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Research Article

Main Themes and Bibliometric Analysis of Conflict and Climate Change Studies

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Abstract

Climate change, thought to cause significant problems if necessary precautions are not taken, causes droughts and natural disasters to occur frequently and severely. The primary resources required for life, such as water, soil, and food, will decrease in such a situation. It is thought that experiencing tensions dependent on resource scarcity will trigger internal and external conflicts, especially in underdeveloped countries with weak central governments and low income levels. On the other hand, because wars cause the use of large amounts of fossil fuels and firearms, they destroy forests and natural resources and increase carbon dioxide emissions, which are considered the most crucial cause of the climate crisis. In other words, while climate changes trigger wars, unfortunately, wars also increase the climate crisis. Especially when war reaches an existential dimension for countries, the risk of non-compliance with these agreements increases even in states that reshape their energy policies with significant investments to prevent climate change. In this study, we examined the Web of Science (Wos) literature on the relationship between climate change, which is seen as a significant threat to our future, and wars through its main themes and bibliometric indicators. Looking at the time series, interest in conflict and climate change studies has increased, and most studies have been done mainly in the field of "environmental sciences and ecology". Latent Dirichlet Allocation (LDA) Topic Modeling was applied to the abstracts downloaded in this study to find the main topics of conflict and climate change studies. So, the main topics were food, politics, migration, carbon emissions, and animals.

Keywords: Climate Change, Conflict, Climate Crisis, War, Topic Modeling

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Araştırma Makalesi

Çatışma ve İklim Değişimi Çalışmalarının Ana Temaları ve Bibliyometrik İncelenmesi

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Özet

Gerekli önlemler alınamadığı takdirde büyük sorunlara yol açacağı düşünülen iklim değişikliği, kuraklıkların ve doğal afetlerin sık ve şiddetli yaşanmasına neden olmaktadır. Bu durumda su, toprak, gıda gibi yaşam için gerekli kullanılabilir temel kaynaklar azalacaktır. Kaynaklar azaldığında yaşanan gerilimlerin, özellikle merkezi yönetimi zayıf, gelir seviyesi düşük olan az gelişmiş ülkelerde, iç ve dış çatışmaları tetikleyeceği düşünülmektedir. Diğer yandan, savaşlar, çokça fosil yakıt ve ateşli silahlar kullanımına sebep olduğundan, ormanlar ve doğal kaynakları tahrip etmekte, iklim krizinin en önemli nedeni olarak görülen karbondioksit emisyonunu arttırmaktadır. Yani, iklim değişimleri savaşları tetiklerken, ne yazık ki savaşlar da iklim krizini arttırmaktadır. Bilhassa savaş ülkeler için varoluşsal bir boyuta ulaştığında, iklim değişikliğini engellemek için büyük yatırımlarla enerji politikalarını yeniden şekillendiren devletlerde bile bu anlaşmalara uymama riski çoğalır. Bu çalışmada geleceğimiz için önemli bir tehdit olarak görülen iklim değişikliği ile savaşlar arasındaki ilişkiyi konu alan Web of Science (Wos) literatürünü ana temaları ve bibliyometrik göstergeler üzerinden inceledik. Zaman serileri incelendiğinde çatışma ve iklim değişikliği çalışmalarına ilginin arttığı ve en fazla çalışmanın özellikle "çevre bilimleri ve ekoloji" alanında yapıldığı görüldü. Çatışma ve iklim değişikliği çalışmalarının ana konularını bulmak için bu çalışmada indirilen özetlere Gizli Dirichlet Tahsisi (LDA) Konu Modellemesi uygulanmıştır. Böylece ana konuların gıda, politika, göç, karbon emisyonları ve hayvanlar olduğu belirlendi.

Anahtar Kelimeler: İklim Değişikliği, Çatışma, İklim Krizi, Savaş, Konu Modelleme

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INTRODUCTION

Since ancient times, many nations having difficulty adapting to changing climatic conditions and exposing to famine have migrated as tribes and fought to find settlements. Today also, droughts, water shortages, and conflicts caused by climate change can play a triggering role. The effects of the climate crisis are felt more in poor countries whose economies are based on agriculture, and internal conflicts and wars may occur in these countries. Therefore, there is a growing interest in examining the effects of climate change, which has caused global concerns in the last few decades, on security and peace, especially in Africa (Burke et al., 2009; Benjaminsen et al., 2012; Sánchez & Rylance, 2018; Mack et al., 2022). However, it is not easy to prove statistically the relationships that climate change may cause conflict. Emphasizing this, Ide and Scheffran wrote that most studies are problematic because they are based on changes in short time intervals. In contrast, to talk about climate change, it is necessary to look at meteorological averages over at least 30 years (Ide and Scheffran, 2014; Gleditsch, 2012). In support of this claim, Selby et al. (2017), who examined the relationships between climate change and war through many articles on the 2006-2008 Syrian Civil War, stated that in these studies, it could not be presented as evidence whether the drought experienced in Syria due to climate change triggered the civil war there (Selby et al., 2017).

Climate change can be associated with changes such as drought, higher temperatures, decreased precipitation rates, excessive precipitation, decreased freshwater resources, deterioration of land structure, and climate-related natural disasters (Ide & Scheffran, 2014). When examining whether these changes cause conflicts, it is seen that scientists reach different results in the studies in the literature. Paradoxically, some studies have concluded a significant relationship between climate change and conflicts, and some studies, conversely, have concluded that there is no semantic relationship (Ide and Scheffran, 2014). Although the climate crisis turning into conflicts is not considered a single factor, it is thought to cause conflicts indirectly. In his study in 2021, Sharifi states that climate change has a lower impact on conflicts, along with factors such as poverty, weak governance, political impotence, and ethnic divisions (Sharifi, 2021b). A 2015 survey of farmers in Southern Zambia in Africa suggested that the causes of conflict were people's misunderstanding of each other and political reasons rather than issues such as land, crops, or water. Nevertheless, farmers had the perception that conflicts would increase in future drought and water scarcity scenarios due to climate change (Marcantonio, 2015). It is thought that tensions arising from reasons such as migration due to natural disasters caused by climate change and decreasing resources trigger civil and foreign wars. This effect is not one-sided. There is also a reverse effect. In other words, climate change increases wars; Wars also contribute to climate change. During the conflicts in Swat, Pakistan, led by the Taliban in 2010, most of which resulted from land ownership disputes, many forest areas were destroyed by fires caused by heavy artillery fire and by the Taliban ignoring forest cuttings. This change caused floods to become more severe, and illegal houses built in the river beds collapsed during floods, changing the direction of the river and causing more forest and cultivated land to be damaged (Muzamil et al., 2021).

Wars cause enormous and sometimes irreparable damage to the environment. While countries have accepted the Paris Agreement to reduce emissions in the short term and achieve zero emissions in the long term, it is still unpredictable what can be done about the emissions that will be released as a result of intense dependence on fossil fuels in wars (Kaplan et al., 2022). War technology is mainly dependent on fossil fuels. In real wars and activities such as training, exercises, and carrying out illegal activities, it causes environmental pollution and carbon emissions (Depledge, 2023). Transitioning to a low-carbon war will be challenging due to the high material damage of the war, the prolongation of conflicts, and the war becoming existential for one or both parties (Depledge, 2023). In addition to the fossil fuels used in the war, forests damaged during the war, which play a role in reducing the amount of CO_2 in the atmosphere, considered the most critical component of the climate crisis, also trigger the climate crisis. In a study emphasizing this situation, when the effects of conflicts in Colombia between 1992 and 2015 were examined on deforestation, it was seen that the effects of conflicts on deforestation were much greater than the growth rate of forest areas (Landholm, et al., 2019). Similarly, during war-related migrations in Jordan between 2013 and 2015, pastures were used as settlements, and this caused water scarcity, food security problems, and desertification (Sawalhah et al., 2018).

Although most scientists see climate change as a danger, there is no definitive consensus on this issue. Some scientists who do not believe in the climate crisis argue that the temperature increase is due to

temperature fluctuations in the geological period and that the increase in the amount of CO_2 is due to the temperature increase. Based on this claim, Teklu states in his 2018 study that CO_2 emissions (energy consumption) are related to the industrialization and economic welfare level of countries and that underdeveloped countries such as Ethiopia, which has less than one percent CO_2 emissions compared to developed countries, should increase their CO_2 emissions until they reach the world average. He argues that it is necessary (Teklu, 2018). On the other hand, groups that have a conflict of interest regarding preventing the climate crisis may also argue that fossil fuels do not cause climate change. Particularly in the fossil fuel industry, some elites finance activist groups under the name of a healthy economy and increased welfare and may try to cast doubt on theoretical arguments about climate change (Van Schalkwyk et al., 2021). In addition, sometimes climate change can be ignored for the sake of short-term gains. For example, despite the significant threats that the climate crisis will pose to living things in the future, in interviews with high-level lobbyists in the mining and energy sector in Austria, it was seen that mining and energy companies focused on their local operations, their impacts and target audiences, and global problems such as climate change were in the background (Hobbs, 2020).
Although many articles in the literature examine the relationships between climate change and war, only one article examines the main topics and bibliometric data of this relationship. This study is consistent with Sharifi et al. in two respects. (2021) differs from this article. First, Sharifi et al. (2021) scanned the keywords in all fields in Wos and included many articles outside the subject's domain in their analysis. We explained this situation by giving an example in the method section. This article progressed through more topic-focused articles by filtering only keywords. Second, this study's theme determination methodology is different. When determining a theme, it has been determined that using only software-based approaches is insufficient to reach ideas, and including human evaluations in determining the topic gives better results (Chang et al., 2009). Accordingly, the main themes in this study were prepared with a hybrid approach, using both topic modeling software and human evaluation. Thus in this study, the literature on the relationships between conflict and the climate crisis, which scientists consider an existential problem for the future, will be examined. From this point of view, it will investigate what kind of a connection is established between the climate crisis and conflict, in what contexts the problem is addressed, where and in which areas these studies are carried out, and what the main issues and problems in this field are. Thus, the climate crisis, which is the subject of major agreements in interstate relations and in which significant investments have been made, will be investigated. Attention will be drawn to the connection between conflict.

Methodology

In the study, articles containing at least one of the terms "climate change", "climate crisis", "global warming," and one of the words "conflict", or "war" in the "Author Keywords" field were filtered on the Wos platform on 3.10.2023. Unlike the bibliometric study of Sharifi et al. (2021) in the literature, filtering words were selected by searching keywords instead of all fields. Because, if the searched words were scanned in all areas in Wos, it was seen that many articles that were not related to the desired topics were found. For example, some studies whose central theme is not related to the concepts of war or conflict were added to the dataset due to expressions such as "industrialization after World War II triggered the climate crisis" (Szopa et al., 2013, Stoll 2020; Ryan et al., 2014). Some articles that had nothing to do with anti-peace, but contained the word "conflict" to express that measures to reduce climate change could conflict with each other, were articles that should be removed from the list. These articles were often used together with "trade-off". In this study, article selection was made by searching among the keywords given by the author instead of searching in all fields so that the central theme was climate crisis and conflict. Additionally, by reviewing the abstracts, articles that were still irrelevant to the topic were removed from the dataset.
The data (such as author, title, source, number of citations, abstract, address, document type, Wos categories, research regions, number of cited references, publisher information and open access information of 528 literature studies), were downloaded from Wos and they were saved as an excel file. In this file, the repetitive ones were first removed; thus, the number of studies decreased to 512. Studies that were outside the scope of this study, such as Culture Wars, and studies that did not have summary data were deleted, and the number of records was reduced to 457.
After this stage, the summary texts were converted to lowercase and cleared of unique characters, frequently used words (stopwords), and numbers in each text. Afterward, lemmatizing was applied to

combine words with the same root. Thus, the preliminary preparation for the analyses to be carried out using the summary has been completed.

Results

Distribution by Years

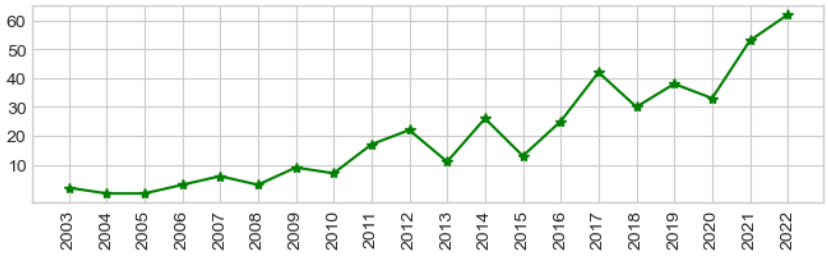

Figure1: Distribution of Wos articles containing keywords by years

The first studies prepared at Wos focused on climate change and conflict issues were in 2003. However, the studies started to show an upward trend after 2010. There has been a significant increase in its use in dealing with these subjects in recent years.

Word Cloud

Figure 2: Word cloud created by using article summaries

The word cloud visually presents the most frequently used words from largest to smallest, depending on the number of uses. Word clouds support quick visibility of essential words and encourage research and focus (Williams et al., 2013). From the word cloud comprising summaries of the articles studied, climate change is seen as a global risk, and the importance of water, food, and resources is emphasized. Among the words emphasized are disasters, temperatures, droughts, migrations, and crises, which are expected to be seen more frequently with the climate crisis. In order to prevent the climate crisis and the conflicts that may arise and to minimize the threats that may arise, policymakers' approaches, analyses, and ensuring security are among the prominent issues.

Research Areas

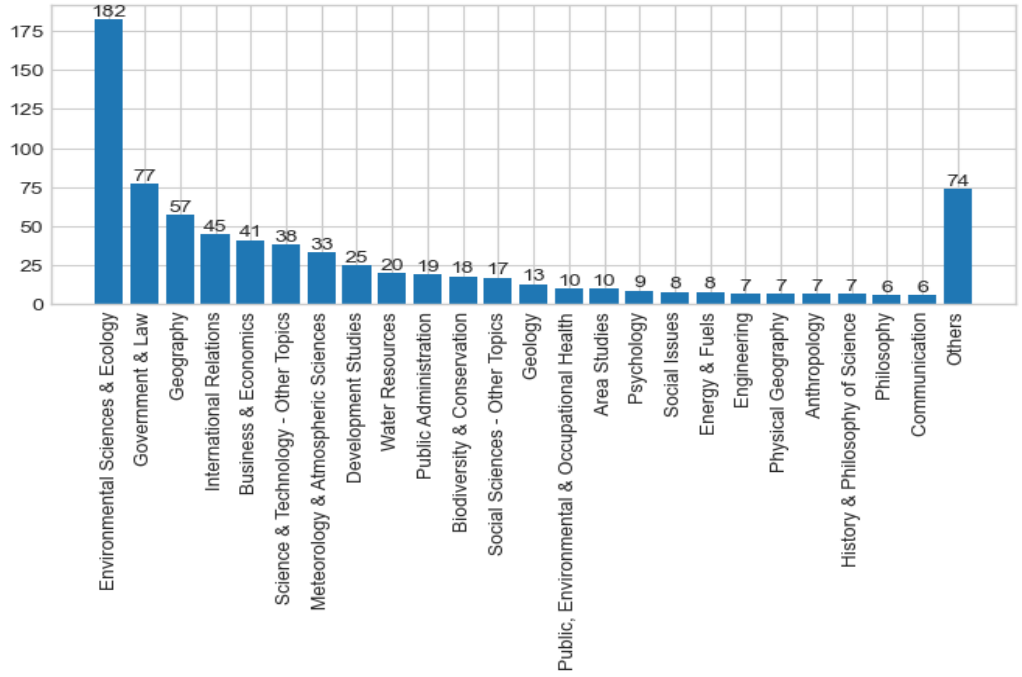

Figure 3: Research area distribution of articles containing the words Conflict and Climate Change

One hundred eighty-two of the articles that use the words war and climate change together are associated with the "Environmental Sciences and Ecology" field. Climate change was the most common research topic related to the environment and established a relationship between humans and the environment. Although individual studies contribute to reducing this danger on a global issue such as climate change, the most important thing is the decisions and sanctions that states will take on these issues. In this context, the second place among the articles was the research topic Government & Law, to which 77 articles were associated. These are the most commonly associated research topics and numbers, respectively: 'Geography': 57, 'International Relations': 45, 'Business & Economics': 41, 'Science & Technology - Other Topics': 38, 'Meteorology & Atmospheric Sciences' ': 33, followed by ' Water Resources': 20.

Keywords

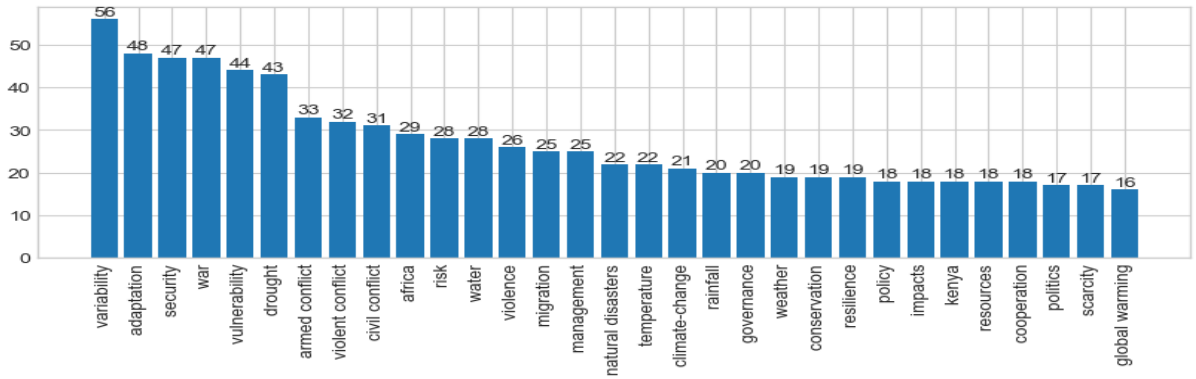

Figure 4: Most frequently used keywords

When the studies were examined based on keywords, "climate change" in 293 studies and "conflict" in 150 were seen as the most used. The ones that come after these two keywords are shown in Figure 4 with their frequency of occurrence in the articles. Diversity, which represents climate change, adaptation, which represents efforts to keep up with the new order along with climate change, war, and

security, an essential component of war, were among the most frequently used keywords. Weather conditions, temperatures, droughts, and precipitations that will cause change in the climate crisis are among the keywords frequently used in many articles.

Author Distributions

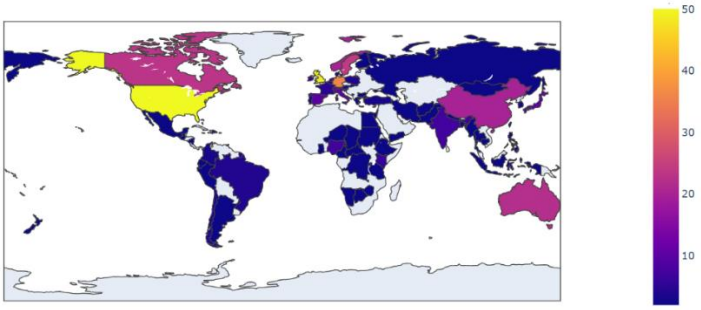

Figure 5: Distribution of authors by country

When we look at the country distribution of the authors, we see that by far most authors are registered to the USA address. While the number of authors from the USA is 106, the number of authors from the United Kingdom is 48. The countries and distribution of the later authors are Germany, Sweden, Canada, and Australia, respectively; 33, 23, 19 and 18 (Fig. 5).

Basic Topics

Topic modeling algorithms are frequently used to find hidden topics in texts. One of the most preferred among these algorithms is the Latent Dirichlet Algorithm (LDA), developed by (Blei et al., 2003) in 2003. In this algorithm, each text examined, such as a comment, tweet, news, etc., is seen as a document, the distribution of words in the documents is examined, and the probabilistic equivalent of each topic in the documents is calculated.

We wanted to see which topics were mainly included in articles about climate change and conflict in the literature from the summary texts studied using the LDA algorithm. In topic modeling algorithms, one of the parameters that must be given to determine topic distributions is the number of topics. In addition to quantitative methods, such as using the consistency value (Altıntaş et al., 2021; Röder et al., 2015) to determine the value of the number of topics to be entered; Qualitative methods, such as evaluation and decision-making by experts on the subject are also used, and more consistent results can be obtained in the subject distributions determined by the qualitative method (Cheng et al., 2009). In this study, the authors decided the number of topics by examining the words obtained from the LDA algorithms in which different topic numbers (4, 8, 20, 30) were applied and the frequencies (unigram and bigram) of the words. As a result, the articles were grouped under five main topics with the selected distinctive words determined (Table 1). These issues were determined as food, politics, migration, carbon emissions, and animals. When compared with the themes obtained from Sharifi et al.'s study, it was seen that the themes of immigration, politics and migration were common themes in both studies. In this study, different topics from Sharifi et al.'s study are carbon emission and animal themes.

Table 1: Topic tags and distinguishing words attained using LDA method analysis, and the number of documents containing at least one of these words.

	Distinguishing Words and Sequences	**n (%)**
Food	[agriculture, draft, farmer, food, resource]	182 (39.9%)
Politics	[management, policy]	163 (35.7%)
Migration	[displacement, migration, movement]	73 (16.0%)
Carbon	[pollution, carbon, dioxide, emission, greenhouse]	52 (11.4%)
Animals	[animal, bear, fish]	28 (6.1%)

Topic 1 - Food: The main distinguishing words of this topic are agriculture, drought, farmer, food, and resource. Most summary documents (39.9%) were associated with this topic. If the necessary measures regarding climate change are not taken, serious dangers will likely occur in many places and globally in

the future. Masses challenging governments and interregional conflicts can increase with reduced access to primary natural resources such as water and food (Bowles et al., 2015). In African countries, whose livelihoods are based mainly on agriculture and where state guarantee is insufficient, failure to access sufficient water can lead to problems that may turn into conflict (Mack, 2022). For this reason, water conflicts have been extensively studied in the literature through measurements of precipitation, drought, and evapotranspiration in these regions. However, issues related to water quality, access to water, and water rights have yet to be studied much. Since these issues may also be a source of conflict in the future, it would be helpful to study them (Mack, 2022). The relationship between conflicts in African countries, natural disasters, and droughts should be studied using machine learning based on big data. In this way, possible scenario points that may occur in the future can be determined, predictions can be made about where conflicts may occur, and precautions can be taken for environmental variables (Ide, 2023). Temperature trends in Africa, combined with climate model simulations, predict a roughly 54% increase in the frequency of armed conflict by 2030 and 393,000 deaths from war-related causes if future wars are as deadly as recent wars (Burke et al., 2009). In addition to conflicts, diseases are also likely to increase with climate change. In India, it is predicted that temperature increases may lead to an increase in diseases such as malaria, the emergence of new agricultural pests, and changes in the crops that can be planted (Singh & Bagchi, 2013).

When the concerns arising from the Ukrainian War in Lithuania were compared with the concerns about climate change, it was seen that the war caused more anxiety. This situation is attributed to the fact that the effects of climate change are long-term and are only remembered during extreme weather events. The need to raise awareness by educating people about climate change is emphasized (Liobikienė et al., 2023).

Topic 2 – Politics: The distinguishing words of this topic are management and policy. Over a third of the summary documents (35.7%) discuss this topic. Science-policy interaction begins as science progresses and studies on the climate crisis increase. Thus, the co-production of knowledge has led politicians to decide on reducing heat-trapping emissions, carbon removal, and sunlight reflection management (Mach and Kraan, 2021). However, in these countries, most of which are governed by a capitalist system, it does not seem easy to implement the decisions taken. Preventing climate change can be achieved by taking revolutionary, socioeconomic, and ecological measures in the same context as preventing the nuclear danger. It does not seem possible that this aim can be compatible with capitalism, a political and economic system designed to maximize the financial gain of the powerful elite (Blunt et al., 2023).

Droughts in poor and agriculture-based countries such as Africa negatively affect economic growth (Dell et al., 2012). This may cause the resources governments will use to ensure peace to decrease and people to turn to illegal businesses where they can earn money more easily (Koubi et al., 2012). However, although many people claim that droughts and hot weather caused by climate change triggered civil wars in Africa, scientific models show that climate change is a weak indicator of conflicts. Instead, it shows that these wars are due to factors such as a weak economic system and an ethno-political system (Buhaug, 2010).

Topic 3 – Migration: The distinctive words of this topic are displacement, migration, and movement. The rate of summary documents touching on this subject is 16%. Migrations can bring stress and conflict due to the increased demand for available resources. Ravi draws attention to this issue in his 2021 article. He recommends evaluating the social reactions to the migration of East Pakistani refugees to India, which occurred in the 1971 Bangladesh War, state and NGO efforts, and developing policies on potential risks that may occur in the future (Ravi, 2021). Although climate change is a catalyst for migrations, it occurs primarily due to economic, social, and political factors (Freeman, 2017). In societies where the economic level is high, and state security is provided, the migration rate is lower because of the precautions that can be taken against disasters and because a new structure can be made quickly by the new conditions after the disaster. Thinking now about possible migrations that will occur with climate change and taking precautions regarding possible conflicts will reduce the severity of future crises.

Topic 4 – Carbon: The distinctive words of this topic are carbon, pollution, dioxide, emissions, and greenhouse gas. The rate of summary documents touching on this issue is 11.4%. Greenhouse gases play an essential role in increasing temperatures by retaining heat. If precautions are not taken, changes in sea level due to climate change may threaten India's coastal cities, the world's largest greenhouse gas emitter (Singh & Bagchi, 2013). Although wars generally increase climate change, the Ukrainian War

can be an advantage in preventing the climate crisis. Because the crises and pressures on natural gas resulting from the Ukrainian War have increased the interest in biogas, which has relatively low emissions (Farghali et al., 2020). If appropriate policy mechanisms are implemented, the biogas industry can significantly reduce global greenhouse gas emissions, and global warming can be limited to 2°C in countries (Farghali et al., 2020).

Topic 5 – Animals: The distinctive words of this topic are animal, fish, and bear. The rate of summary documents touching on this issue is 6.1%. With climate change, changes in water temperatures, ocean currents, and increases in coastal water levels affect marine species distributions and, as a result, cause scarcity of resources, which can trigger the proliferation of illegal activities, food security concerns, and territorial disputes (Spijkers et al., 2019). Current trends suggest there may be greater future food insecurity and fishing conflicts (McClanahan et al., 2015). Changing the balance in nature causes conflicts between humans and can increase tensions within animals and between animals and humans. It is estimated that polar bears, whose living space has become smaller and nutritionally stressed due to melting glaciers, can spend more time in areas close to humans. In such a scenario, ways to protect the safety of polar bears and humans should be investigated (Wilder, 2017).

Table 2: Percentages (numbers) of two topics' intersections [1,2]

	Food	Politics	Migration	Carbon	Animals
Food	39.91% (182)				
Politics	16.01% (73)	35.75% (163)			
Migration	8.77% (40)	5.92% (27)	16.01% (73)		
Carbon	3.51% (16)	5.04% (23)	0.88% (4)	11.4% (52)	
Animals	2.41% (11)	3.07% (14)	1.32% (6)	1.1% (5)	6.14% (28)

In Table 2, the values on the diagonal show the numbers and percentages of records for each subject. Values off the diagonal are the numbers and percentages of records containing both subjects. It is seen that policy and migration issues have the biggest number intersection with food. On the other hand, carbon and animals issues have the biggest number intersection with politics.

CONCLUSION

Studies on the effects of climate change on wars and wars on climate change are increasing year by year. However, bibliometric evaluations and examination of the main themes of these studies are limited. The prepared studies are mainly in environmental science & ecology and government & law. The countries where this subject is studied most are the USA and the UK.

Studies emphasize the expectation that if necessary measures are not taken in the future, resources such as land areas, water, and food will decrease due to the melting of glaciers due to climate change, increases in sea levels, and increases in temperatures and natural disasters. These changes may affect ecological balances, increase the tension on living things, and bring about the risks of civil and external wars and migrations that may occur due to this. In order to reduce these risks, sanctions and policies by states and even supra-state organizations are needed. Scientists have a guiding and remarkable role with the scientific studies they prepare. When looking at the literature, in studies on confusion and climate change, food is the subject that is given the most coverage. The second fundamental issue is politics, essential to prevent the climate crisis. The next topic concerns migrations due to wars and scarce resources. The fourth most common topic concerns carbon emissions, which must be reduced to prevent the climate crisis. The last issue concerns the conflicts between animals whose resources are decreasing and the conflicts that may occur over animals consumed as food. Raising awareness about the climate crisis and the wars it will bring, investigating the relationships between them in more detail, and developing solution suggestions can significantly reduce the extent of the danger. For this reason, more

[1] The authors obtained Table 1 data using topic modeling based on discriminant words.
[2] Diagonal values are the studies related to each topic

detailed studies are needed to examine the parameters between war and climate crisis and to investigate the measures to be taken against these parameters.

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