by systematically mapping the structure and dynamics of climate change research in Africa using a bibliometric approach. In this bibliometric review, we focus on the scholarly production and dissemination of climate-related research through peer-reviewed journal publications, rather than public communication or media discourse. Specifically, it seeks to:

(i) Identify the prevalent trends to understand the dominant themes and approaches in climate change research across Africa, including the role of indigenous knowledge
(ii) Map the geographic distribution of the researchers who have emerged as thought leaders in research on climate change in Africa to identify regional strengths and gaps.
(iii) Evaluate the degree to which these researchers collaborate to guide strategies for information dissemination and capacity building.

This study presents a focused bibliometric analysis of climate change research within the African context, making a novel contribution to the body of knowledge on climate change. The scholarly landscape of climate change research in Africa is mapped, highlighting patterns of authorship, collaboration, and thematic focus, in contrast to global assessments that frequently neglect regional disparities. The study offers practical insights for academics, funders, and policymakers seeking to improve the quality and inclusivity of climate science on the continent by identifying thematic patterns, spatial discrepancies, and collaborative networks. The study finds structural gaps and potential for improving information distribution by integrating studies of communication routes, visibility, and research output measures. It facilitates the decolonisation of climate science by highlighting African scholarship and exposing barriers to its global impact. The outcomes aim to enhance academic research and policy formulation, ultimately fostering more inclusive, equitable, and effective climate action across Africa.

2. Methods

2.1. Search strategy

The Web of Science database was comprehensively searched due to its vast and multidisciplinary repository of academic papers (Mishra et al., 2023; Yohannes et al., 2024; Yuan and Sun, 2022). The Web of Science (WoS) database uses clear criteria for selecting articles, ensuring high quality and relevance. It is more user-friendly than databases like Scopus and Google Scholar, allowing easy data management and precise citation analysis with minimal data cleaning (Ahmed et al., 2024). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework's recommendations for conducting systematic reviews were followed to ensure transparency and accountability (Page et al., 2021). The advanced search was carried out on August 13, 2024, using specific criteria to filter articles that align with our research goals. Keywords were combined using Boolean operators "AND" and "OR" as follows: TS= ("climate science" OR "climate change" AND Communication OR awareness AND Africa). The data was searched and compiled within a day to avoid potential bias from the frequent Web of Science database updates. The search did not specify a particular timeframe for the studies covered. This methodology was selected to guarantee the thorough inclusion of all pertinent papers, irrespective of their publication date. It was restricted to original research articles in English and excluded non-African countries. Publications addressing various aspects of climate change or climate science without reference to

communication or awareness, as well as research outside the African context, were excluded.

The AI Rayyan platform (www.rayyan.ai/) helped expedite the screening process by removing duplicates and evaluating records according to predetermined criteria. Three researchers screened in two stages—first reviewing titles and then abstracts—while a fourth reviewer resolved any discrepancies to ensure objectivity. The final dataset included 622 documents for bibliometric analysis. Fig. 1, created using an interactive R package and the Shiny application, depicts the PRISMA framework flowchart of the search strategy.

2.2. Bibliometric analysis

Bibliometric analysis employs mathematical and statistical techniques to quantitatively analyse literature concerning the overall trends in the development of a subject or field, and it has found widespread application across various disciplines (Mishra et al., 2023). Researchers can utilise bibliometric tools to investigate the relationships among authors, frameworks, methodologies, and practices. The entire collection was downloaded in Research Information System (RIS) format and imported into the Zotero reference manager for sifting before uploading to VOSviewer. Additionally, the retrieved documents were exported to a Microsoft Excel spreadsheet for evaluation of descriptive statistics. The list of reviewed articles is presented in Supplementary Table 1.

VOSviewer software (version 1.6.20, http://www.vosviewer.com) was selected for creating bibliometric maps in this study. This software is a tool that enables users to build and visualise networks or relationships through text mining during citation or reference processes (van Eck and Waltman, 2010). In the network visualisation maps generated by VOSviewer, labels are shown as coloured nodes, with larger nodes indicating higher usage frequency. The thickness of the nodes and connecting lines reflects how often the labels co-occur, while nodes of the same colour signify stronger connections (Hsieh and Yeh, 2024).

3. Results

3.1. Publication trends in climate change research

To offer an initial overview of the progression in the field of climate-related research, an analysis of the publication productivity over time, indicated by the number of papers published each year, was conducted. The exponential increase in the annual publication trend from 1977 through August 2024 in the WoS database is presented in Fig. 2. From 1977–2005 is viewed as the early phase, with 4.82 % of publications. During this period, the subject is considered to be still at the nascent stage of the global research trend. 2006–2015 is the transition phase with 19.93 % publications. During this phase, annual publications exhibit a fluctuating trend, but there is an overall increase compared to the earlier stage.

The development phase is seen from 2016 to the present, with 75.24 % of total publications. In this phase, the number of papers has increased steadily since 2016, indicating that the academic and scientific community has recently shown a greater interest in research on climate–related research. This can be credited to the influence of the Paris Agreement, which highlighted the importance of public awareness and effective communication regarding climate change information (Dupar et al., 2019). Also, climate change's consequences and risks have become increasingly obvious. The dip observed around 2024 is likely due to WoS's incomplete coverage of recent publication years at the time the search was conducted and does not indicate a decline.

3.2. Geographical distribution

Climate science research is a highly interdisciplinary undertaking

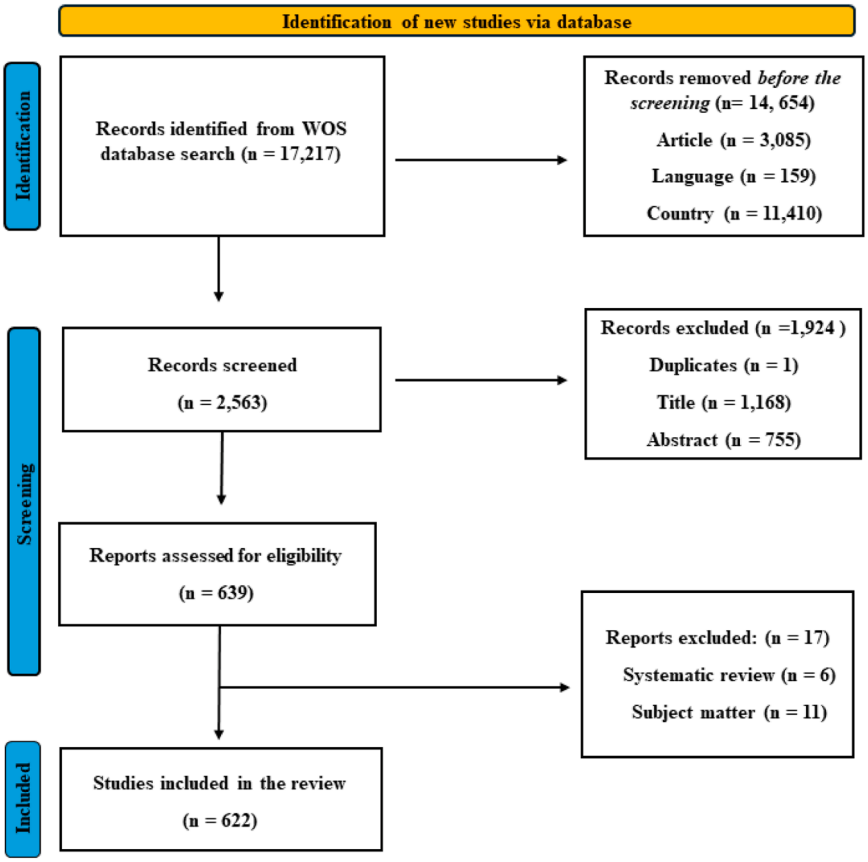


Fig. 1. PRISMA framework flowchart of the search strategy.

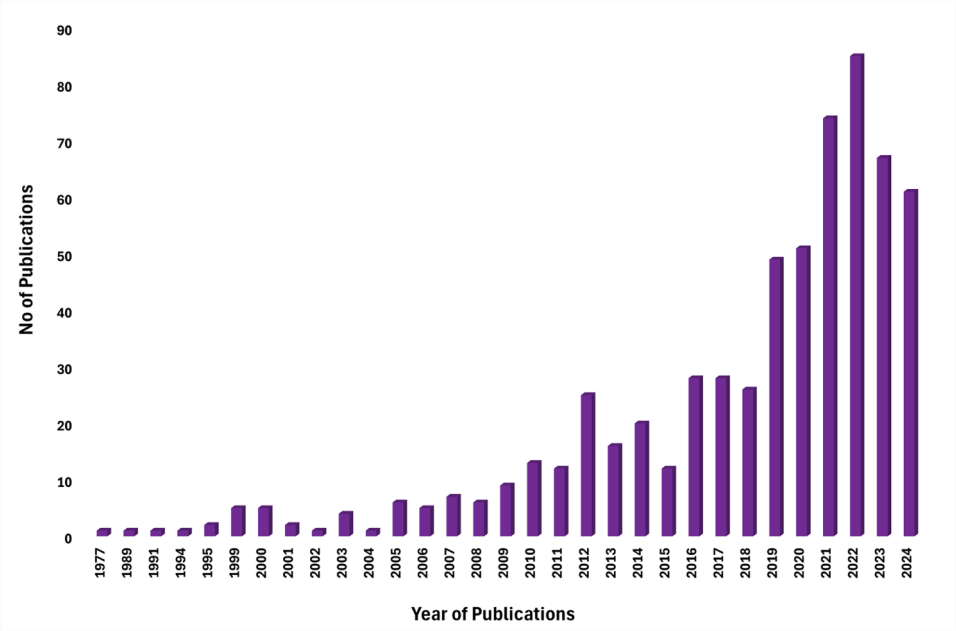


Fig. 2. Publication trend.

and a field where numerous countries are actively engaged and collaborating with one another. An analysis was conducted on the countries that have published on climate-related research. The analysis shows that climate science research has attracted worldwide interest. In total, 36 African countries have contributed to the literature on this subject, with 15 countries publishing more than five articles. The top ten countries with the most academic production are displayed in Fig. 3. The countries are colour-coded based on their publication frequency. The Treemap indicates that South Africa has the highest number of publications, totalling 399 articles (64.15 %), followed by Nigeria with 60 articles (9.65 %) and Ghana with 47 articles (7.56 %). It's possible that data availability is the cause of this South African prejudice. This broad involvement demonstrates that even though climate science research is an urgent global challenge that has drawn the attention of authors from these nations, numerous African countries remain new frontiers. This corroborates previous research indicating a scarcity of studies focused on Africa (Baninla et al., 2022; Okoliko and De Wit, 2020)

3.3. Co-authorship and Collaboration Analysis

The co-authorship network analysis reveals the collaboration patterns among researchers in communicating climate science research. Authors represented by the same colour demonstrate a more substantial level of association. The nodes indicate which researchers hold greater importance and influence within the network. Out of the 1880 authors, 27 met the threshold of a minimum of three documents for an author. Considering the total number of articles an author has published on the subject, Nhamo, Godwell, Wright, Caradee Y., Ojo, Temitope O., and Shackleton, Charlie M. authored 10, 10, 7, and 6 documents, respectively. Although many authors might have the same number of publications, their significance can be distinguished by the number of citations they receive. Using this criterion, the authors with the highest citations are Ojo, Temitope O., with 251 citations, Baiyegunhi, L. J. S., with 223 citations, Shackleton, Charlie M., with 184 citations, Ziervogel, Gina, with 136 citations, and Nhamo, Godwell, with 105 citations.



Fig. 3. Tree Map of the top 10 countries' scientific production on climate-related research in Africa.

However, the result in Fig. 4 indicates that Wright, Caradee Y., has the most influential node in the network, with a total link strength of 7. The map suggests that there is little collaboration among climate science researchers in Africa and that certain researchers occupy more significant and collaborative roles than others.

3.4. Keyword Analysis

Keyword analysis, which highlights main themes and concepts at the leading edge of current trends, reveals a more correlated landscape of climate-related research in Africa. At a minimum threshold of five, only 150 keywords met the threshold out of the 2912 keywords and six clusters were denoted. As depicted in Fig. 5, the keywords that appeared most amongst a wide range of topics were “climate change”, “management”, “adaptation” and “awareness”, which occurred 84 times (total link strength 308), 58 times (total link strength 243), 53 times (total link strength 279), and 51 times (total link strength 234), respectively. The six clusters of keywords are presented in Table 1.

According to Isah et al. (2024), applying the author’s keyword co-occurrence is an integral part of academic research papers as these words summarise the central theme of the research work and offer readers insight into what to expect. Further analysis of the authors’ keywords showed that at a minimum threshold of five, 54 out of 1898 authors’ keywords met the threshold. Fig. 6 depicts that “climate change” is the highest keyword, appearing 84 times with a total strength link of 106.

3.5. Journal impact analysis

The number of papers published in specific journals serves as an indicator of the journal’s significance in the field. Therefore, it is valuable to identify which journals are quantitatively leading as publication venues for researchers in climate-related research. Among the journals surveyed, a significant majority (72.36 %) published only one article on climate-related research. This finding suggests that these journals may lack a specialised focus on the subject, potentially highlighting a cross-cutting theme relevant across various fields of knowledge. Additionally, 11.92 % of the journals have published two articles, 6.50 % have published three articles, and 3.52 % have contributed four articles. Notably, 5.69 % of journals have released five or more articles, indicating a comparatively higher level of engagement with the subject. The leading ten journals on climate-related research in Africa were analysed and presented in Fig. 7. Sustainability, Water SA, South African Journal of Science and Heliyon, comprising 25, 13, 12 and 11 articles, are the top active sources.

3.6. Subject area

The current study analysed the distribution of research articles on climate-related research across various subject areas. As anticipated, the natural sciences play a leading role in climate change research. Fig. 8 shows that Environmental Sciences is the primary subject area with a total of 130 articles (20.9 %), followed by Environmental Studies with 99 articles (15.92 %) and Green Sustainable Science Technology with 64



Fig. 4. Network visualisation of co-authorship among authors in climate-related research in Africa.

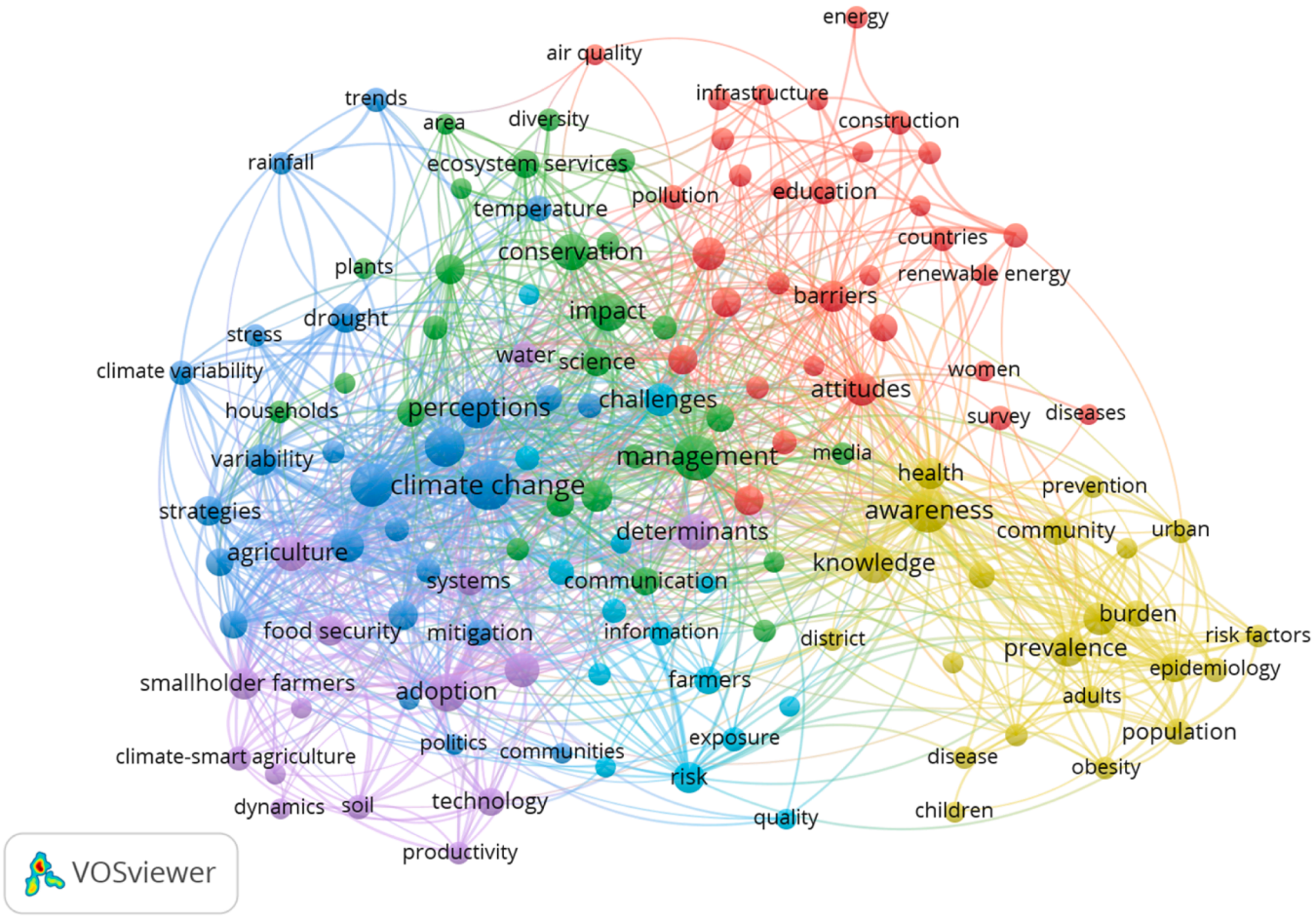


Fig. 5. Network visualisation of keywords used for climate-related research in Africa.

Table 1
List of keywords according to clusters.

Clusters	Keywords	Theme
Red	Air quality, attitudes, barriers, construction, disposal, drivers, energy, environmental awareness, environmental education, framework, pollution, recycling, renewable energy, sustainability, sustainability development, water conservation	Sustainability practices
Green	Area, biodiversity, communication, conservation, diversity, ecology, ecosystem services, implementation, income, livelihoods, management, people, plants	Ecosystem management
Blue	Adaptation, adaptation strategies, adaptive capacity, challenges, climate change, climate change variability, engagement, governance, innovation, mitigation, politics, resilience, technology, variability, vulnerability	Climate resilience and policy
Yellow	Adults, awareness, blood pressure, children, community, depression, disease, epidemiology, health, hypertension, mortality, obesity, prevalence, prevention, risk factors	Public health
Magenta	Adoption, agriculture, agroforestry, climate-smart agriculture, drought, food security, smallholder farmers, soil, temperature, trends	Agriculture
Turquoise	Challenges, climate change adaptation, exposure, information, innovation, opportunities, patterns, quality, sustainable development goals, system, urbanisation	

articles (10.29 %). Moreover, climate change research has become a topic of interest for disciplines outside the natural sciences due to its widespread importance across various fields, reflecting its multifaceted nature.

4. Discussion

4.1. Broad overview of the research subject

Climate-related research is an essential field of study that has received considerable attention in recent years. To assess the state and evolution of climate-related research studies in Africa, 662 scientific papers from the WOS database were examined. Our research reveals that these fields have experienced three significant phases over the past few decades: the early phase (1977–2005), the transition phase (2006–2015), and the development phase (2016–2024). During the initial stage, there were only a limited number of publications in Africa addressing climate science and communication. In 2006, the number of publications on this topic rose, indicating a positive trend. There was a significant surge in climate-related research during the development phase that started in 2016. Our findings indicate a growing awareness and focus on climate science and communication issues in Africa.

The advancement of research on this topic is evidenced by the participation of numerous countries, authors, keywords, journal publications, and subject areas. Scientific contributions are led mainly by South Africa, Nigeria and Ghana. The research keywords and authors' keywords identified climate change as a persistent and relevant theme. Meanwhile, in terms of authors, Nhamo, Godwell, Wright, Caradee Y., Ojo, Temitope O., and Shackleton, Charlie M. tend to have published

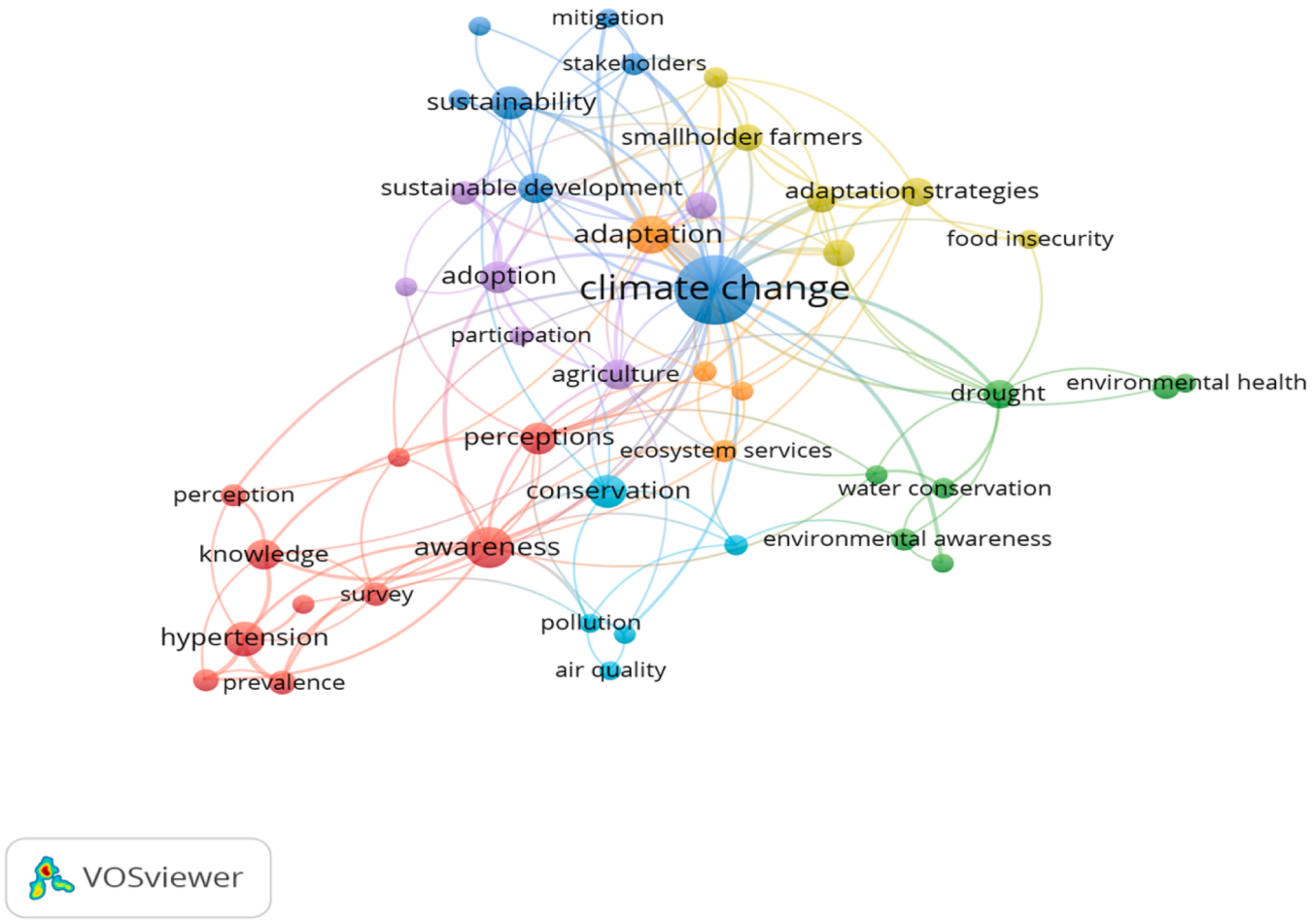


Fig. 6. Network visualisation of authors' keywords.

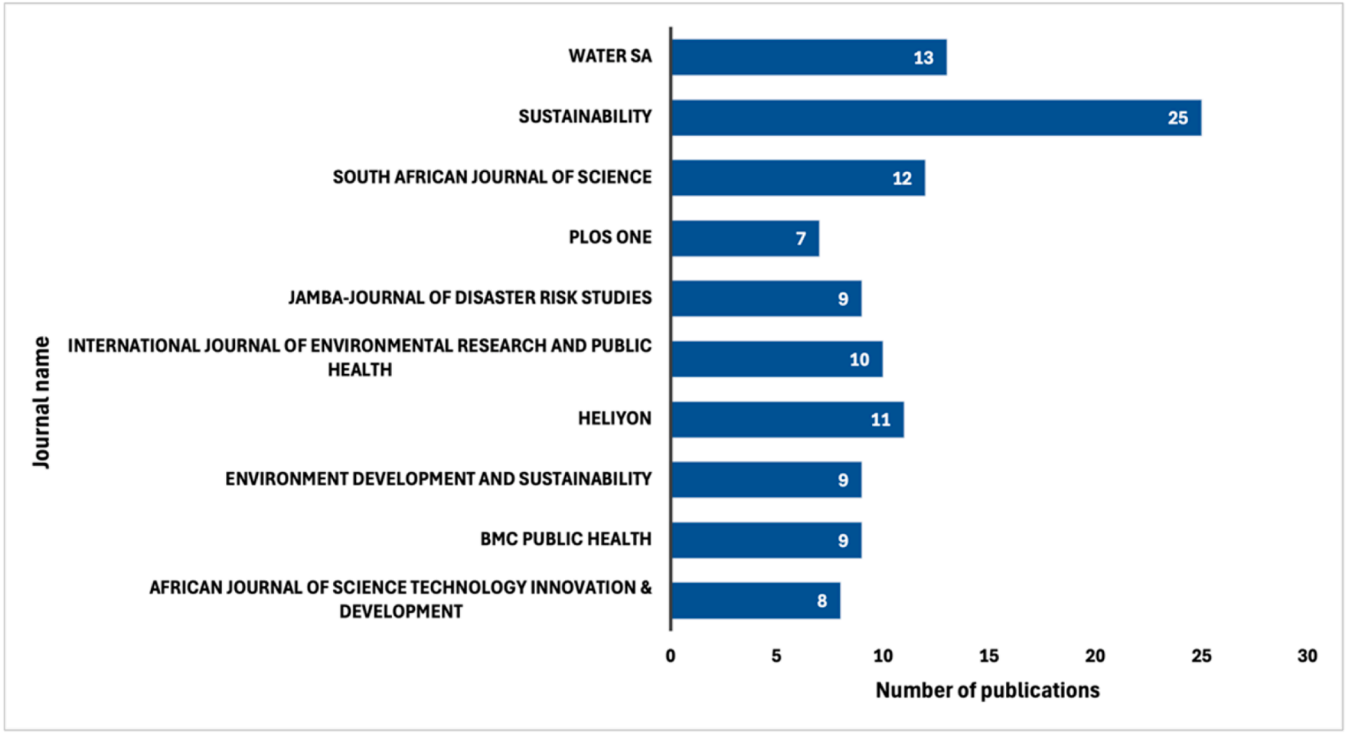


Fig. 7. Top ten most productive journals on climate-related research in Africa.



Fig. 8. Tree Map of the top 10 subject areas of climate-related research in Africa.

more articles on the subject matter. However, Wright, Caradee Y has the most collaborative node. According to Ahmed et al. (2024), scientific collaboration is essential as it enables researchers to enhance their work, discover new insights, and communicate their findings more broadly. There is a risk of errors or overlooking crucial information that may alter their approach to a challenge when scientists operate independently. Collaborating allows them to leverage diverse perspectives, expertise, and resources.

4.2. Concerns on Climate-related research in Africa

Climate change started as a scientific issue; however, its far-reaching effects and possible mitigation and adaptation strategies make it relevant to everyone, regardless of their sector, interests, or nationality. The IPCC, in one of its assessment reports (AR5), emphasised the critical role that communication plays in raising public awareness of the risks associated with climate change, disseminating information on adaptation strategies, and strengthening the ability of both individual and group adaptation efforts (Vulturius et al., 2020). Consequently, it is becoming increasingly apparent that successfully conveying climate science is crucial in determining how various stakeholders respond to climate change. Despite the growing climate communication strategies for the vulnerable and impoverished in Africa, some concerns were noted. The cumulative problems provide a substantial risk to Africa's objectives of alleviating poverty, resolving conflict, and establishing resilient, peaceful, and affluent communities, as outlined in the latest policy framework of the African Union Commission (Okoliko and De Wit, 2020).

A notable challenge identified in the literature is the limited participation of the African scientific community in international climate change publications. A conflict appears to exist between universalistic science and Indigenous knowledge systems, frequently leading to inconsistencies in policy development and climate action. Universalistic science frequently overlooks local contexts and indigenous knowledge systems that have evolved throughout time (Kamara et al., 2018). Rudiak-Gould's (2014) study on the impact of science communication on Indigenous perceptions of climate change underscores the need for climate-related research in frontline and Indigenous communities. It enumerates several critical advantages, including informing individuals about the global human and technology factors contributing to climate change, so exonerating them from accountability for the issue, offering long-term climate predictions beyond ecological knowledge, and proposing novel adaptation strategies.

A vital aspect of climate communication in Africa is the significance of public confidence in scientists and climate research. Cologna et al. (2025), assert that widespread scepticism towards climate scientists may undermine the effectiveness of climate communication initiatives. This is particularly relevant in the African context, where historical and socio-political factors may shape public opinions of science and scientists. Sippel et al. (2022) highlight the importance of trust in climate communication, asserting that scientists must adopt strategies to bolster credibility and foster public engagement. This entails tailoring communications to meet the specific needs and cultural contexts of diverse audiences, fostering a more inclusive dialogue on climate issues.

The review reveals a disparity between the generation of climate knowledge and its practical implementation. Therefore, it is essential to evaluate the efficacy of existing communication techniques in Africa regarding their influence on perceptions and their role in fostering societal change related to climate change adaptation. For example, Levi (2021) stated that the widespread inequality in South Africa, along with its economic reliance on coal, shapes how climate change is communicated and understood. Environmental NGOs, journalists, and scientists often lead the discourse on climate change. However, their messages predominantly appear in newspapers targeting an urban, educated audience and tend to have less impact on rural communities or individuals working in the coal and mining industries. Also, Okoliko and De Wit (2020) noted a lack of interest, especially in new media (social media and blogs) and radio. Therefore, alternative media formats beyond newspapers should be taken into account should citizen engagement be accorded appropriate significance.

Therefore, we recommend a need for climate scientists to reassess their methods of collaborating with and assisting media professionals in disseminating accurate climate information. Also, a deliberate effort is necessary to allocate research focus to various regions of Africa to facilitate a more comprehensive understanding of climate-related research across the continent. Expanding climate-related research in Africa is advantageous, as a diversified academic community is more likely to generate a wider range of research enquiries, employ varied methodologies, and access a broader spectrum of resources.

4.3. Limitations of the review

This study has its limitations. Primarily, it depends on the Web of Science database, which means we might have overlooked some publications not included in WoS but accessible through other databases like Scopus and Google Scholar. Secondly, texts in languages other than

English were not considered. Together, these factors could potentially influence the results of our study.

5. Conclusion

As scientific publications grow increasingly complex, comprehending the framework and dynamics of climate change research has become progressively essential for directing evidence-based initiatives. A bibliometric analysis was conducted to systematically map Africa's ongoing efforts in climate change research based on the prevalent trends and geographic distribution of the researchers who have emerged as thought leaders in this domain. It also analyses collaboration patterns among these scholars, offering insights into the networks that influence knowledge production across the continent. The study selected 662 articles systematically from the Web of Science database using the PRISMA framework. The findings indicate a substantial increase in the literature, emphasising the key challenges faced in Africa. South Africa leads in productivity, followed by Nigeria, Ghana, and Ethiopia. Trending keywords include climate change, management, adaptation and awareness, while Wright, Caradee Y. remains the author with a high total strength link. The results of this study have important implications for future research on climate change. The keywords and authors' keywords highlight the necessity for focused inquiries into particular areas, such as climate change mitigation, adaptation and awareness. The limitations of this study include its reliance solely on the WoS database and its focus on articles published in English.

CRediT authorship contribution statement

ILO OBIANUJU PATIENCE: Writing – original draft. **Saheed O Sanni:** Writing – review & editing. **Hamza Badamasi:** Writing – review & editing. **Mulala D Simatele:** Supervision. **Ademidun Adeola Adesibikan:** Methodology, Formal analysis, Data curation. **Stephen Sunday Emmanuel:** Methodology, Formal analysis, Data curation. **Ajibola A. Bayode:** Validation. **Odunayo T. Ore:** Methodology, Formal analysis, Data curation.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envsci.2025.104285.

Data availability

No data was used for the research described in the article.

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