



The Climate Change and National Security Nexus: A Bibliometric Analysis of Publication Patterns, Intellectual Structure and Future Agendas

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Abstract

Background: Climate change has emerged as a critical global challenge with far-reaching implications for national security. Growing concerns over its impacts on human, food, water, and energy security have led to increasing scholarly attention; however, the overall intellectual structure and evolution of this research field remain insufficiently explored.

Purpose: This study examines the nexus between climate change and national security by analyzing global research trends, thematic evolution, influential contributors, and future research agendas.

Design/methodology/approach: A bibliometric analysis was conducted on 1,186 documents published between 2000 and 2025, retrieved from the Scopus database. The data were analyzed using Biblioshiny (R) and VOSviewer to perform performance analysis and science mapping.

Findings: The results reveal substantial growth in the field, with an annual growth rate of 22.35% and an average of 29.49 citations per document. Annual publications increased from 74 in 2020 to 155 in 2025. Sustainability (Switzerland) emerged as the most productive journal with 27 publications, while Climatic Change was the most influential source, receiving 1,922 citations. Wang Y was identified as the most productive author (10 publications), whereas Barnett J was the most impactful author (107 citations). The United States dominated research output with 178 publications and 7,330 citations. Science mapping identified climate change and national security as central themes, closely connected to human, food, water, and energy security. Thematic analysis further highlighted the absence of well-developed motor themes and the emergence of topics related to sustainable development and health risks.

Conclusion: The climate change–national security research domain is expanding rapidly but remains conceptually fragmented. The findings underscore the need for integrated climate–security frameworks, greater interdisciplinary collaboration, and increased scholarly attention to climate-vulnerable regions to strengthen future research and policy development.

Keywords: Climate change, national security, human security, environmental security, bibliometric analysis

1. Introduction

Climate change has become one of the defining global challenges of the twenty-first century, exerting profound impacts on natural systems, human livelihoods, and geopolitical stability (Upreti, 2023; Rashidy, 2024; Khadka et al., 2025; Khanal et al., 2025). The average global surface temperature has already increased by approximately 1.1°C above pre-industrial levels, and the frequency and intensity of climate-related extreme events, such as heatwaves, floods, droughts, and cyclones, have risen markedly over the past three decades (Price et al., 2024; Warren et al., 2024). In 2023 alone, climate-induced disasters affected more than 300 million people worldwide and generated economic losses exceeding USD 250 billion (United Nations Office for Disaster Risk Reduction, 2023). Moreover, the World Bank estimates that climate change could push over 130 million people into extreme poverty by 2030 if adaptive measures are not strengthened (Africa, 2025). These escalating impacts extend beyond environmental degradation and development setbacks, increasingly intersecting with issues of political stability, social cohesion, and security (Berebon, 2025). As a result, climate change is no longer viewed solely as an environmental concern but is increasingly recognized as a systemic risk that shapes national and international security landscapes.

Climate change refers to long-term alterations in temperature, precipitation, and other climatic patterns resulting from both natural variability and, predominantly, human activities such as fossil fuel combustion, deforestation, and industrial processes that increase greenhouse gas concentrations in the atmosphere (Raizada et al., 2022; Rawat et al., 2024). These changes affect ecosystems, water availability, agricultural productivity, and human health, thereby influencing the foundations of economic and social systems (Sarfaraz, 2024; Singh, 2024; Jadav et al., 2025). National security, traditionally defined as the capacity of a state to safeguard its territorial integrity, political sovereignty, and vital interests from internal and external threats, has undergone significant conceptual expansion in recent decades (Paleri, 2022; Wu, 2025). Contemporary security thinking increasingly incorporates non-traditional threats, including pandemics, cyber risks, and environmental degradation (Nwoko & Briggs, 2025). Within this broadened framework, climate change is conceptualized as a “threat multiplier” that exacerbates existing vulnerabilities and amplifies the likelihood of instability, rather than acting as a direct cause of conflict (Torales et al., 2026).

A substantial body of literature has examined the pathways through which climate change intersects with national security. Empirical studies suggest that climate variability and extreme weather events can increase the risk of civil conflict by undermining livelihoods and intensifying competition over scarce resources (Dutse, 2024; Vanden Eynde & Vargas, 2025). Research has also highlighted the role of climate-induced migration in reshaping demographic patterns and generating political and social pressures within and across states (Osei-Amponsah et al., 2023; Almulhim et al., 2024; Poddar, 2024). Other scholars emphasize the security implications of climate impacts on critical infrastructure, food and water systems, and military installations, particularly in coastal and arid regions (Daoudy et al., 2022; Read et al., 2025). At the geopolitical level, climate change is altering strategic environments by opening new Arctic shipping routes, intensifying competition over natural resources, and influencing power relations among states (Carniel et al., 2024; Hashum, 2025). Collectively, these studies demonstrate that the climate–security nexus is multifaceted, operating across local, national, and global scales.

Despite the rapid growth of this interdisciplinary scholarship, the literature remains dispersed across environmental science, political science, security studies, and development research. Much of the existing work relies on qualitative case studies or region-specific quantitative analyses (Daoudy et al., 2022; Rawat et al., 2024; Hashum, 2025), which, while insightful, offer limited understanding of the overall structure and evolution of the field. There is comparatively little systematic evidence on how research output has expanded over time, which countries and institutions dominate knowledge production, and how dominant themes have shifted in response to emerging global concerns. Bibliometric analysis provides a robust methodological approach to address these limitations by quantitatively mapping publication patterns, citation structures, and keyword co-occurrences (Donthu et al., 2021; Lowar et al., 2025; Siddique et

al., 2026). However, comprehensive bibliometric investigations focusing specifically on the climate change–national security nexus remain scarce. In response to this gap, the present study conducts a bibliometric analysis of global scholarly literature on the climate change–national security nexus. The specific objectives are to: (1) analyze global research trends; (2) examine thematic evolution; and (3) identify future research agendas. By providing a systematic overview of the intellectual landscape, this study seeks to enhance understanding of how climate and security research has developed and to inform future scholarly and policy-oriented inquiries.

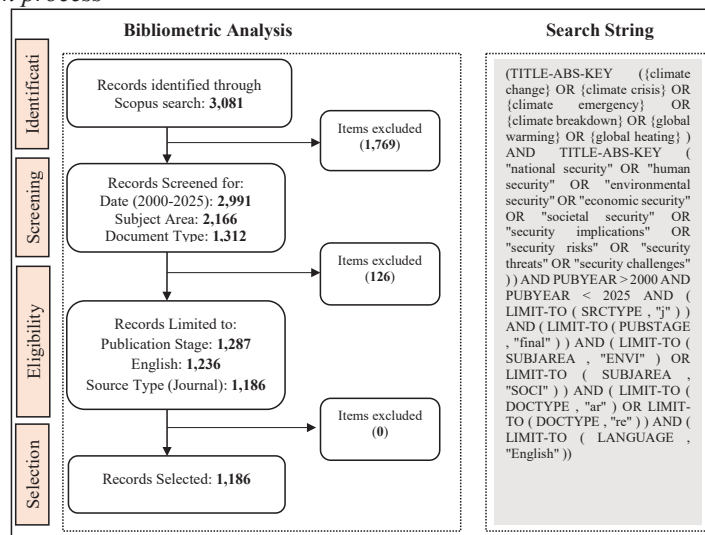
2. Methodology

The study utilized bibliometric analysis. Bibliometric analysis is a quantitative technique used to systematically examine large volumes of scholarly publications in order to identify research trends, influential sources, and thematic patterns within a field. Bibliometric analysis is particularly suitable for synthesizing interdisciplinary and fragmented literature, making it a rational method for analyzing the nexus between climate change (Khanal et al., 2025) and national security (Lowar et al., 2025; Donthu et al., 2021). This study adopted a single-source database approach by extracting bibliographic data from the Scopus database. Scopus is one of the largest abstract and citation databases of peer-reviewed literature, indexing more than 27,000 active journals across scientific and social science disciplines (Zhu & Liu, 2020). Scopus was selected due to its extensive coverage, standardized metadata, and strong compatibility with bibliometric software, which enhances reliability and reproducibility of results (Zhu & Liu, 2020; Singh et al., 2021).

Document selection followed the four step structured process: Identification, Screening, Eligibility, and Selection. In the identification stage, the search string was applied (See Figure 1), yielding 3,081 records. During screening, filters for publication year (2000–2025), subject areas (Social Sciences and Environmental Sciences), and document type (Article and Review) reduced the dataset to 1,312 records. Eligibility checks for final publication stage, English language, and journal source type resulted in, 1886 documents, which were retained for analysis. The selected dataset was analyzed using Biblioshiny (the web-based interface of the R bibliometrix package) and VOSviewer, which are widely used bibliometric tools for performance analysis, science mapping, and visualization of co-authorship, co-citation, and keyword networks (Khanal et al., 2025; Siddique et al., 2026). These tools enabled systematic examination of global research trends, thematic evolution, and identification of research gaps within the climate change–national security literature (Ejaz et al., 2022; Lowar et al., 2025).

Figure 1

Document selection process



Bibliometric analysis encompasses multiple analytical perspectives that enable a systematic understanding of scholarly landscapes. Prior studies distinguish two dominant approaches within this methodology: performance analysis and science mapping (Donthu et al., 2021; Siddique et al., 2026). Performance analysis concentrates on evaluating the productivity and influence of research actors by examining indicators such as publication volume, citation impact, prominent authors, leading journals, and the geographical distribution of research output (Basnet et al., 2024). Conversely, science mapping seeks to reveal the underlying intellectual and conceptual architecture of a field by exploring relational patterns among publications, authors, and keywords. This is commonly achieved through techniques such as co-authorship, co-citation, and keyword co-occurrence analyses, which help to identify dominant themes, knowledge clusters, and their temporal evolution (Lowar et al., 2025). Building on these perspectives, the present study integrates both approaches to generate a comprehensive and nuanced assessment of the climate change–national security research domain.

3.1 Information of Data Extracted

The extracted dataset provides a comprehensive overview of the scope and maturity of scholarly research on the climate change–national security nexus (See Table 1). Covering a 25-year period (2000–2025), the dataset comprises 1,186 documents published across 572 sources, indicating wide disciplinary dispersion and sustained academic engagement with this interdisciplinary domain. The annual growth rate of 22.35% reflects a rapidly expanding body of literature, suggesting escalating scholarly and policy interest in understanding climate change as a security-relevant phenomenon. The average document age of 7.21 years further indicates that much of the research is relatively recent, consistent with the growing recognition of climate change as a non-traditional security threat. Additionally, citation-based indicators demonstrate notable academic influence, with an average of 29.49 citations per document and a cumulative 9,039 references, underscoring the intellectual depth and connectivity of the field. The presence of 3,034 author keywords and 3,901 Keywords Plus highlights conceptual diversity and the emergence of multiple thematic strands linking environmental change to security concerns. In terms of document types, the dominance of articles (1,058) alongside a substantial number of review papers (128) suggests a balance between empirical investigation and knowledge synthesis. Further, authorship patterns reveal a strong collaborative orientation, evidenced by 3,375 contributing authors, an average of 3.24 co-authors per document, and 27.91% international co-authorship, reflecting the transboundary nature of climate–security challenges.

Table 1

Main Information about the Data

DESCRIPTION	RESULTS
DATA INFORMATION	
Timespan	2000:2025
Sources (Journals, Books, etc)	572
Documents	1186
Annual Growth Rate %	22.35
Document Average Age	7.21
Average citations per doc	29.49
References	9039
DOCUMENT CONTENTS	
Keywords Plus (ID)	3901
Author's Keywords (DE)	3034

DESCRIPTION	RESULTS
AUTHORS	
Authors	3375
Authors of single-authored docs	377
AUTHORS COLLABORATION	
Single-authored docs	423
Co-Authors per Doc	3.24
International co-authorships %	27.91
DOCUMENT TYPES	
Article	1058
Review	128

3.2 Performance Analysis

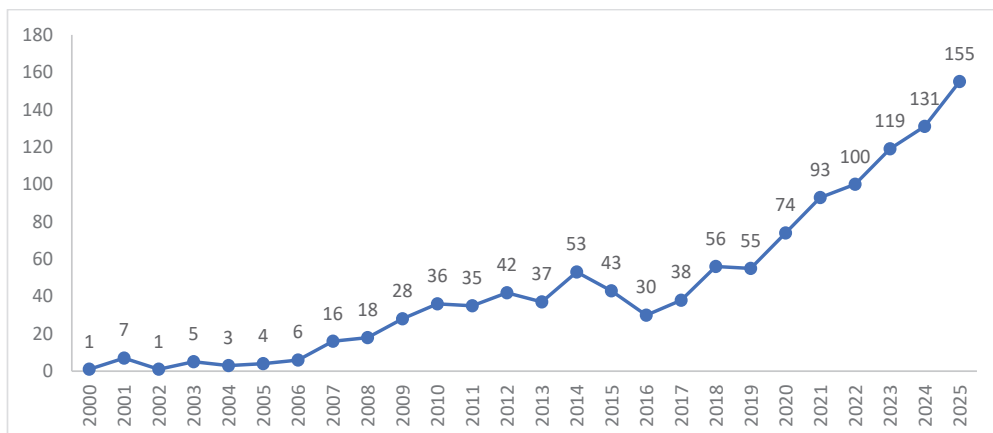
In this study, performance analysis covers Annual Scientific Production, the Life Cycle of Scientific Production, Most Relevant Sources and their Local Impact, Most Relevant Authors and their Local Impact, Most Relevant Affiliations, and Most Relevant Countries along with their Impact.

Annual Scientific Production

Annual scientific production refers to the number of scholarly documents published in a given year, reflecting the growth and temporal dynamics of research within a field (Basnet et al., 2024). The results show a gradual and modest output between 2000 and 2006 (See Figure 2), with fewer than ten publications annually, indicating limited early attention to the climate change–national security nexus. A noticeable upward trend begins after 2007, reaching 36 publications in 2010 and 53 in 2014, signaling growing scholarly recognition. Although minor fluctuations occurred between 2015 and 2019, production increased sharply from 2020 onward, rising from 74 documents in 2020 to 155 in 2025. This sustained acceleration highlights the expanding importance of climate change as a central concern within national security discourse. The post-2015 expansion coincides with international policy shifts, such as the Paris Agreement (2015), and growing acknowledgement of climate change as a “threat multiplier” within defense and security strategies (Stricof, 2021). The pronounced surge after 2020 further reflects how intensifying climate disasters, geopolitical tensions, and global risk assessments have reinforced the need for integrated climate–security perspectives.

Figure 2

Annual Scientific Production



Life Cycle of Scientific Production

The life cycle of scientific production refers to the temporal evolution of research output within a field (Huang et al., 2026). The analysis forecasts that research on the climate change–national security nexus will reach its saturation level (K) when the total number of publications reaches approximately 11,860 (See Table 2). However, only 1,186 publications have been recorded to date, indicating that the field remains far from maturity. This suggests that research on the subject is expected to experience sustained long-term growth and expansion in the coming years. The model estimates a peak year (T_m) of 2041 and a peak annual output of 425 publications, reflecting expectations of sustained acceleration in research activity. A growth duration (Δt) of 30.6 years implies an extended and dynamic development phase. The model exhibits strong explanatory power, as evidenced by a high R^2 value of 0.954, indicating that over 95% of the variance in publication trends is explained by the model. Additionally, the relatively low RMSE of 8.98 suggests minimal prediction error and high model accuracy. Collectively, these results confirm that the field remains in a robust growth stage and has not yet reached maturity.

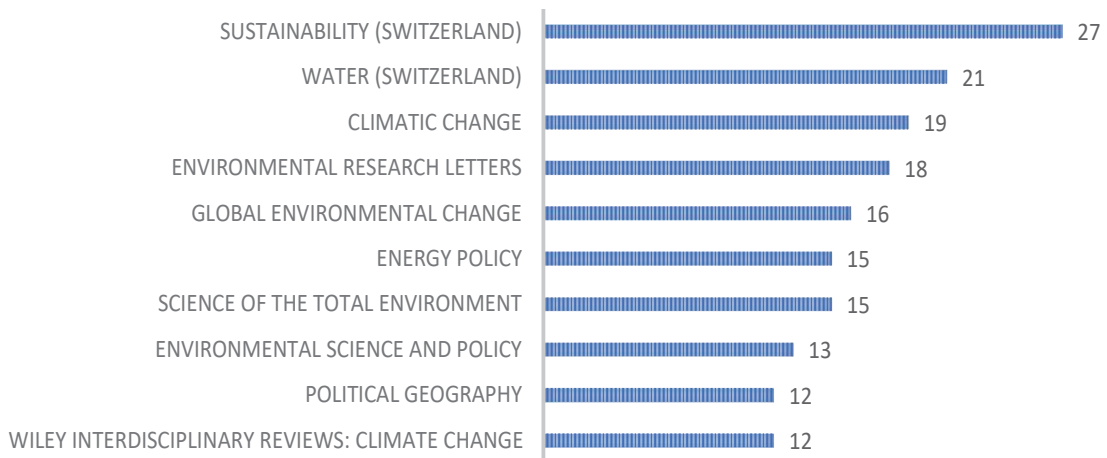
Table 2

Life Cycle of Scientific Production

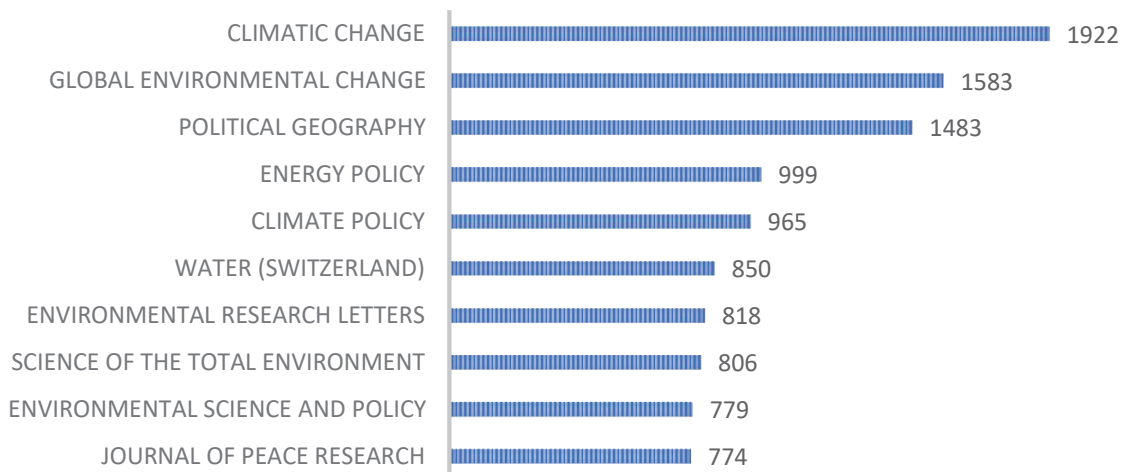
Indicator	Value
Saturation Level (K)	11,860 publications
Peak Year (T_m)	2041
Peak Annual Production	425 publications/year
Growth Duration (Δt)	30.6 years
Model Fit Quality	Excellent
R^2	0.954
RMSE	8.98

Most Relevant Sources

Most relevant sources are journals contributing significantly to a research field (Donthu et al., 2021). Figure 3 presents the top 10 journals publishing on the climate change and national security nexus. Sustainability (Switzerland) leads with 27 publications, followed by Water (Switzerland) with 21, and Climatic Change with 19 articles. Other notable contributors include Environmental Research Letters (18), Global Environmental Change (16), and Energy Policy (15). Science of the Total Environment also shares 15 publications, while Environmental Science and Policy (13), Political Geography (12), and Wiley Interdisciplinary Reviews: Climate Change (12) complete the list. This highlights a strong interdisciplinary focus, combining environmental science, policy, and energy studies with geopolitical implications. European journals, particularly from Switzerland, dominate, reflecting regional research leadership in sustainability and water management. Journals such as Global Environmental Change and Climatic Change indicate a strong global emphasis on climate impacts. Therefore, this distribution suggests that research on climate-security nexus is both policy-oriented and environmentally driven, underlining the multifaceted nature of this emerging field.

Figure 3*Most Relevant Source Analysis***Sources' Local Impact**

Sources' local impact refers to the influence of journals within research communities (Siddique et al., 2026). Figure 4 presents the top 10 journals producing the most impactful work on climate change and national security nexus. While Water (Switzerland) (21 publications, 850 citations) and Sustainability (Switzerland) (27 publications) lead in output, their citation impact remains moderate. In contrast, journals such as Climatic Change (19 publications, 1,922 citations), Global Environmental Change (16 publications, 1,583 citations), Political Geography (12 publications, 1,483 citations), and Energy Policy (15 publications, 999 citations) exert significant influence despite lower publication volumes. This contrast highlights a notable divergence between production and impact. High publication counts do not automatically translate into high citations, whereas journals with fewer articles can shape scholarly discourse more effectively. These findings underscore that research influence is determined by relevance, visibility, and cross-disciplinary resonance, rather than publication quantity alone (Donthu et al., 2021), emphasizing quality over quantity in advancing the climate-security research agenda.

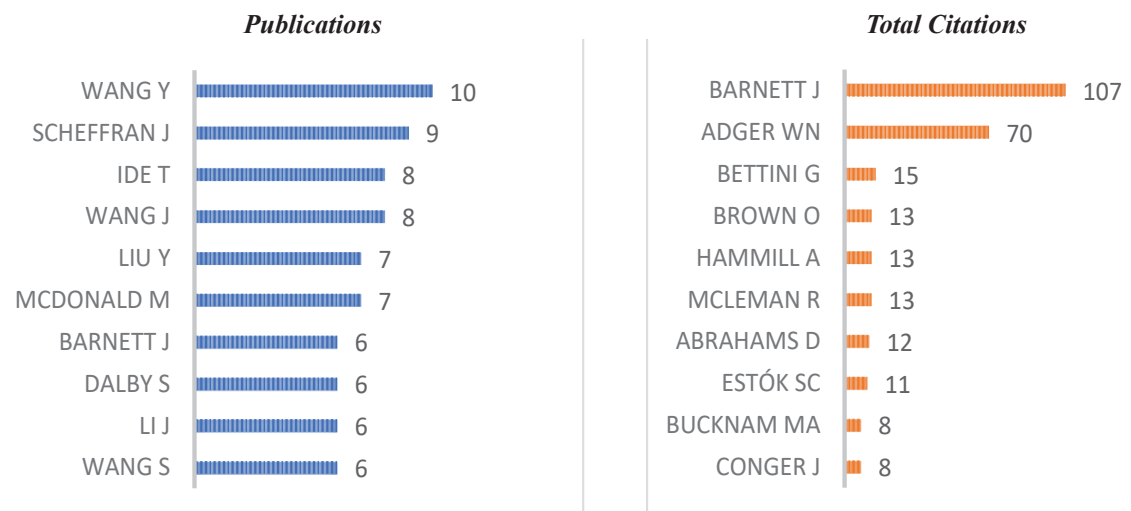
Figure 4*Sources' Local Impact*

Most Relevant Authors and their Local Impact

Most relevant authors are researchers who contribute significantly to a field through publications and citations (Basnet et al., 2024). Figure 5 illustrates this distinction: the left-side shows the most relevant authors based on publication count, while the right-side highlights authors' local impact based on total citations. Wang Y leads in productivity with 10 publications, followed by Scheffran J (9), Ide T (8), Wang J (8), and Liu Y (7). Other prolific contributors include McDonald M, Barnett J, Dalby S, Li J, and Wang S, each publishing 6–7 articles. However, high publication volume does not always equate to high influence. In terms of citation impact, Barnett J (107 citations) and Adger WN (70) stand out, while Bettini G, Brown O, Hammill A, and McLeman R also show notable influence despite fewer publications. This pattern underscores a divergence between productivity and scholarly impact, indicating that authors who generate fewer but highly cited works shape the discourse more effectively (Huang et al., 2026). The analysis highlights that visibility, relevance, and cross-disciplinary engagement are critical in establishing research authority within the climate change and national security nexus.

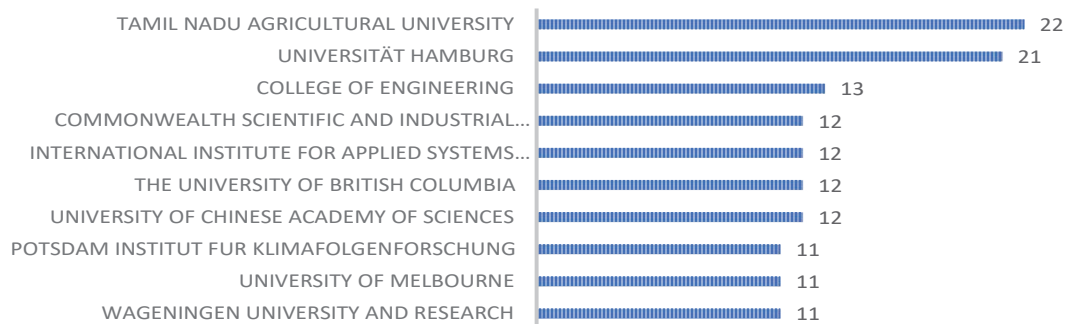
Figure 5

Most Relevant Authors and their Local Impact



Most Relevant Affiliation

Most relevant affiliations are institutions contributing significantly to a research field through the number of publications (Basnet et al., 2024). This becomes important as it identifies the leading institutions driving research productivity and advancing knowledge within the field. Figure 6 highlights the top 10 affiliations producing research on the climate change and national security nexus. Tamil Nadu Agricultural University leads with 22 publications, closely followed by Universität Hamburg with 21. College of Engineering contributes 13 publications, while Commonwealth Scientific and Industrial Research Organisation, International Institute for Applied Systems Analysis, The University of British Columbia, and University of Chinese Academy of Sciences each account for 12 publications. Potsdam Institut für Klimafolgenforschung, University of Melbourne, and Wageningen University and Research each have 11 publications. The distribution reflects a diverse global network of institutions actively engaged in the field, spanning Asia, Europe, North America, and Australia. These affiliations represent the primary centers of research activity, highlighting institutions that have made consistent contributions to advancing knowledge on the climate change and national security nexus through sustained publication efforts.

Figure 6*Most Relevant Affiliation***Most Relevant Countries and their Impact**

Most relevant countries are nations contributing significantly to a research field through scholarly publications and citations (Passas, 2024). Figure 7 shows the countries with the highest publication volumes on the climate change and national security nexus. The USA leads with 178 publications, followed by China (101), the United Kingdom (73), Australia (63), and India (49). Germany (43), Canada (37), Sweden (19), and the Netherlands (17) also feature among the top contributors. Similarly, Figure 8 presents the most cited nations, reflecting the influence of research output. The USA remains the most impactful with 7,330 citations, followed by the United Kingdom (3,393), Australia (2,837), and China (1,914). Other highly cited countries include Norway (1,805), Germany (1,638), Canada (866), Sweden (853), Japan (730), and India (606). The comparison reveals a clear dominance of the USA in both publication volume (178) and citations (7,330), reflecting its leading role in climate change and national security research. However, countries like the United Kingdom (73 publications, 3,393 citations) and Australia (63 publications, 2,837 citations) demonstrate high influence relative to their output, indicating that impact is not solely tied to quantity. The distribution also highlights the global nature of research, with significant contributions from North America, Europe, and Asia, underscoring a collaborative and internationally engaged research landscape.

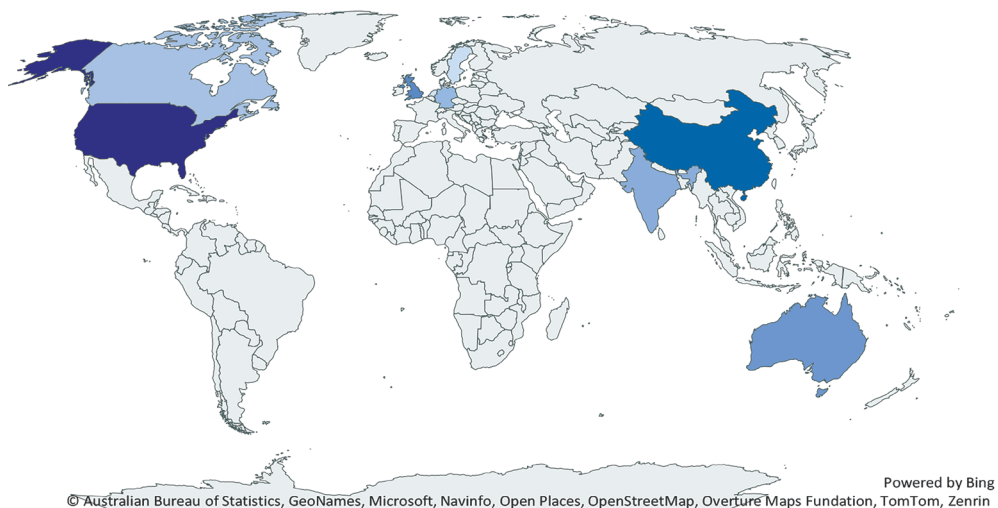
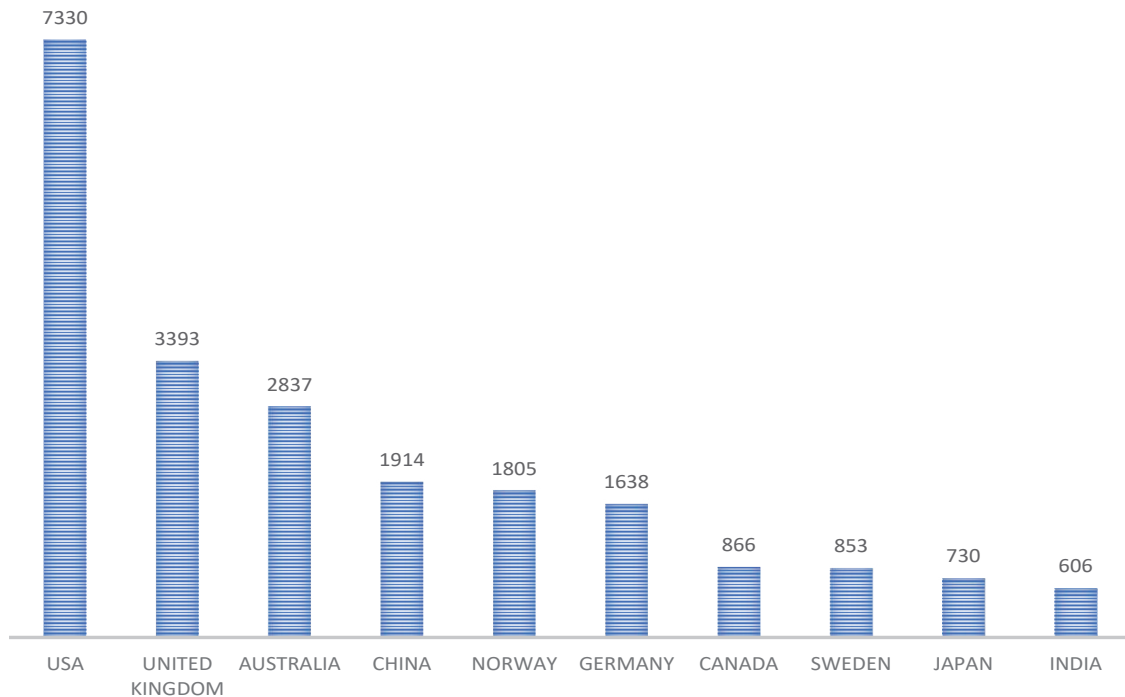
Figure 7*Most Relevant Countries*

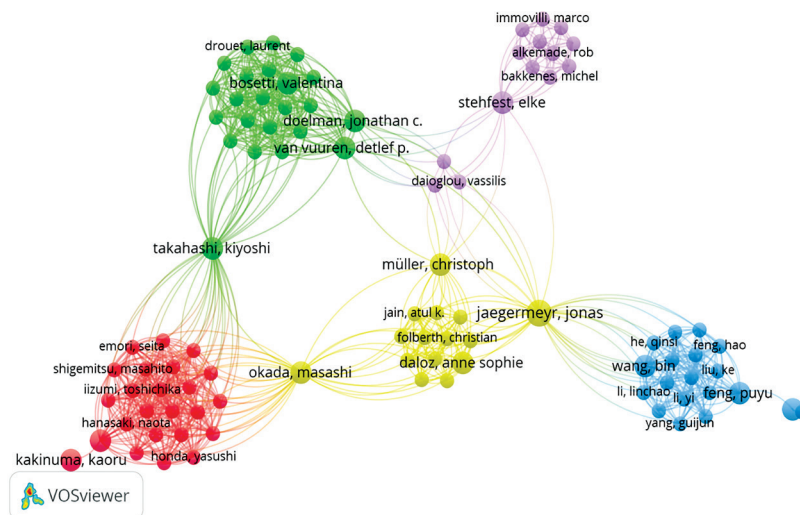
Figure 8*Most Cited Countries*

3.3 Science Mapping

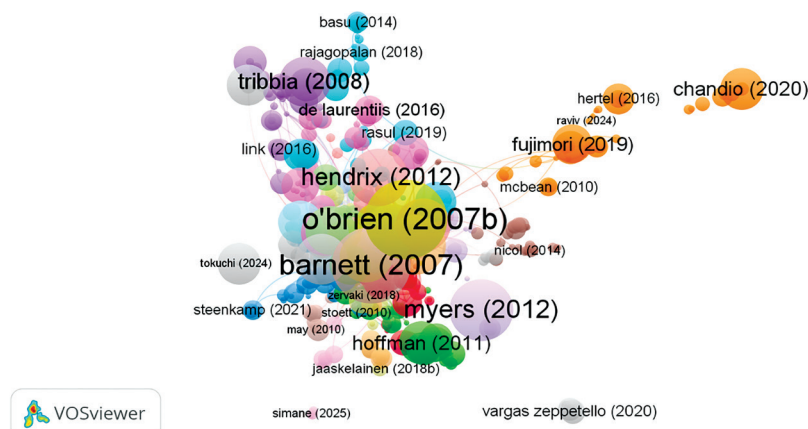
In this study, science mapping encompasses co-authorship analysis, bibliographic coupling, co-citation analysis, co-occurrence and tree-map analysis, trend topic analysis, and thematic mapping.

Co-authorship Analysis

Co-authorship refers to collaborative scholarly relationships formed through jointly authored research publications (Basnet et al., 2024; Passas, 2024). Figure 9 illustrates the co-authorship analysis based on authors with a minimum threshold of one document and one citation, highlighting collaborative patterns within research on the climate change and national security nexus. The network reveals several well-defined clusters connected through varying link strengths, indicating the intensity of scholarly collaboration. The green cluster is anchored by Takahashi, Kiyoshi, who demonstrates strong collaborative influence with a high total link strength of 46 and substantial citations (226), reflecting foundational work in climate systems that underpins security risk assessments. The yellow cluster, centered on Jaegermeyr, Jonas (link strength 38) and Ide, Tobias (link strength 34, 424 citations), represents a core group directly engaging with climate–conflict dynamics, food security, and vulnerability, key components of national security discourse. The red cluster, featuring Okada, Masashi (link strength 38) and other Japanese scholars, shows dense internal linkages, suggesting regionally concentrated collaboration contributing empirical evidence relevant to national-level security planning. The blue cluster, led by Yang, Chao (link strength 35), reflects emerging Asian collaborations addressing climate risks with security implications. Additional influential contributors such as Scholes, Robert J. (link strength 32) and Ludwig, Ralf Peter (link strength 31) act as connectors across thematic areas. Overall, the distribution of link strengths demonstrates a highly interconnected and interdisciplinary research landscape, reinforcing that understanding climate change as a national security issue relies on strong, cross-domain scholarly collaboration.

Figure 9*Co-authorship Analysis based on Authors***Bibliographic Coupling Analysis**

Bibliographic coupling measures document relatedness based on shared references cited by publications (Donthu et al., 2021). Figure 10 presents the bibliographic coupling analysis based on documents with a minimum of one citation, revealing the intellectual structure of research on the climate change and national security nexus. The network is organized around a dense core cluster, with Barnett (2007) and O'Brien (2007b) occupying the largest and most central nodes, reflecting their foundational role in linking climate vulnerability to security discourse. Closely coupled with this core are Myers (2012), Hendrix (2012), and Hoffman (2011), whose proximity and shared edges indicate substantial reference overlap with the foundational security-framing literature. A distinct upper-left cluster, anchored by Tribbia (2008), Rajagopalan (2018), and Link (2016), reflects a thematically related but more policy- and governance-oriented strand, while an upper-right cluster led by Fujimori (2019) and Hertel (2016) shows coupling around resource and food-security dimensions. Peripheral and loosely connected nodes such as Tokuchi (2024), Simane (2025), and Vargas Zeppetello (2020) form emerging, less-integrated clusters. Therefore, the coupling structure demonstrates a cohesive and cumulative knowledge base, illustrating how climate change has progressively been conceptualized as a critical national and human security concerns.

Figure 10*Bibliographic Coupling based on Documents*

Co-citation Analysis

Co-citation analysis examines how frequently multiple references are cited together in scholarly literature (Hassan & Duarte, 2024). Figure 11 shows the co-citation analysis based on cited references with a minimum of two citations, revealing the intellectual foundations of research on the climate change and national security nexus. The network is dominated by seminal works that frame climate change as a security and human security concern. Barnett's work on climate change emerges as the most influential and largest node in the network, with the underlying VOSviewer citation data indicating 52 citations and the highest total link strength (225) among all references, indicating its central role in connecting climate change, human security, and violent conflict. Adger's work on human security forms an equally prominent node, reflecting its foundational contribution to framing vulnerability and adaptation within the security discourse. Classical security studies texts, represented by nodes such as National Security and the Threat and Theory of World Security, also form a strong adjacent cluster, demonstrating theoretical integration between traditional security frameworks and environmental change. Peripheral clusters, including Buhaug's work on violent conflict, Rockström's work on planetary boundaries, and Anderson's and Altieri's contributions on agricultural and adaptive risk, extend these theoretical bases by connecting empirical climate–conflict linkages to the core cluster. The co-citation structure as a whole reflects a two-tier knowledge base: a small set of highly central, frequently co-cited foundational works (Barnett, Adger) surrounded by a broader periphery of empirical and applied studies, together reinforcing climate change as a core national and human security issue.

Figure 11

Co-citation Analysis based on Cited References

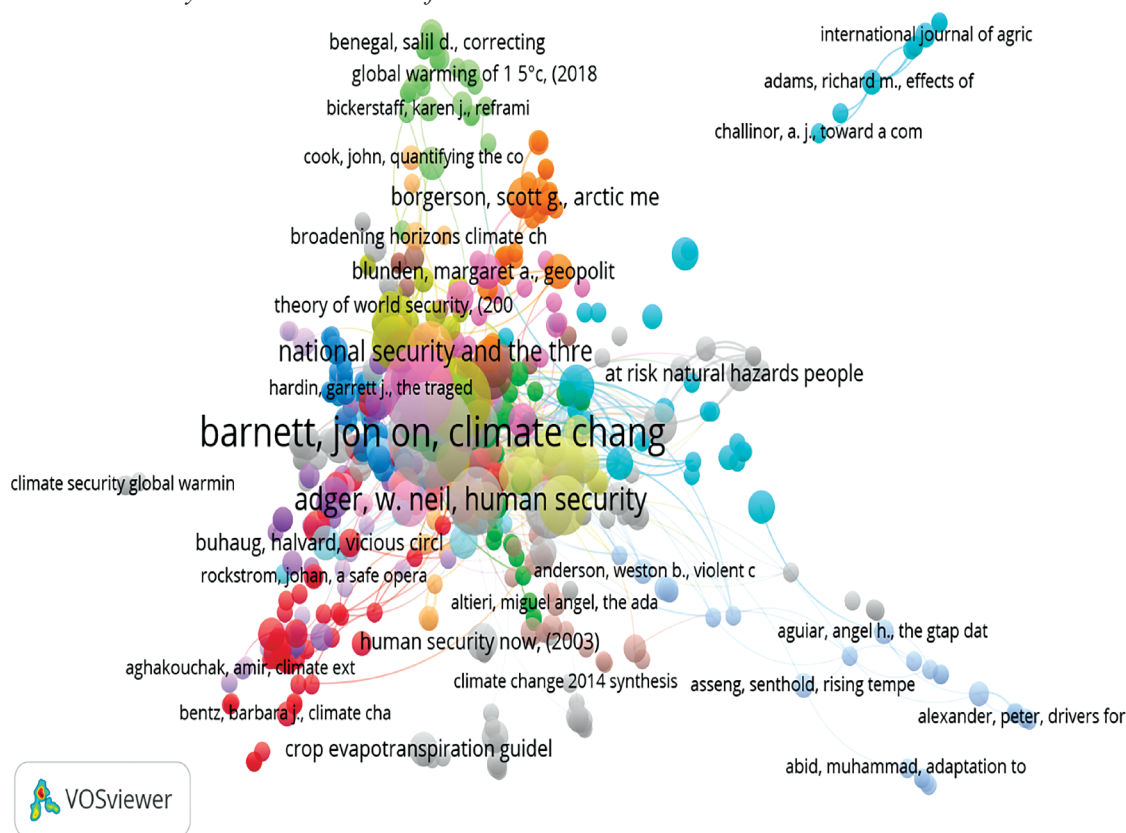
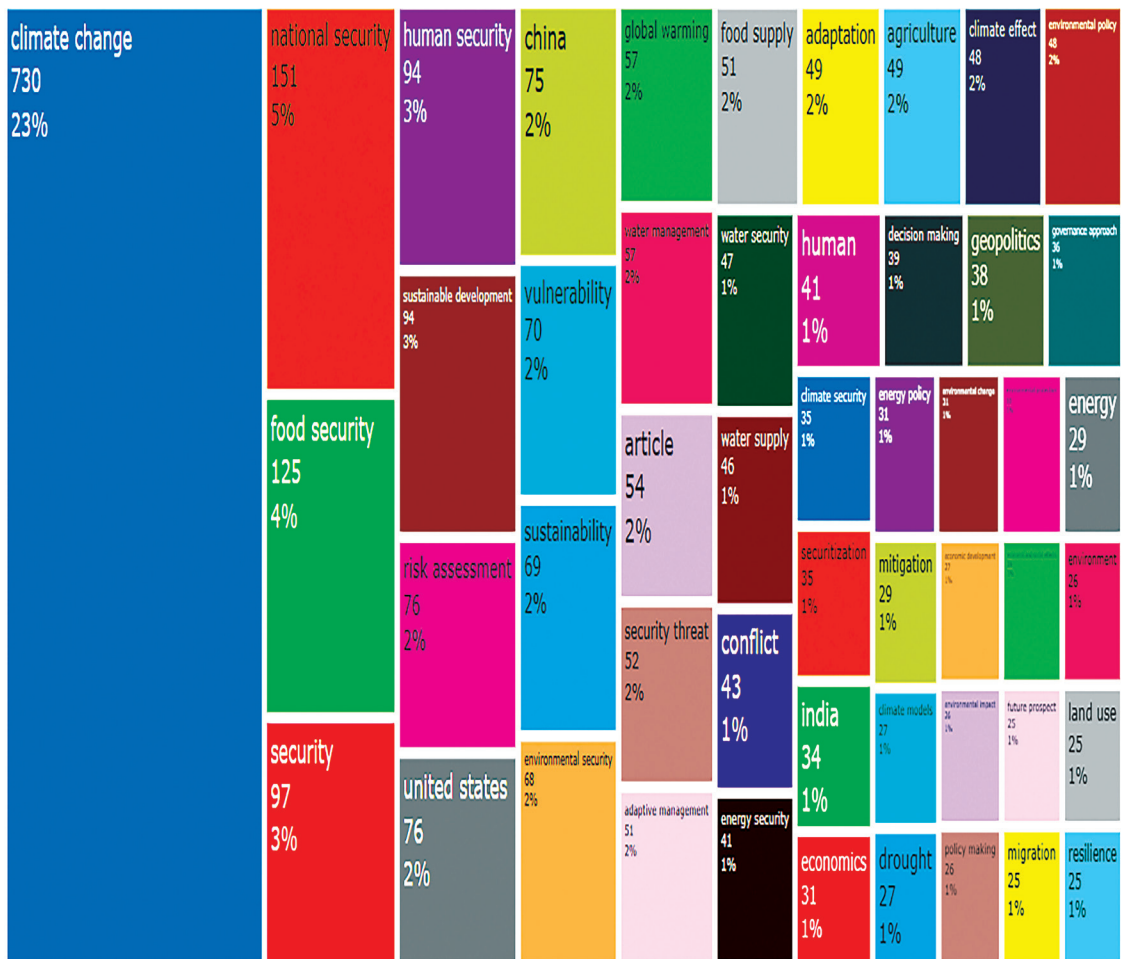
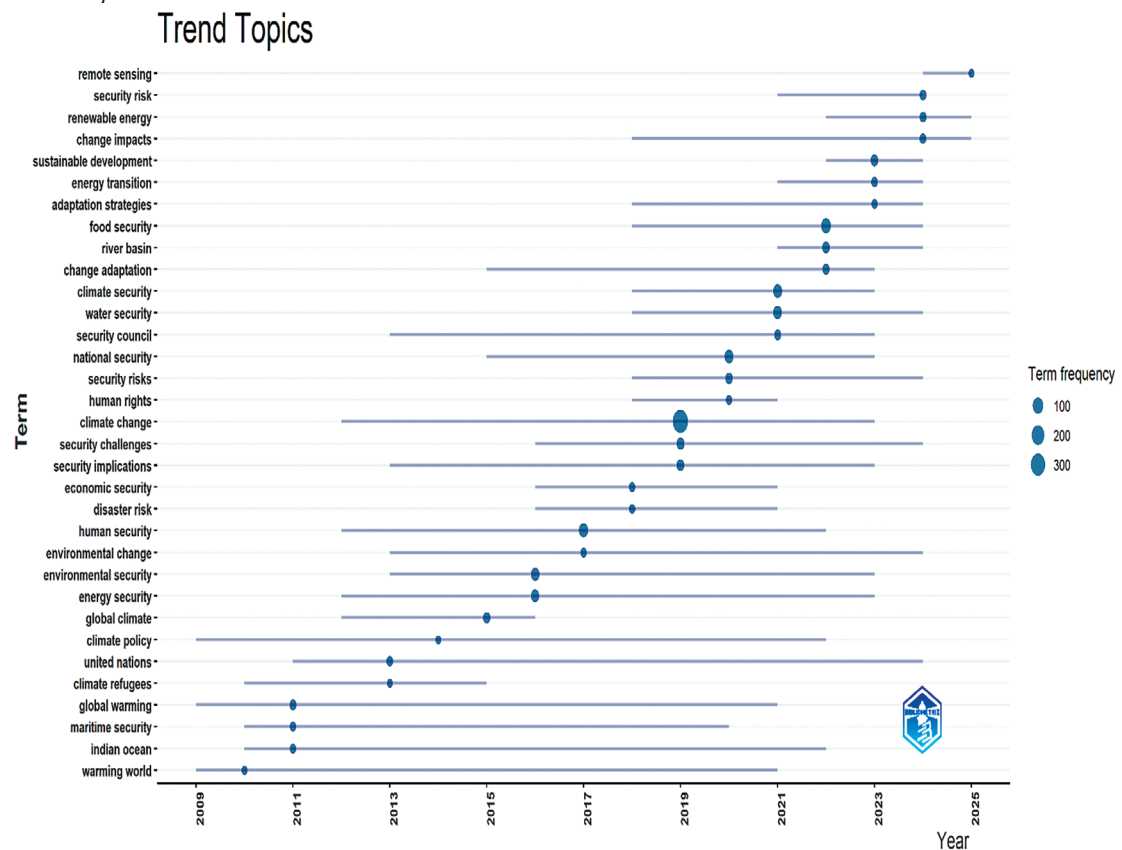


Figure 13*Tree-Map*

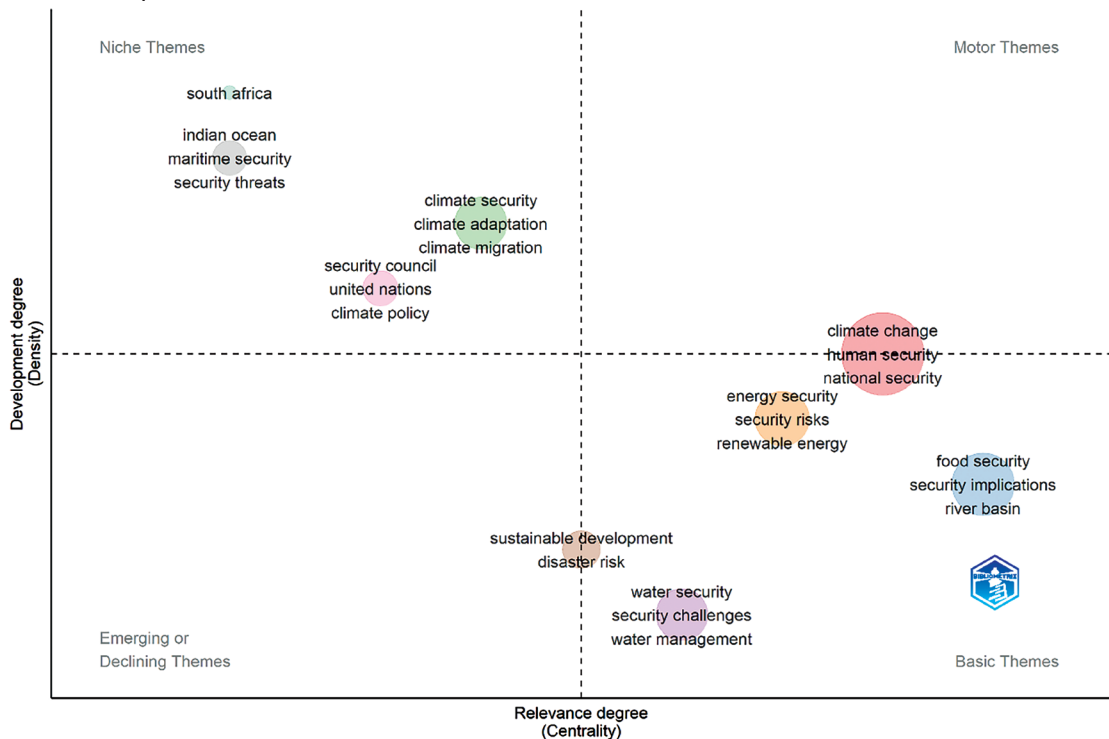
Trend Topics Analysis

Trend topics analysis traces the temporal evolution and prominence of key themes in research (Donthu et al., 2021). Figure 14 shows the trend topics over time from 2000 to 2025, illustrating how scholarship on the climate change and national security nexus has progressively matured. Climate change remains the most dominant and persistent topic (frequency = 355), forming the conceptual backbone of the field since 2012. Recurrent security-oriented themes such as human security (57), national security (48), environmental security (35), and energy security (31) indicate an early shift from environmental concerns toward securitized interpretations of climate risks. Between 2015 and 2018, the emergence of climate security (44), food security (66), water security (40), and security risks reflect growing empirical attention to climate-induced instability and resource stress. Post-2020 trends show thematic diversification, with sustainable development and renewable energy gaining prominence, alongside governance-oriented topics such as energy transition and river basin security. Notably, by 2024–2025, the appearance of remote sensing signals a methodological shift toward data-driven risk monitoring and early warning systems. Critically, while traditional state-centric security topics persist, recent trends emphasize integrated, technology-enabled, and human-centric approaches, underscoring climate change as a complex, multidimensional national security challenge rather than a singular environmental threat.

Figure 14*Trend Topics Overtime***Thematic Map Analysis**

A thematic map is a bibliometric visualization approach used to examine and interpret prominent research themes based on their significance and level of development within a scholarly field (Passas, 2024). The map is structured around two core dimensions: centrality, which represents a theme's relevance and interconnectedness within the research network, and density, which reflects the theme's internal cohesion and conceptual maturity (Huang et al., 2026). On the basis of these dimensions, themes are grouped into four categories: motor themes, niche themes, emerging or declining themes, and basic themes (Basnet et al., 2024; Siddique et al., 2026).

The thematic map illustrates a nascent yet expanding research structure within the climate change–national security nexus (Figure 15). The prominence of basic themes, such as climate change, national security, human security, food security, water security, energy security, and security risks, indicates that these topics are central to the field and widely connected across studies. However, their low density suggests that research remains largely descriptive and fragmented, highlighting the need for deeper theoretical integration (Donthu et al., 2021). The emerging themes, particularly sustainable development and disaster risk, reflect a critical broadening of the security discourse beyond state-centric concerns toward long-term resilience, public health, and systemic vulnerability. Their early-stage positioning signifies growing but still limited scholarly engagement, presenting clear opportunities for future investigation (Lowar et al., 2025). Therefore, the thematic configuration underscores that while the field is grounded in core security concerns, it is gradually evolving toward more holistic, interdisciplinary, and human-centered approaches to understanding climate-induced national security challenges.

Figure 15*Thematic Map*

4. Discussion

The performance analysis clearly demonstrates the growing scholarly recognition of the nexus between climate change and national security as a critical global concern. The high annual growth rate of 22.35%, an average of 29.49 citations per document, and a cumulative 9,039 references reflect both the maturity and policy relevance of this research domain. The marked increase in publications from 74 documents in 2020 to 155 in 2025 aligns with the post-Paris Agreement policy landscape, where climate change has increasingly been framed as a national and international security risk (Stricof, 2021). Global commitments following the Paris Agreement (2015) and post-2020 climate policies, including net-zero and emissions-reduction strategies, have encouraged scholars to examine climate change not only as an environmental issue but as a destabilizing force affecting state security, governance, and geopolitical stability (Price et al., 2024; Warren et al., 2024). Journal dominance by Sustainability and Water underscores the centrality of resource security in climate–security debates, while the high citation impact of Climatic Change indicates the field's theoretical foundations. At the author level, Wang Y leads in productivity, whereas Barnett J provides the most influential contributions, shaping how climate change is conceptualized as a driver of insecurity. The strong dominance of the United States in publications and citations reflects its strategic framing of climate change as a security threat, but also highlights an imbalance in global knowledge production.

The thematic evolution further reinforces the centrality of the climate change–national security nexus, though it also exposes the field's conceptual and methodological limits. Co-authorship analysis identifies Takahashi as a key collaborative actor linking climate systems science to security risk assessments, yet this connection remains descriptive rather than explanatory, the bibliometric data show co-authorship proximity, not the causal or methodological pathway by which climate science is translated into security

assessment. Bibliographic coupling and co-citation analyses consistently position Barnett's (2007) *Climate Change, Human Security and Violent Conflict* and O'Brien et al.'s (2007) *Why Different Interpretations of Vulnerability Matter in Climate Change Discourses* as intellectual anchors, with vulnerability and human security recurring as the dominant framing devices through which climate change is discursively linked to national security (Torales et al., 2026); however, their centrality in the network reflects citation frequency and shared-reference density, not empirical validation of a causal climate–conflict pathway. Barnett's prominence in the co-citation network similarly indicates disciplinary consensus around a human-security framing, rather than confirmation that this framing is theoretically or empirically superior to state-centric alternatives. Keyword co-occurrence and treemap analyses further show that climate change and national security form the conceptual core of the field, densely connected to human security, environmental security, and energy security, yet this density signals topical co-occurrence rather than integration, since, as noted earlier, these sub-themes are frequently studied in isolation. Trend-topic analysis indicates that climate change remains the most persistent theme, with a discernible shift toward securitized framings over time; however, this shift reflects a change in labeling and discursive emphasis rather than necessarily a maturation of underlying theory. The thematic map reinforces this reading, positioning climate change and national security as highly central but still "basic" rather than "motor" themes, a distinction that signals the field's continued conceptual centrality alongside its limited theoretical consolidation across security dimensions.

Despite substantial growth, the analysis reveals critical research gaps in understanding the climate change–national security nexus. The absence of motor themes suggests that the field has yet to develop integrated and mature theoretical frameworks capable of systematically explaining how climate change translates into national security threats. Emerging themes such as sustainable development and disease risk highlight underexplored pathways linking climate stress to long-term state stability, governance capacity, and health security. Moreover, although water security and food security appear as highly repetitive and central themes, they are often examined in isolation rather than as interconnected drivers of conflict, displacement, and geopolitical risk. This fragmentation limits comprehensive security analysis. Additionally, the dominance of research from developed countries underscores the need for greater inclusion of Global South perspectives, where climate impacts pose the most immediate security challenges (Almulhim et al., 2024). In this regard, future research must strengthen the climate–security nexus by integrating resource security, human vulnerability, and geopolitical analysis into cohesive, policy-relevant frameworks (Warren et al., 2024; Rawat et al., 2024; Hashum, 2025s).

5. Future Research Agendas

The thematic analysis demonstrates that research on the climate change–national security nexus is expanding rapidly but remains theoretically fragmented. Although climate change and national security constitute the conceptual core of the field, the absence of mature motor themes indicates limited theoretical consolidation. Accordingly, future research should focus on strengthening conceptual integration, broadening resilience-oriented perspectives, and addressing geographical imbalances in knowledge production to develop more robust and policy-relevant climate-security scholarship.

Developing Integrated Climate-Security Frameworks

The thematic map reveals that climate change, national security, human security, food security, water security, and energy security function as central basic themes. However, their relatively low density indicates that these concepts remain insufficiently integrated within coherent theoretical frameworks, a pattern consistent with Donthu et al.'s (2021) observation that thematic centrality without density signals conceptual immaturity rather than consolidation. Likewise, the keyword co-occurrence network demonstrates strong associations among these security dimensions, yet existing studies predominantly

examine them independently rather than as interacting components of a complex security system, an isolation problem that Daoudy et al. (2022) directly address by modelling water, food, and migration risk as a single interconnected security triad in the Middle East and North Africa rather than as separate literatures. Such fragmentation limits the ability of existing scholarship to explain how multiple climate stressors interact to generate cascading national security risks. Future research should therefore develop interdisciplinary, systems-based frameworks capable of integrating environmental, human, economic, and geopolitical security dimensions, following the methodological rigor called for by Lowar et al. (2025) in synthesising cross-sectoral bibliometric evidence into structured conceptual models. Rather than analysing food insecurity, water scarcity, migration, governance failures, and conflict as isolated outcomes, future studies should investigate their dynamic interdependencies through longitudinal and cross-sectoral approaches, an advancement that would substantially strengthen explanatory power where current scholarship remains descriptive.

Advancing Resilience-Oriented and Multidimensional Security Research

The trend topic and thematic analyses indicate a gradual shift from traditional state-centric security towards themes such as sustainable development, disaster risk, and human security. Nevertheless, these topics remain in the emerging quadrant, suggesting that resilience-based security perspectives have yet to become mainstream, a limitation reinforced by Torales et al.'s (2026) finding that the dominant "threat multiplier" framing emphasises conflict pathways while leaving adaptive and protective mechanisms comparatively under-theorised. Moreover, the dominance of foundational co-cited studies centred on vulnerability and human security demonstrates that empirical evidence explaining how resilience mechanisms influence national security remains limited. Future research should therefore move beyond framing climate change solely as a threat multiplier and instead examine how adaptive governance, institutional capacity, climate-resilient infrastructure, public health preparedness, and disaster risk reduction collectively shape national security outcomes, building on Warren et al.'s (2024) cross-country risk assessments, which already show that exposure to comparable climate stressors produces divergent outcomes depending on institutional capacity. Greater emphasis should also be placed on evaluating policy effectiveness across different institutional contexts to determine the conditions under which resilience strategies successfully mitigate climate-induced insecurity, extending Rawat et al.'s (2024) systematic review of climate impact models toward outcome-focused, policy-evaluative designs. Such evidence would contribute towards more proactive and policy-oriented climate–security frameworks rather than reactive, threat-centred ones.

Expanding Climate-Security Research in the Global South

The performance analysis highlights a clear geographical concentration of research output and scholarly influence within developed countries, particularly the United States, despite climate-related security risks being disproportionately experienced across the Global South, a disparity Almulhim et al. (2024) demonstrate empirically through their in-depth analysis of climate-induced migration patterns across vulnerable Global South regions. This imbalance raises concerns regarding the external validity of existing climate–security theories, many of which are developed within political, institutional, and socio-economic contexts that differ substantially from those of climate-vulnerable developing countries, a concern echoed in Osei-Amponsah et al.'s (2023) social-transformation account of climate-induced migration in West Africa, which foregrounds local governance and livelihood dynamics largely absent from mainstream theoretical models. Consequently, future research should prioritise empirical investigations across Africa, South Asia, Small Island Developing States, and other highly vulnerable regions to determine whether existing theoretical assumptions adequately capture local security dynamics. Comparative studies incorporating governance quality, adaptive capacity, migration, resource competition, and socio-economic vulnerability would strengthen theoretical generalisability while producing context-specific policy recommendations, particularly given Vanden Eynde and Vargas's (2025) finding that the climate–resource–conflict relationship is highly conditional on local institutional context rather than uniform across settings. Expanding Global South scholarship would therefore not only improve geographical representation but also enable the development of more inclusive and globally applicable climate–security frameworks.

6. Conclusion

The study has successfully investigated the nexus between climate change and national security. The study has three major objectives: analyze global research trends; (2) examine the thematic evolution; and (3) identify future research agendas. The performance analysis reveals a rapidly growing research field, evidenced by a high annual growth rate, increasing scientific output after 2020, and strong citation impact, reflecting the rising policy and strategic relevance of climate change as a national security concern. The dominance of journals such as *Sustainability* and *Water*, alongside the high citation influence of *Climatic Change*, highlights the interdisciplinary and theoretically grounded nature of the field, while author and country-level findings underscore the intellectual leadership of key scholars, such as Wang and Barnett, and the prominent role of the United States in advancing climate–security scholarship. Thematic evolution analysis demonstrates that climate change and national security constitute the core of the literature, closely linked with human, food, water, and energy security, and network analyses further reveal a reliance on foundational frameworks connecting climate vulnerability to security risks, while the absence of mature motor themes indicates limited theoretical consolidation. Hence, the study confirms that although the climate change–national security nexus is well recognized, it remains an evolving research domain requiring deeper integration and diversification. These findings carry important policy implications: recognizing climate change as a multidimensional security threat can support more proactive risk assessment, adaptation planning, and resilience-building strategies, with policymakers benefiting from aligning climate policies with national security agendas, particularly across food, water, and energy systems.

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