

# Impact of Climate Change on Water Resources: A Comprehensive Review for the Last Decade

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**Abstract.** Environmental changes, particularly climate change, negatively influence on livelihoods, food security, public health, and water resources. Global climate change destroys water reservoirs due to its consequence as drought. This review paper aimed to investigate studies on climate change and its impact on water resources in the world for the last 10 years. For this goal, Web of Sciences Core Collection Database was chosen for material search. The initial search conducted on July 21, 2025 and identified 1027 articles. After filtering by language “English”, research period “2016-2025” and document type “Article”, we received 384 final published papers on selected topic. Additionally, we explored publication trend, leading authors, popular subject areas, active institutions, prominent financial supporters, remarkable journals and top countries. Total research interest has increased since 2016, reaching its maximum point in 2021 with a 14.3% contribution. Additionally, Chinese researchers have dominated global scientific output in this field especially Wang. Y had contributed 3.1% to total publications. Environmental Sciences Ecology occupied the leadership as the research topic matches the most, and the Chinese Academy of Sciences contributed a 7.8% share to total publications, demonstrating strong research interest. The National Natural Science Foundation of China was mentioned as a remarkable leader with 18.4% contribution. Water journal produced the most papers with 8.5% share. At last, China illustrated superiority among countries that published more than a fifth of all publications.

## 1 Introduction

Climate change is an unprecedented and disruptive global phenomenon with no precedence where some of its consequences is presently being observed. Worldwide food, water and nutrition security confronts significant problems, including climate change [1]. As mentioned by Ahmad et al. [2] climate change had affected public health, crop production, water availability and biodiversity, resulting in significant consequences for the world. As one of

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the consequences of climate change, drought is a serious natural calamity, which induces water scarcity in rivers and lakes, profoundly impacting both individuals and communities economically, socially, and ecologically [3]. As noted by Egerer et al. [4] climate change would profoundly affect future water facilities in the world.

Water is vital for human existence and is a key aspect in the evolution as well as growth of human civilizations. According to Adjei-Mensah and Kusimi [5] water is fundamental for human and animal welfare and must be preserved for its sustainability globally. Its security is critically endangered in many locations due to the limited availability, disparate share, and diminishing ecological integrity of water resources, which have grown into key obstacles to individual sustainable progress and social growth [6]. As noted by Isaacman et al. [7], and Salokhiddinov et al. [8] an increasing number of regions are facing water security challenges, including shortages, flood catastrophes, and aquatic degradation as a result of human growth, industrialization, and climate change.

Today, massive lakes are acknowledged as essential freshwater resources that have been experiencing major problems owing to continuing climate change and its attendant repercussions [9]. According to Tang et al. [10] climate change and water shortages are two major concerns impeding the growth of field agriculture. Also, agriculture was mentioned as a main water consumer for over 70% of worldwide water use [11] which is one of the most vulnerable water industries to climate change [12]. Water shortage is primarily caused by excessive use of water reserves, growth in population, contamination, and rising need for commercial growth.

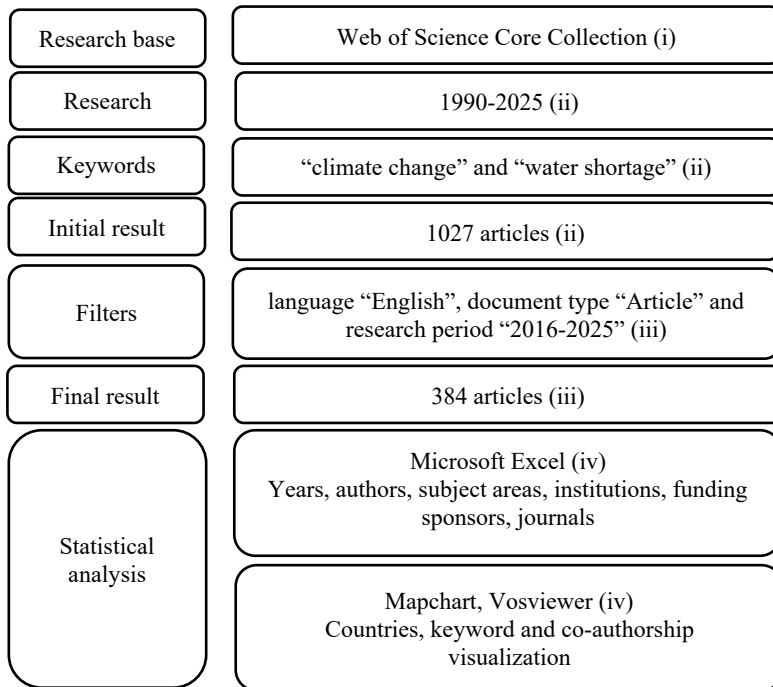
Despite the increasing volume of the researches on impacts of climate change on water resources, most prior studies have primarily focused on particular cases, regional assessments or specific hydrological components. For example, Yang et al. [13] analyzed global hydrological cycles and highlighted the significance of coordinated methods in assessing climate change implications on watersheds. Similarly, Ciampittiello et al. [14] investigated 134 research globally and found major effects of climate change on freshwater availability, groundwater recharge and river flow. Daha et al. [15] developed existing research and emphasized the significant impacts of climate change on freshwater ecosystems and water security. Although these studies offer useful information, they do not provide a comprehensive worldwide view of the evolution of development, structure and emerging trends in scientific research in this topic. Additionally, while numerous reports and systematic studies have been performed, they have focused mostly on physical impacts, hydrological modelling, or adaptation methods with minimal consideration to quantitative assessment of scientific efficacy, interaction systems, and knowledge development patterns.

Specifically, there is a notable deficit in bibliometric assessments that comprehensively characterize worldwide research patterns, key researchers, organizational partnerships, and thematic developments in climate change impacts on water resources over the last decade. Bibliometric analysis offers an effective and quantitative technique to assessing the state of science, highlighting research priorities, and revealing emerging trends, allowing for improved research planning and policy formulation.

As a result, the primary issue addressed in this work is the absence of a thorough, quantitative, and up-to-date bibliometric assessment of global research on climate change's effects on water resources. To close this gap, this review will conduct a thorough bibliometric analysis of scientific papers published during the last decade. This study aims to: (i) analyze worldwide publication trends; (ii) identify prominent countries, institutions, authors, and journals; (iii) investigate collaboration networks; and (iv) identify significant research themes and developing hotspots applying an open access database as Web of Science Core Collection. This study's findings give a systematic assessment of the current state of research and significant insights for academics, policymakers, and water resource managers seeking to better understand and solve climate change concerns affecting water resources.

## 2 Method

This study applied a systematic bibliometric analysis combined with literature review to explore global research trends on climate change impacts on water resources over the period 2016-2025. The methodological framework consisted of four main stages: (i) data source selection, (ii) search strategy and data retrieval, (iii) data filtering and screening, and (iv) bibliometric analysis and visualizations. The overall workflow of the bibliometric process is demonstrated in **Fig. 1**.



**Fig. 1.** Methodology flowchart for the research

### 2.1 Data source selection and justification

The Web of Science Core Collection (WoSCC) database was selected as the primary data source due to its high-quality indexing standards, comprehensive coverage of peer-reviewed journals, and widespread use in bibliometric research. It ensures reliable and standardized bibliographic information, including citation data, author affiliations, and keywords, which are essential for accurate bibliometric and network analysis. Compared to other databases, WoSCC provides consistent indexing and minimizes duplication, making it suitable for identifying global research trends and scientific collaboration patterns.

### 2.2 Search strategy and keyword justification

The data retrieval was conducted on July 21, 2025, using the keywords “climate change” AND “water shortage.” These keywords were selected because they directly represent the interaction between climate change and water resource availability, which is a major consequence of climate variability and global warming. The selected keywords ensured the inclusion of relevant studies addressing water scarcity, water security, and hydrological

impacts related to climate change. The search initially yielded 1,027 publications covering the period 1990–2025.

### **2.3 Data screening and filtering process**

To ensure relevance and consistency, several inclusion criteria were applied. Only peer-reviewed articles published in English between 2016 and 2025 were included in the analysis. Other document types such as reviews, conference papers, and book chapters were excluded to maintain consistency in publication quality and bibliometric indicators. After applying these filters, a total of 384 articles were selected for final analysis. This period was chosen to capture recent research developments reflecting the increasing impacts of climate change on water resources.

### **2.4 Bibliometric analysis and visualization**

The selected publications were analyzed using multiple bibliometric indicators, including annual publication trends, research areas, leading authors, active journals, institutions, contributing countries, and funding organizations. In addition, keyword co-occurrence and co-authorship network analyses were conducted to identify major research themes, collaboration networks, and emerging research hotspots.

VOSviewer software (version 1.6.20) was used to construct and visualize keyword co-occurrence networks and co-authorship relationships. These networks helped identify research clusters, collaboration patterns, and thematic evolution. Additionally, the MapChart online platform was used to visualize the geographic distribution and productivity of countries.

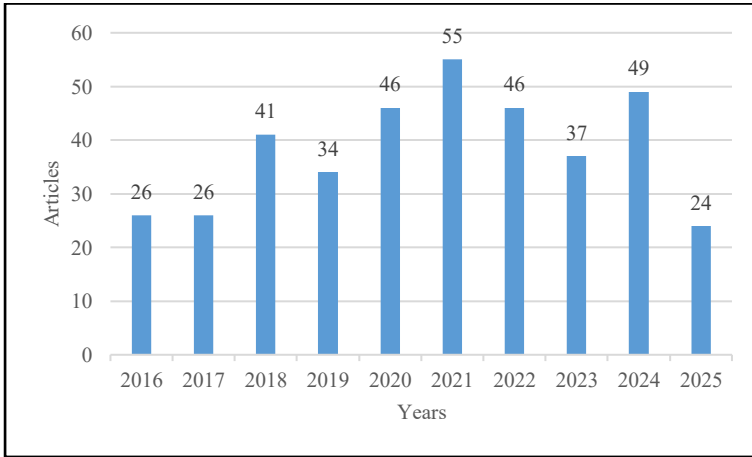
### **2.5 Limitation of the methodology**

Despite the robustness of the bibliometric approach, several limitations should be acknowledged. First, this study relied solely on the Web of Science Core Collection database, which may not include all relevant publications indexed in other databases such as Scopus or Google Scholar. Second, only English-language articles were included, which may exclude relevant research published in other languages and introduce language bias. Third, the use of specific keywords such as “climate change” and “water shortage” may have excluded some relevant studies using alternative terms such as “water stress” or “water scarcity.” Nevertheless, the applied methodology provides a reliable and representative overview of global research trends in climate change impacts on water resources.

## **3 Results**

### **3.1 Publication trend**

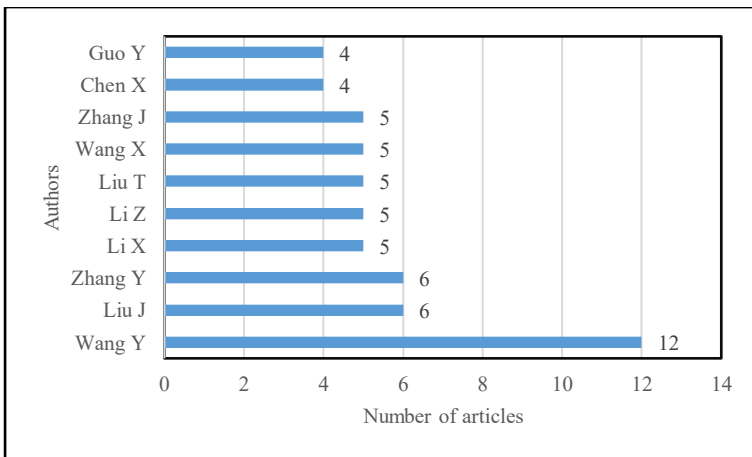
The volume of publications is a significant indication which describes the developmental patterns of research in science. Climate change impact on water resources studies from Web of Science Core Collection database demonstrated in **Fig. 2**, shows significant growth since 2016, reaching a peak in 2021. Yearly scientific production output varies between 6.2-14.3%. 2024 was the second most productive year with 12.7% contribution. Total research interest in environmental changes impact on natural resources has increased due to instability in the world.



**Fig. 2.** Publication production trend

### 3.2 Top authors

Scientific researchers usually have an enormous influence on the development of certain topics in the research. Author’s contribution analysis illustrated in **Fig. 3** demonstrates mainly Chinese scholars who promoted more research on selected topic. Wang. Y was mentioned as an absolute leader with 3.1% contribution for the last 10 years and followed by Lui. J and Zhang. Y each shared 1.5% of total publications, respectively. Contribution of other authors varied between 1.04-1.3%. Total of 200 authors actively produced 384 research papers for the last 10 years.

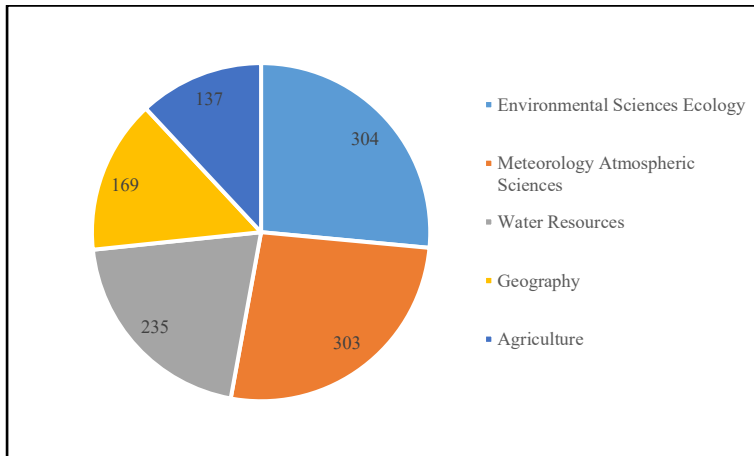


**Fig. 3.** Most productive researchers

### 3.3 Subject areas

The distribution of the most relevant subject areas is illustrated in Figure 3. The field is notably dominated by “Environmental Sciences Ecology” and “Meteorology Atmospheric Sciences,” which account for 79.1% and 78.1% of the publications, respectively. Given that climate change and water resources are inherently multidisciplinary, they also intersect

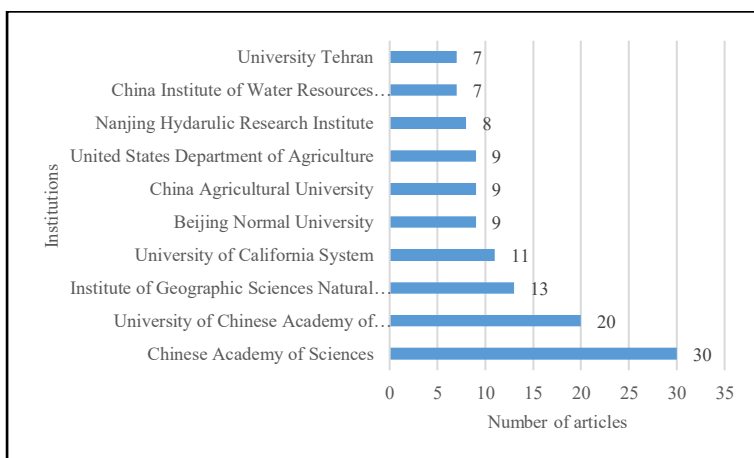
significantly with “Water Resources,” “Geography,” and “Agriculture,” as evidenced by the findings. Interestingly, the total count of publications across all categories shown in **Fig. 4** exceeds the initial 384 articles; this is because several research papers are indexed under multiple subject areas simultaneously. In total, the analyzed research activity spans 70 distinct subject areas.



**Fig. 4.** Most popular subject areas

### 3.4 Active institutions

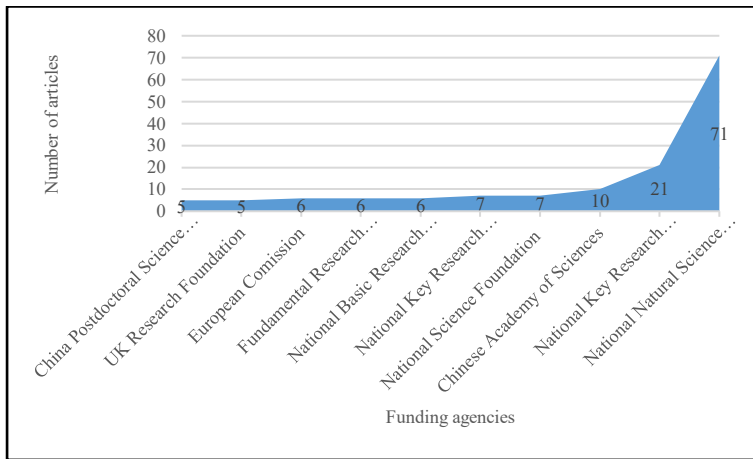
Value of the institutions are identified by quality and number of publications. **Fig. 5** visually demonstrates the most active 10 institutions which produced 123 articles. Contribution of selected institutions is 32%. Chinese Academy of Sciences took the leadership with 7.8% share and followed by University of Chinese Academy of Sciences which contributed 5.2% of total publications. Surprisingly, there are 7 Chinese institutions, 2 from USA and 1 presents Islamic Republic of Iran. Contribution of Chinese institutions was 25% to total publications.



**Fig. 5.** Most prominent institutions

### 3.5 Funding sponsors

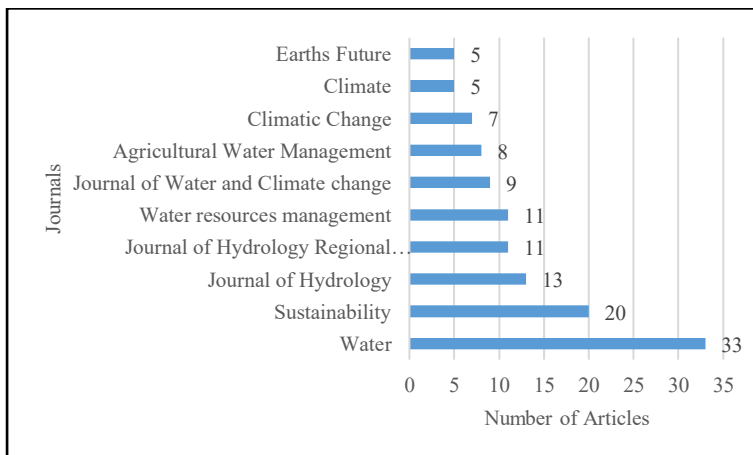
Financial support of research activity is an important part of any research project. For this investigation, we identified the most popular organizations which promoted and financially supported research on climate change impact on water resources. **Fig. 6** shows top 10 financial supporters which encouraged 37.5% of publications. National Natural Science Foundation of China was a remarkable leader with 18.4% contribution. There were 8 Chinese and 2 European participants included in shortlist.



**Fig. 6.** Most active financial supporters

### 3.6 Sources of publication

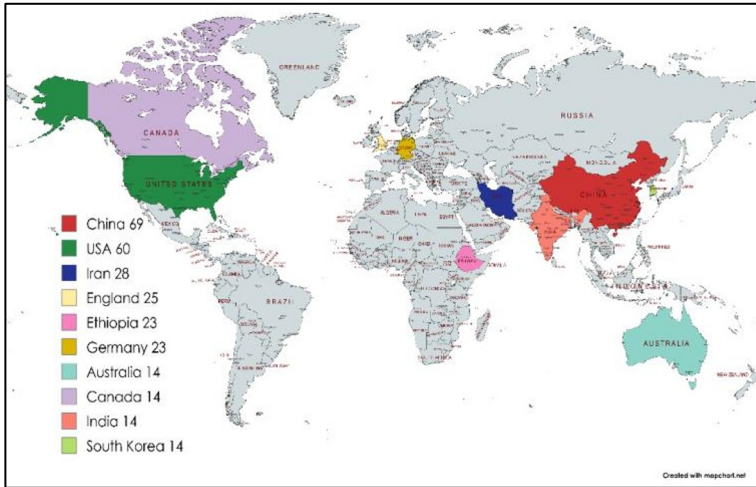
Journals are usually assessed by the number of publications and received citations. We selected top 10 journals actively publishing articles for the last 10 years demonstrated in **Fig. 7**. A total of 198 journals were involved to produce 384 articles. Contribution of selected 10 journals was 31.7% of total publications. Water journal dominated among others with 8.5% share and followed by Sustainability with 5.2% contribution. Other journals promoted research between 1.3-3.3%.



**Fig. 7.** Most popular journals

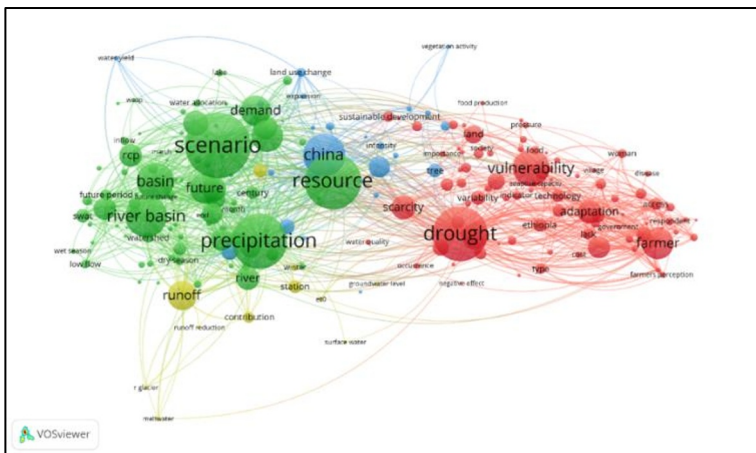
### 3.7 Countries research productivity

The role of national support is often crucial in fostering research activity. In this study, a total of 97 countries contributed to the publication of the 384 analyzed articles. **Fig. 8** illustrates the top 10 most influential countries based on their total publication volume. China emerged as the leader, accounting for the largest share at 17.9%, closely followed by the USA with a 15.6% contribution. The presence of both advanced and developing nations in this ranking highlight that the impact of climate change on water resources is a high-priority issue globally, garnering significant attention from scientific communities across diverse economic landscapes.



**Fig. 8.** Most active countries

### 3.8 Keyword network analysis



**Fig. 9.** Keyword network visualization

To identify the primary research focus based on keyword usage, a co-occurrence network of author keywords was developed using VOSviewer, as illustrated in **Fig. 9**. The keywords were extracted from the titles and abstracts of the analyzed papers, involving a total of 11,462 terms. By setting a minimum occurrence threshold of 10, the analysis identified 360 terms



The dominance of countries such as China in publication output highlights the important role of national research capacity, financial investment, and policy priorities in shaping scientific development. China's leadership in this field can be attributed to its significant investments in climate research, advanced scientific infrastructure, and strong governmental support for addressing environmental challenges. This reflects a broader global trend where countries facing severe water stress and rapid economic development invest more heavily in climate and water research. However, this imbalance also indicates disparities in research capacity between developed and developing countries, particularly in water-stressed regions such as Central Asia and Africa, where climate change impacts are severe but research output remains relatively limited. This gap may constrain the development of locally adapted water management strategies and highlights the need for increased international collaboration and knowledge sharing.

Furthermore, the prominent role of leading research institutions and funding organizations demonstrates the importance of institutional support and interdisciplinary collaboration in advancing climate and water research. Strong collaboration networks facilitate knowledge exchange, technological innovation, and the development of integrated solutions for water resource management. These findings support the growing recognition that addressing climate change impacts on water resources requires coordinated global scientific efforts and cross-disciplinary approaches.

In addition to climate-related drivers, anthropogenic factors such as population growth, urbanization, and increasing water demand further exacerbate pressure on water resources. These combined pressures highlight the need for adaptive water governance frameworks that integrate climate science, policy development, and sustainable resource management. Therefore, bibliometric analysis provides valuable insights into the structure, evolution, and priorities of scientific research, supporting the identification of knowledge gaps and guiding future research and policy decisions.

## **5 Conclusion**

Climate change is a global phenomenon that disrupts environmental systems worldwide, manifesting in extreme events such as floods, wildfires, droughts, and water scarcity. Among these, water shortage is identified as a critical factor that negatively impacts sustainable development. While humid zones are increasingly prone to flooding, arid regions face the most severe consequences regarding agricultural stability. This study aimed to analyze current research trends on climate change and its impact on water resources by utilizing the Web of Science Core Collection. Using the keywords "climate change" and "water shortage" for the period 2016–2025, an initial search yielded 1,027 articles. After filtering for English-language peer-reviewed articles, 384 publications were selected for final evaluation.

The analysis reveals that annual scientific production reached its peak in 2021 with 55 published papers. Geographically and institutionally, China has emerged as the dominant leader in this field; Chinese researchers led the top author indicators, with Wang Y. being the most prolific (12 publications), while seven of the top ten institutions were also based in China. This dominance is further reflected in national productivity, where China holds a 17.9% share, followed by developed nations such as the USA, Germany, and Canada. Funding patterns mirror these results, showing Chinese sponsors as the most prominent supporters.

In terms of academic scope, "Environmental Sciences Ecology" was identified as the primary subject area. The *Journal of Water* emerged as the leading publication source, significantly outperforming other journals whose contributions fluctuated between 1.3% and 5.2%. Finally, co-authorship analysis identified Liu and Tie as the most frequent collaborators, while "scenario," "resource," "precipitation," and "drought" were the most

frequently occurring keywords. These findings highlight a concentrated research effort, largely driven by Chinese institutions, focusing on modeling future scenarios and resource management in response to climate-driven water instability.

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