



## Bibliometric study on food security and climate change research from 2000 to 2020

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### Abstract:

Recent years have seen a steady rise in scientific interest in global issues such as food security (FS) and climate change (CC). According to the Web of Science (WoS) database's number of published publications (e.g., journal articles, reviews, and conference papers), this is evident. This field has changed throughout the years, but few systematic studies show how it has progressed over time. This study's goal is to use an applied bibliometric technique to examine the research trends in the areas of food security and climate change from the years 2000 to 2020. Research into FS and CC has grown fast in the previous 20 years, but especially in the last eight years, as shown by our examination of the WoS database. 5626 research publications have been published, with over 95% of them published in the recent decade. In this area, the United States, the United Kingdom, the People's Republic of China and Germany are the top research producers. Researchers and scientists will benefit from this bibliometric study, but so will policymakers since they will be able to utilize up-to-date data to see how FS and CC research has evolved and trended, allowing them to get a sense of the overall state of the field.

**Keywords:** Web of Science, bibliometric study, food security, climate change.

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### Introduction

FAO first defined food security as "ensuring that enough food for life and health is accessible to everybody at all times" in 1974. That definition has remained relevant ever since. Anyone who can afford to purchase basic meals at any moment became the new definition in 1983. Food security has evolved over the last two decades, and it is now believed to be best achieved by ensuring that everyone has access to enough food to suit their dietary requirements and preferences, regardless of where they live or what they do [1]. Food security is not merely a question of having enough food on hand, but rather a combination of elements including geographical accessibility, the buying power of citizens, food quality, political and socio-economic stability, and more [2-4]. Sustainable food security is defined as incorporating four connected pillars, including food supply, access, and use, as well as stability, into the idea of food security [5,6]. Although this notion has been thoroughly explored by the international community, many nations still face major food security issues because of the ever-growing

population of the Earth. Other than defining it, various research has focused on evaluating it [7,8], and analyzing the elements that influence it [9,10]. In reality,

Climate change, population increase, wars and conflicts, urbanization, food waste, and, more recently, the breakout of COVID-19, have all been proposed by academics as variables impacting food safety. Varieties of views were expressed on the impact of climate change on food security. A decrease in the natural ecosystems' ability to serve as a source of food for humans has been linked to climate change, according to many studies [11-19]. Others, on the other hand, feel that rising carbon dioxide concentrations due to the greenhouse effect would benefit photosynthesis in plants, which will enhance agricultural yields [20, 21]. The importance of climate change on food security's various dimensions and overall effects will vary over time by region and, most importantly, will depend on a country's overall socioeconomic performance under the impact of climate change [22]. Other scientists have not made a direct assessment of the degree to which climate change impacts food security. Food security is a hotly debated issue, as has been shown. Scholars' attention to climate change's impact on food security has risen sharply in recent years. As a result of this surge in interest, scientific output on the subject has risen dramatically.

As a result, current data collection is important and fascinating to utilize to track the progress and trends of this field of study over the previous few years. A fuller picture of the present state of food security and climate change research will be provided, something that policymakers, as well as academics, want. One of the most useful methods in this kind of study is bibliometrics, which has been utilized in numerous worldwide studies [23-29] to examine the evolution of scientific literature. Different studies were conducted on food security and climate change using this strategy, but each issue was evaluated separately. Sweileh's bibliometric study of food security under climate change from 1980 to 2019 using the Scopus database [30] resulted in just one article being published in 2020. For the first time in this subject, we will use the WoS database in our study, which will be the second publication that takes food security and climate change into consideration when drawing an overall picture of research progress.

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## Material and methods

### 1. Search strategy

The years 2000 to 2020 were selected for our bibliometric study. Both WoS and Scopus, with their wide range of fields covered, are the most often used literature databases for bibliometric studies [31,32] and are likely to provide findings that are quite comparable in large-scale analysis. Food security and climate change have been studied using Scopus in the past. Web of Science (WoS) was used in this study since it is well recognized as a reliable resource in this field. Titles and abstracts of WoS articles spanning the years 2000 to 2020 were scanned for the terms "food security" and "climate change.". On the topic of food security and climate change, our search approach turned up 5626 papers.

### 2. VOSviewer

To analyze and display our data, we employed the VOSviewer software program in our research. VOSviewer is a popular tool for doing field-specific bibliographic analysis since it allows users to create and explore bibliographic networks.

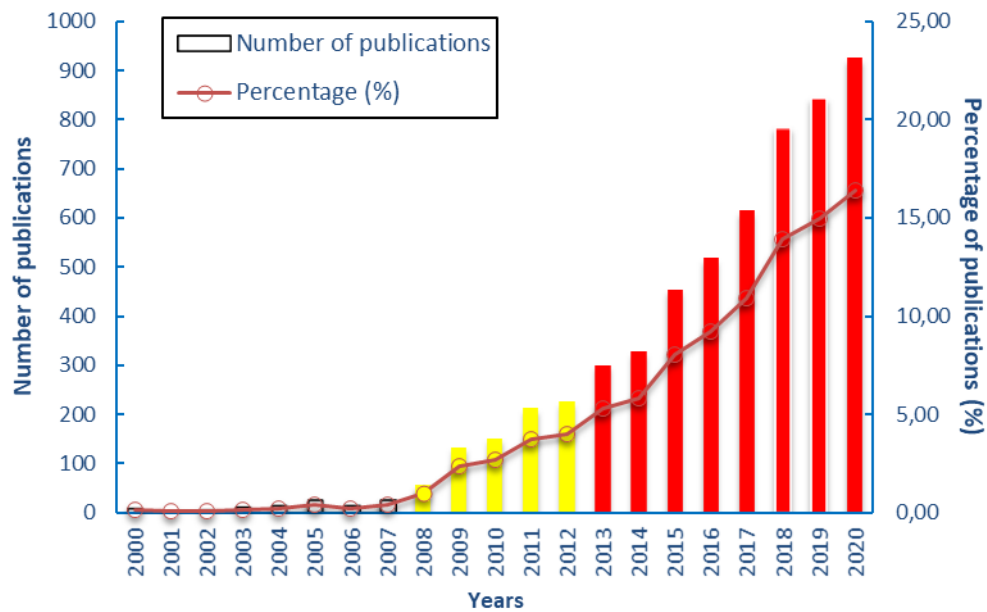
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## Results and discussion

### 1. Publication evolution over the years

The trend of research may be shown by the distribution of literature in chronological order, and the features of the trend in various phases of growth can be discerned [33]. There were 5626 publications published in the fields of "food security" (FS) and "climate change" (CC) between the years 2000 and 2020, according to Web of Science. Figure 1 depicts the yearly publishing numbers of the FS and CC papers, which show an overall pattern of expansion over time. The trend may be broken down into three stages: 2000–2007, 2008–2012, and 2013–2020. From 2000 to 2007, there was a lack of exploratory activity. The yearly average number of articles published before 2007 was 12.12, and the rise in the number of articles was gradual. The subject of food security and climate change research was in its infancy, indicating that most scientists were unaware of its relevance. An annual average of 154.4 articles was published between 2008 and 2012, a 13-fold increase over the period 2000–2007. This indicates that the scientific community has entered a period of fast growth. With an average yearly publishing output of 594.62 articles between 2013 and 2020, the high-yield period was lively and productive. Because of the food crisis that occurred between 2008 and 2012, there was an increase in relevant research [34,35]. As a bonus, the years 2008–2012 coincided with the signing of the Copenhagen Climate Agreement (2009). One hundred and

eighty-eight percent of world emissions are represented by the nations who signed on voluntarily to the Accord." Furthermore, the Paris Agreement was signed in 2016 and was the first time that countries agreed to take action to prevent climate change and adapt to its repercussions. International academics are increasingly concerned about food security and climate change as a result.



**Figure 1:** Between 2000 and 2020, the number of articles on food security and climate change.

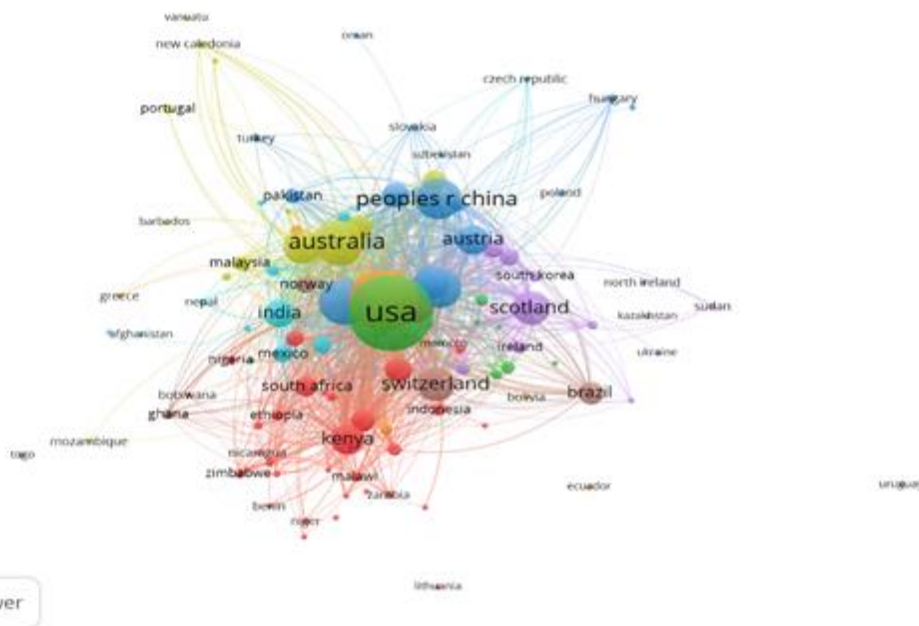
## 2. Geographical distribution of FS and CC articles

A worldwide problem that affects all countries and governments is food security and climate change. Table 1 shows the worldwide distribution of research in FS and CC. In the period between 2000 and 2020, more than 150 nations worldwide published research on FS and CC. Table 1 reveals that most of the research on FS and CC is undertaken by experts from the United States, England, and China. Over half of all publications come from these three nations. North African nations (Tunisia, Morocco, and Algeria) have the worst climatic conditions in the world, however, there is little study on this topic in these countries. Weaknesses in these two areas are clearly shown by this outcome. In general, the United States and the United Kingdom have tight ties, although there is room for improvement in the amount of collaboration between African nations and wealthy countries. Figure 2 shows the same trend in citations as the number of articles produced per nation.

**Table 1:** Distribution of FS and CC papers by country: the most prolific.

Country	Number of publications	Percentage of 5626 (%)
USA	1592	28.297
England	842	14.966
Peoples R China	770	13.686
Australia	686	12.193
Germany	602	10.700
India	398	7.074
Canada	394	7.003
Netherlands	376	6.683
Italy	326	5.795

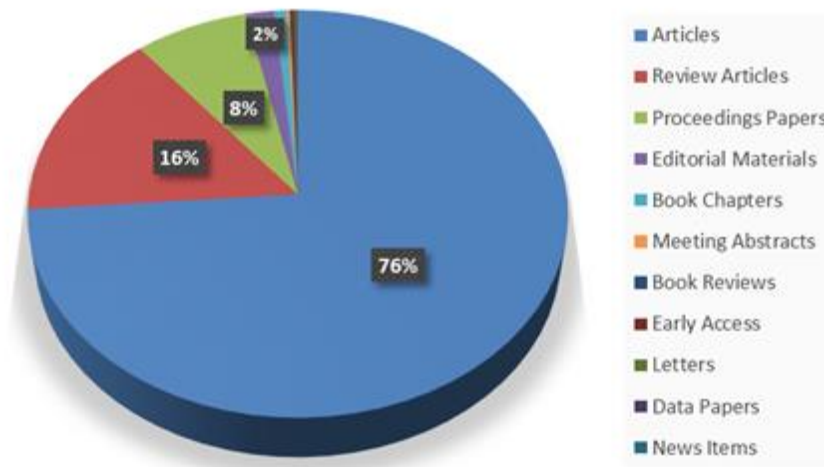
France	295	5.244
South Africa	245	4.355
Kenya	243	4.319
Spain	188	3.342
Scotland	183	3.253
Sweden	167	2.968
Switzerland	154	2.737
Austria	152	2.702
Japan	135	2.400
Brazil	134	2.382
Mexico	129	2.293



**Figure 2.** Visualization of citations to academic works on a map by nation. As the number of instances of a node increase, so too does its size.

### 3. Analysis of document types and languages

Articles account for 76% of all papers published, followed by reviews (16%) and proceedings papers (8%), according to the bibliometric study (figure 3). According to the data in Figure 4, almost all the 5626 publications published were in English.



**Figure 3.** Distribution of document kinds.



**Figure 4.** Distribution of FS and CC research in different languages.

#### 4. Most productive authors and organizations

Lal R, from Ohio University, is the most prolific author, followed by Smith P, Herrero M, and Tao FL, according to the bibliometric study (Table 2).

There is 10.114 percent of the total number of articles from CGIAR and 4.728 percent from the Chinese Academy of Sciences in Table 3. In truth, CGIAR is a global research collaboration for food security that includes 15 research institutions throughout the globe and is devoted to decreasing poverty, promoting food and nutrition security, and preserving natural resources.

**Table 2:** Top 20 most productive authors on FS and CC research.

Author	Number of publications	Percentage of 5626 (%)	Author	Number of publications	Percentage of 5626 (%)
Lal R	48	0.853	Challinor AJ	24	0.427
Smith P	42	0.747	Sieber S	23	0.409
Herrero M	38	0.675	Lobell DB	22	0.391
Tao FL	34	0.604	Ruane AC	22	0.391
Muller C	31	0.551	Hoogenboom G	21	0.373
Havlik P	30	0.533	Mason-d'croz D	21	0.373
Thornton PK	30	0.533	Liu Y	20	0.355
Asseng S	29	0.515	Wollenberg E	20	0.355
Zhang Z	27	0.480	Yang P	20	0.355
Ewert F	25	0.444	Ford JD	19	0.338

**Table 3.** Top 10 most productive organizations on FS and CC research.

Organization	Number of publications	Percentage of 5626 (%)
CGIAR	569	10.114
Chinese Academy of Sciences	266	4.728
Wageningen University Research	220	3.910
Commonwealth Scientific Industrial Research Organisation Csiro	199	3.537%
University Of California System	176	3.128
Alliance	150	2.666
nited States Department of Agriculture Usd	116	2.062
Institute Of Geographic Sciences Natural Resources Research Cas	113	2.009
International Food Policy Research Institute Ifpr	113	2.009
International Center for Tropical Agriculture Ciat	110	1.955%

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## Conclusion

Readers, researchers, and policymakers that are interested in food security and climate change research may use this bibliometric study of publications published between 2000 and 2020.

Food security and climate change have received an enormous amount of attention from scientists since 2008, as we have demonstrated. The Kyoto Protocol, the Copenhagen Accord, and the Paris Agreement, as well as the food crisis of 2008-2012, have had a significant impact on this study subject.

Global attention has been paid to food security and climate change, yet the power to address these concerns is not divided. In terms of scientific output, wealthy nations much outweighed underdeveloped countries. The

United States, the United Kingdom, and China are the primary producers of research in this area. Science output is still quite restricted and developing at a significantly slower pace in industrialized nations than in the Middle East and North Africa (MENA). This necessitates greater study and cooperation, particularly amongst scholars in the Middle East and North Africa (MENA). Creating national or regional FS and CC networks might help accomplish this aim.

A macro view of FS and CC research is provided by our study. Climate change research at the micro-level is not covered in-depth in this report. Consequently, a thorough literature evaluation and bibliometric analysis would be necessary to have a deeper understanding of the topic.

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