climate

MDPI

Article

Disaster Risk, Climate Change, and Urbanization as Research Topics in Western Asia—A Bibliometric Literature Analysis

Alexander Fekete

Institute of Rescue Engineering and Civil Protection, TH Köln—University of Applied Sciences, Betzdorferstr. 2, 50679 Köln, Germany; alexander.fekete@th-koeln.de

Abstract: Scientifically analyzing and documenting climate change and related disaster risks is demanded by international organizations such as the United Nations. However, global or national studies predominate, and cross-regional overviews are lacking, especially for Western Asia. In four countries in the region, Iran, Israel, Saudi Arabia, and Turkey, transport accidents, floods, fires, and earthquakes are the predominant accidents and disasters in the Emergency Events Database (EM-DAT). The result is different when analyzing the scientific publications via a bibliometric literature analysis using VOS viewer and the Web of Science, and earthquakes, climate change, COVID-19, and terrorism dominate here. Governance and management are also an important and recurring cluster topic. The conceptual components of vulnerability and resilience are discussed in most countries. The hazards are often associated with specific concepts and quantitative methods. GIS and remote sensing as specific methodologies also often appear in a cluster. Further clusters derived from the keyword search include floods and droughts, food security and agriculture, and posttraumatic stress and psychological aspects. The results help us to identify countries with a rich literature on certain hazards and gaps in relation to other types of disasters, which are more prevalent. The findings can help scientists and policymakers to support future studies based on either high or low research coverage.

Keywords: community resilience; disaster risk; urban development; disaster risk management; disaster risk reduction; public health

Citation: Fekete, A. Disaster Risk, Climate Change, and Urbanization as Research Topics in Western Asia—A Bibliometric Literature Analysis. *Climate* **2023**, *11*, 131. https://doi.org/10.3390/cli11060131

Academic Editors: Lelys Bravo de Guenni, Huikyo Lee, Wen Cheng Liu, Josh Tsun-Hua Yang and Nir Y. Krakauer

Received: 25 March 2023
Revised: 14 June 2023
Accepted: 15 June 2023
Published: 17 June 2023

1. Introduction

Despite the existence of the International Panel on Climate Change (IPCC) and recurring international conferences of the parties (COP) with high political and public visibility, progress in further research and action to mitigate or adapt to climate change is lacking [1,2]. In addition, climate change adaptation, adjustments after natural hazards, and the transformation of society in related ways are quite heterogeneous when comparing countries [3]. A great variety of potential underlying reasons explain this. The varying occurrences and impacts of climate change per country, including extreme events and related disasters, are possible reasons [4]. Apart from measurable effects, the perception and representation in publications could be an indirect indicator. Analyzing public media would be one option to analyze how climate change is reflected in a population [5–7]. Academic publications can act as an interesting indicator of which topics around climate change are covered in a country [8], even when this must also be critically analyzed, especially within the climate change discourse [9,10].

One characteristic of climate change compared to other natural hazards, for example, is that it is a developing process with a relatively short history compared to other disasters and hazards. Climate change's effects are just beginning to be felt, and causal correlations remain a matter of analysis [11]. This could be another reason for the different speeds of uptake of climate change [12] in academic publications and public media. It is also important to analyze climate change in relation to human activities so as to capture impacts and awareness about the topic [4]. Disasters and related impacts are, therefore, one suitable

additional area of research related to climate change [13], even when political attribution must be cautiously addressed [14]. Increases in the occurrence, variability, and impacts of disasters associated with climate change have been seen in certain countries in the MENA region, Middle East, North Africa, and Western Asia [15–17]. In some countries, awareness is related to differences in how often meteorological hazards occur compared to earthquakes. Another important area associated with both climate change and disasters is the topic of human exposure, vulnerability, and resilience [18–20], as well as the coupled concept of social–ecological systems [21–23]. International research around climate change and disaster risk reduction has contributed to raising awareness about the importance of analyzing risks not only via hazards and damages, but also by looking more in-depth into underlying reasons on the societal impact side. This is achieved by analyzing the vulnerability of populations, as well as physical conditions, institutions, the economy, and many other dimensions of vulnerability [19,24]. The same dimensions relate to resilience [25], which is also increasingly being used as an overarching paradigm [26], for example, in the guidelines of the United Nations [27]. Similar to vulnerability, it is also increasingly applied in semi-quantitative indicators or spatial assessments [28]. A qualitative analysis thoroughly examines people's psychology and socioeconomic conditions [29–31]. A "whole community" approach with the analysis of inclusiveness is increasingly being demanded [32,33]. Still, though, spatial exposure and the density of human activity are key features in explaining risk. Therefore, the impacts of climate change are often analyzed by assessing large urban areas with high densities of people and human infrastructure. Urbanization is an additional and related driver of human development that, on the one hand, leads to a higher concentration of exposure in cities and peri-urban areas [33–35]. At the same time, however, this type of development also triggers heterogeneous distributions of socioeconomic conditions, and as such, different patterns of vulnerability [36]. Marginalization is one especially important effect felt in urban or rural areas where development can have negative side effects [30]. In addition, slums and other kinds of detrimental conditions can arise directly in the centers of large urban areas [37]. In dealing with climate change, mitigation via CO_2 emission reductions and related health risks are important topics related to urbanization [38]. Finally, it is important to benchmark and test disasters associated with climate change against other kinds of human risks of high importance for society and academic research. Public health issues and daily life risks must also be analyzed in relation to extreme climate events' impacts [31,39,40]. Considering that not all regions and countries address climate change and natural hazards as a main concern, it is also important to analyze other types of disasters and related risks. For example, war and criminal acts, social unrest, and many other forms of man-made and technological hazards and threats must be compared to natural hazards as they relate to climate change impact in order to fully understand the importance and distribution of hazards and disasters in individual countries.

This article systematically analyzes the availability of studies related to climate change, disasters, and urbanization. Therefore, one scientifically accepted search platform, the Web of Science, is selected using a standardized search method. This platform is also currently widely used in research on climate change and other related topics [41]. For each regional context, for the sake of consistency with another study already conducted in eastern Africa, the United Nations' classification of world regions is applied. "Western Asia" is used, and not "Middle East" or other similar regional names, such as "the MENA region" or others. All regional delineations are problematic, but this specific area is especially sensitive. There is no generally agreed outline or list of countries, and even the United Nations uses a different list of countries within each of its different institutions when discussing topics in this area. It is also a highly sensitive area due to political circumstances, as it includes (depending on the definition) countries such as Iran, Israel, Saudi Arabia, and Turkey (Turkiye). This list could extend to Cyprus, and probably many more of, if not all, the countries in this region. It is, therefore, important to emphasize here that this is solely of scientific interest. As such, to establish a systematic approach amenable to later

comparisons, the United Nations' delineation of regions is applied. Certainly, it could be debated whether many individual countries do not belong to another region, such as Europe, but the main purpose of this article is to provide a cross-regional overview of disasters and climate change, and how they affect urban areas and populations. Climate change and disasters do not stop at borders; administrations and topographic delineations have their constraints. Here, a more humanitarian and disaster risk-reduction perspective is adopted, and the results are intended to offer a better overview and comparison between larger and smaller countries in terms of how they are already addressed in the scientific research. Therefore, it is helpful to compare several prominent countries in this area with less prominent ones. For this purpose, certain countries have been included, such as Cyprus, Iran, Armenia, Azerbaijan, Georgia, and Turkey. These are not consistently included in the available regional lists. Overall, are a better understanding of climate change, disasters, and their impacts on human lives, rather than political debates about a country's political and regional context should be achieved. This is also important to note considering that, over years and decades, such political and regional alignments can vary.

2. Materials and Methods

The methodology employed here consists of a systematic literature review that uses documented search terms within the Web of Science. This approach has been selected to enable comparisons with other research groups and regions already addressed in similar studies. Using just one search platform has its constraints, such as those related to the publishing companies included, the exclusion of grey literature, and the range of representation across different languages. However, these are known constraints, since this platform and this literature review process are both well-established [42]. This approach is useful in enabling contemporary and future comparisons. The searching of the Web of Science database was adjusted so as to restrict it to findings with the pre-designated search terms within the title, keywords, and abstract, but not in the affiliation, the literature, or the manuscript text. This avoided our search yielding, for example, papers that compare one country's context to that of another, but that do not contain a study of this country itself.

The literature search was conducted exclusively on 21 February 2023, so as to give a temporal snapshot. As such, the findings are all consistent for this day. It should also be noted that just one additional day can produce additional publications. Therefore, the results cannot be directly compared easily with those of a follow-up study, which will inevitably identify more publications. The data range of the analyzed articles was from 1976 to 21 February 2023, and it included all of the literature listed on the Web of Science under the respective keywords used. This included the first entries under the respective keywords and the refinement of the search by country/region used (see below). A comparison without the country/region restriction will yield findings containing the keywords in question dating back to 1969 (keyword "climate change") or even 1945 (keyword "disaster"). The search terms used were: "climate change", "climate risk", "community resilience", "disaster", "disaster risk", "natural hazard", "multi-hazard risk", multi-risk, "multiple risk", "urbani*", and "hazard". The search term string employed in the Web of Science database in the selection of the 20 countries read: "and IRAN or TURKEY or SAUDI ARABIA or ISRAEL or U ARAB EMIRATES or CYPRUS or QATAR or IRAQ or JORDAN or LEBANON or OMAN or KUWAIT or GEORGIA or SYRIA or PALESTINE or BAHRAIN or ARMENIA or AZERBAIJAN or YEMEN (Countries/Regions)".

The findings from the Web of Science were extracted into text files in a tabulator delimited format. An additional tool for analysis, the VOS viewer, was used to identify clusters of relations between keywords to identify which terms characterize the articles in this search. This tool is widely used since it permits the visualization of those interrelations and helps structure the findings of a literature review using bibliometric metrics. It also includes certain constraints that enable direct comparisons, since many parameters can be changed individually. However, this is a helpful feature that enables the modifications of cluster sizes, the selection of terms to exclude, thresholds, and visualization. However,

further interpretation was also based on these modifications. For example, authors selecting 1000 articles and carrying out interpretation using mainly the visual output may conclude with different representations, and hence, a system of interpretation whereby the author deselects certain search terms in the final cluster and selects only 100 articles and 50 items to be shown will have an increased threshold for clusters or relations, and this enables interpretations based on the textual output rather than the network image. Therefore, in this study, individual modifications and search terms are documented.

The VOS viewer is especially helpful since it reduces complexity and helps with clustering and visualizing the results of the literature analysis.

The representation thresholds of the VOS viewer for keywords were set so that fewer than 50 items with the highest occurrences were produced. This strategy, and the subsample size, hugely facilitated manual interpretation. Overseeing the selection of 100 items required a lot of work. The sizes of the clusters varied between 100 and 50 items. The original search term and its plural (for instance, "disaster" or "disasters") and the refined search term with the country in question's name were deselected; for instance, the name "Oman" was deselected in samples about Oman.

In addition to scientific publications, the Emergency Events Database (EM-DAT) was used to compare the findings of publications about climate and urban risks, as well as recorded disasters. The EM-DAT (EM-DAT, CRED/UCLouvain, Brussels, Belgium: www.emdat.be, accessed 21 February 2023) lists large natural and man-made accidents, as well as natural and other types of events, that resulted in high numbers of casualties, affected many people, and caused large amounts of economic damage under the term "disaster".

3. Results

The region in question is characterized by different climatic zones, both maritime and continental, and it spreads across much of the globe, from around 10° to around 45° latitude. The topography of the region also varies between low-lying deserts and mountain ranges. Different natural hazards therefore arise, ranging from earthquakes and climate change-related hazards that can affect all countries to more region-specific hazards, such as tropical cyclones. Urbanization is occurring quite rapidly in many of the settlement areas in the region but varies widely at the local level. The country sizes vary significantly, which also determines the degree of exposure to different types of hazards, and thus, the presence of the countries in international journal articles.

A literature search in the Web of Science revealed six articles with "Western Asia" and "review" in the title. Five of these articles deal with diseases and epidemiology. The other article is about eating disorders. Two out of the six articles deal with climate change or environmental drivers. None of the articles are about other disasters or have an explicit focus on urbanization.

A similar pattern persisted when broadening the research to include abstracts and keywords and comparing the results with those of another search engine, Google Scholar. Most review articles focus on transboundary diseases, while others focus on architecture, language, and history. Under this extended search, no other results were returned when adding the search term "disaster", and only two additional articles were yielded when adding the search term "urban". The two main topics comprising "urban" are environmental health conditions during displacement, as well as water, purification, and treatment. It was still necessary to conduct a literature review and provide an overview of disasters, climate change, and urbanization in Western Asia.

That said, many more studies could be found when exchanging the regional context searched from Western Asia to the Middle East. For example, over 80 results were returned when searching the Middle East, "review", and "urban" in the Web of Science database with a scope of title, abstract, and keywords. Thirty results were returned for the same search when exchanging the term "urban" for "disaster". Further, the topic of "climate change" is covered fairly well in articles focusing on the Middle East. However, when that search was restricted to "topic" in Web of Science, many more results with a soft focus on

all the search terms were yielded. Relatively few contained all the terms in their titles. The first screening of all the findings also revealed that certain terms, such as those related to epidemiological aspects, were more prominent. In contrast, references to other types of disasters, such as earthquakes or floods, were missing. Based on these preliminary findings, the search was modified to make it more specific and structured. Our discussion of the results starts with an analysis of disaster occurrence, followed by a closer analysis of the findings of the systematic literature search.

3.1. Disaster Occurrence in Western Asia

When analyzing EM-DAT, a recognized disaster documentation database [43], it would appear that Turkey is significantly affected by high death tolls (Table 1). However, the dataset includes the recent earthquake in Syria and Turkey in 2023, which led to an estimated 50,000 casualties. This event will likely enter the data table as the top-most destructive in Western Asia. That said, Turkey is already notable as the country most affected by earthquakes over a period of decades, with many casualties, many people affected, and the highest degree of monetary damage. Armenia follows in these terms, specifically with the earthquake of 1931, while, interestingly, the one from 1988 does not compare. In Saudi Arabia, one of the most significant events occurred in 2015 when crowds led to a stampede accident. This accident is recorded in the EM-DAT as a disaster involving a high number of casualties resulting from crowd panic.

Table 1. Top 15 disasters by casualties, based on the EM-DAT for Western Asia.

Year	Disaster Type	Country	Total Deaths	Total Affected	Total Damages, Adjusted (USD 1000)
1939	Earthquake	Turkey	32,962		419,844
1999	Earthquake	Turkey	17,127	1,358,953	35,137,907
1943	Earthquake	Turkey	4020	5000	674,981
1914	Earthquake	Turkey	4000	51,700	
1944	Earthquake	Turkey	3959		
1976	Earthquake	Turkey	3840	216,000	128,564
1903	Earthquake	Turkey	3560	60,000	
1942	Earthquake	Turkey	3000		
1931	Earthquake	Armenia	2890		
1966	Earthquake	Turkey	2394	109,500	180,326
1975	Earthquake	Turkey	2385	53,372	92,446
2015	Stampede accident	Saudi Arabia	2300	805	
1954	Fire	Turkey	2000		1,935,446
1903	Earthquake	Turkey	1700		
1982	Earthquake	Yemen Arab Rep	1507	401,500	6,065,385

A fire event that occurred in Turkey is also significant, with the third-highest level of recorded damage. Yemen was also significantly affected by an earthquake in 1982. As such, we can see that the pattern in this region is dominated by earthquakes.

In further detail, the top five disaster events by death toll for individual countries in Western Asia were compared in Table 2. The results showed that the area is affected not only by earthquakes, but also by many other types of disasters, and not just natural ones.

Table 2. Top 5 disaster events by death toll for individual countries in Western Asia (EM-DAT).

Country	Top 1	Top 2	Top 3	Top 4	Top 5
Armenia	Earthquake	Transport accident	Industrial accident	Flood	Famine
Azerbaijan	Transport accident	Earthquake	Industrial accident	Fire	Flood
Bahrain	Transport accident	Epidemic	Industrial accident	Fire	
Cyprus	Heatwave	Transport accident	Earthquake	Industrial accident	Wildfire
Gaza Strip/Westbank (Palestine)	Fire	Collapse	Riverine flood	Storm	Cold wave
Georgia	Transport accident	Flash flood	Fire	Earthquake	Drought
Iran	Earthquake	Flood	Fire	Transport accident	Epidemic
Iraq	Technological accident	Industrial accident	Transport accident	Fire	Flash flood
Israel	Transport accident	Stampede	Wildfire	Landslide	Earthquake
Jordan	Earthquake	Flash flood	Transport accident	Flood	Cold wave
Kuwait	Fire	Transport accident	Flood	Epidemic	
Lebanon	Flood	Industrial accident	Earthquake	Transport accident	Fire
Oman	Tropical cyclone	Transport accident	Flood	Storm	
Qatar	Transport accident	Fire	Industrial accident	Flash flood	
Saudi Arabia	Stampede	Fire	Transport accident	River flood	Construction collapse
Syria	Transport accident	Epidemic	Landslide	Ammunition explosion	Storm
Turkey	Earthquake	Fire	Epidemic	Industrial accident	Avalanche
United Arab Emirates	Transport accident	Fire	Collapse	Flood	
Yemen	Earthquake	Epidemic	Riverine and flash flood	Transport accident	Industrial accident

The results showed that the top disaster type and highest death tolls are associated with the settings, with transport accidents and floods occurring more often than earthquakes (Table 3). Fires and industrial accidents also featured in the top five in all countries in Western Asia. Further, certain countries, such as Turkey, Yemen, and Armenia, are hit the hardest by earthquakes, but are also affected by many other types of man-made and natural hazards.

Table 3. Top 5 disaster types in Western Asian countries, from the EM-DAT.

Disaster Type	*n*
Transport accident	16
Flood (flash and riverine flood)	15
Fire	12
Earthquake	10
Industrial accident	9

These results were then compared with those from a different data source, analyzing the top disasters via a review of the literature in the Web of Science database and the clusters of highest key term occurrence (Table 4). Interestingly, this yielded a different

ranking than that provided by the EM-DAT data above. Earthquakes are covered by far the most often in scientific studies focusing on these countries, followed by climate change and COVID-19. Other disasters follow in frequency, such as terrorism, war, tsunamis, floods, and hurricanes. Interestingly, only very few states in the region are exposed to hurricanes, such as Yemen and Oman. However, this topic is still quite prominent in scientific studies.

Table 4. Top disasters in the Web of Science, as processed via VOS viewer clusters.

Disaster Type	*n*
Earthquake	175
Climate change	23
COVID-19	20
Terrorism	12
War	11
Hurricane	8
Tsunami	10
Flood	10
Outbreak	5

3.2. Disaster as a Research Topic in Western Asia

In the following, I used visualizations yielded by the VOS viewer and analyzed the clusters to identify groups of keywords that represent interrelated fields of interest in the contemporary research. A relatively high number of studies in Western Asia focus on disasters. The threshold was set at a high level to provide better visibility, with less than 50 of the most commonly mentioned keywords visible. The results (Figure 1; see also Appendix A, Figure A1) yielded four clusters that are shown in four colors. The keywords mentioned most often are represented in the largest boxes. "Management" manifests one of the biggest boxes—this term is related to many other key terms and is therefore also at the center of the visualization. Management aspects are also significantly related to preparedness, as well as to education, emergency, medicine, nurses, knowledge, and perceptions. Management processes are related to precautionary, educational, and medical aspects. "Earthquake" represents another cluster that seems to cover many areas, impacting health via inducing posttraumatic stress disorder and trauma, with a special effect on children. The third cluster centers around issues of modeling and optimization, with reference to humanitarian logistics, frameworks, and networks. The final cluster consolidates conceptual components such as resilience, vulnerability, risk, and natural disasters. Interestingly, while "natural disaster" is a contested term [44,45], it appears quite prominently in at least two of the clusters. I then analyzed the results for the four selected countries with the highest numbers of associated publications, which were consistently found in the dataset used for the literature analysis: Iran, Israel, Saudi Arabia, and Turkey.

I searched for "disaster", "literature review", and "Asia" to enable comparisons and further interpretation. The Web of Science search returned 18 hits, none of which concerned Western Asia or its constituent countries. Since the Asian continent is too big and diverse, and the geographic conditions between South Asia and Pacific Asia differ, direct comparisons were not possible. The findings related to these keywords, as for the other keywords below, confirmed that studies with similar approaches and focusing on the context of Western Asia are lacking, thus limiting further scientific comparisons.

Visualizing the clusters massively facilitates intuitive interpretation. However, due to the occurrence of overlay and the preferences set by the author, only some of the key terms could be easily accessed and analyzed in this way. Therefore, I present the clusters of most of the research results yielded by the list of items provided in the VOS viewer. In this representation, the main key terms and the allocations of items to clusters were clearer.

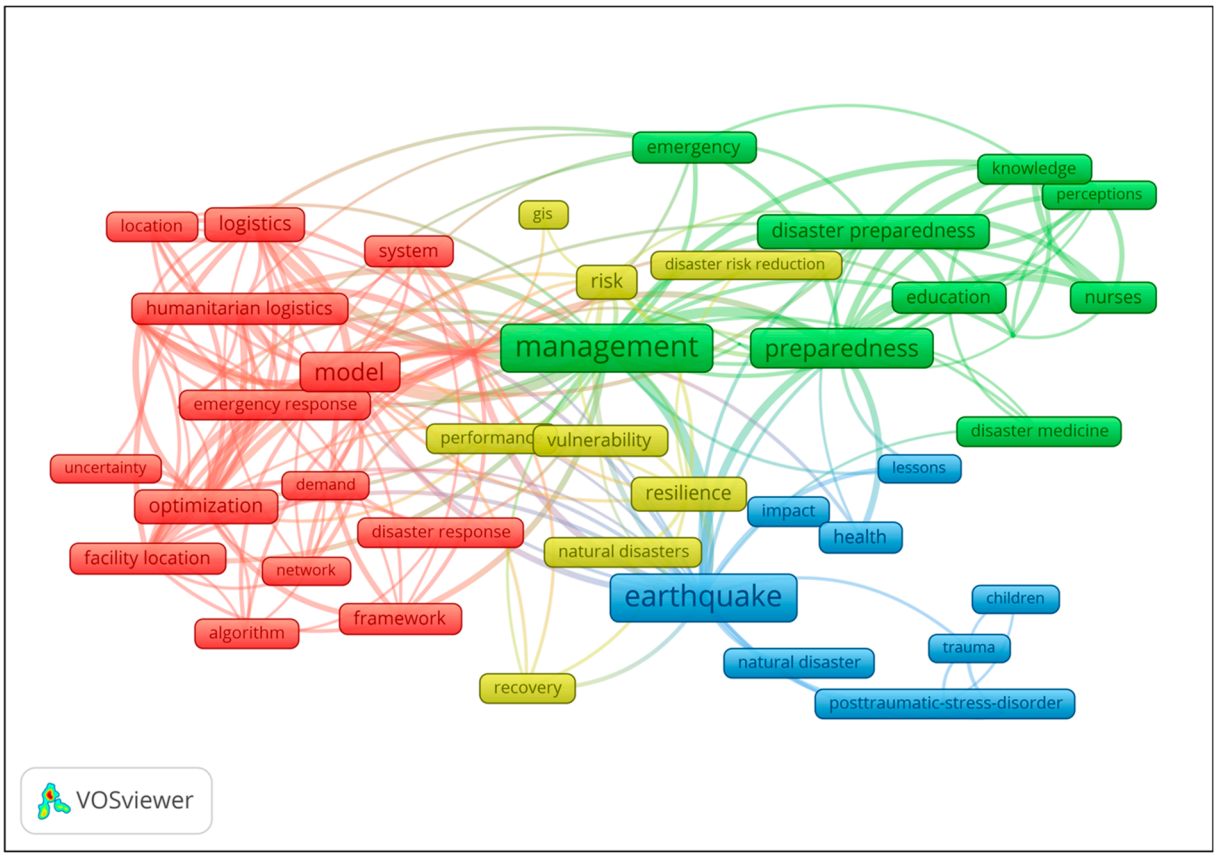

Figure 1. Results of the analysis of VOS viewer clusters (four clusters in four different colors) with the search term "disaster", n = 3363, and a subsample of occurrences for clearer visualization, n = 45.

I also analyzed the keyword "disaster", as it is covered in studies listed in the Web of Science. The top disaster types mentioned in the studies greatly vary, and long lists were yielded when selecting only the top 10 for the top 5 countries in terms of total population in the area (Figure 2). In Iran, earthquakes and climate change were the predominant hazards. The other key terms yielded when searching "disaster" as the top term included "management", "geographic information", "systems", "vulnerability", and others. In Israel, posttraumatic stress, terrorism, and war dominated, and earthquakes were also mentioned, but less frequently. Saudi Arabia is a more diverse field in this respect, with many aspects related to management knowledge, mainly of health topics and emergencies. In Turkey, "earthquake" predominated, along with posttraumatic stress in survivors. The last column shows the top terms when searching for disasters in all countries in Western Asia for the sake of comparison. As previously mentioned in Figure 1, the terms "management" and "earthquake" dominated, while other aspects were more diverse and variously visible, in the four selected countries.

For the sake of a clearer representation, all the search terms and country refinements are maintained in the figure below.

The possible further interpretation of this list of the top 10 key terms (Figure 2) is very limited. Therefore, I also analyzed the top 50 key terms per country in our search for the most commonly searched term, "disaster". For Iran, three clusters emerged (Appendix A, Figure A2). The first cluster, with 19 items, centers on the historic earthquake that occurred in the city of Bam, and earthquakes in general. It is interesting that other hazard types, such as COVID-19 and floods, also appeared, as well as the city of Tehran, the nation's capital. Much of the research centers on disaster management, in which these three hazards always play a major role. The second cluster concerns climate change and droughts, and their health impacts. Resilience and vulnerability were very visible here and were more

significant than in the other clusters. The third cluster does not focus on a specific hazard but concerns quantitative methods of spatial analysis using GIS and remote sensing.

iran	disaster	saudi arabia	turkey	disaster
earthquake	posttraumatic-stress	preparedness	earthquake	management
disaster	israel	management	disaster	earthquake
management	symptoms	knowledge	ptsd	preparedness
disasters	terrorism	disaster	posttraumatic-stress	disaster management
gis	stress	nurses	depression	model
vulnerability	resilience	core competences	management	optimization
model	trauma	disaster preparedness	survivors	disasters
preparedness	war	education	prevalence	humanitarian logistics
resilience	exposure	risk	natural disaster	logistics
climate-change	impact	perceptions	disasters	disaster preparedness
natural disasters	earthquake	emergency	gis	facility location
framework	ptsd	challenges	symptoms	education
risk				

Figure 2. Top disasters via keyword occurrences in Iran, Israel, Saud Arabia, Turkey, and all.

Applying this same assessment to Israel also resulted in three clusters (Appendix A, Figure A3). The first cluster centers around posttraumatic stress and anxiety, terrorism, and war, with only children arising as the group specifically affected. The second cluster centers on earthquake-related injuries and medical issues, which also relate to experiences with the Haitian context. The third cluster concerns COVID-19 and the health aspects of community resilience.

Analyzing Saudi Arabia with the same approach revealed four clusters (Appendix A, Figure A4). The first cluster concerns COVID-19 and the emergency preparedness of hospitals, physicians, and nurses, as well as their skills and knowledge, and management. The second cluster concerns floods, flash floods, and their impacts. It also refers to models that use GIS and remote sensing to infer about risk, resilience, and vulnerability. The third cluster concerns disaster medicine, core competencies, challenges, and frameworks. The fourth considers mass gatherings, health-affecting outbreaks, and climate change.

Analyzing Turkey using "disaster" as a keyword also resulted in four clusters (Appendix A, Figure A5). The first cluster centers on earthquakes, followed by floods, disaster management, and preparedness topics. Resilience, risk, and vulnerability are included as the health aspects. The second cluster concerns posttraumatic stress, trauma, and depression amongst adults, children, and survivors. The third cluster focuses on models developed using GIS and logistic regression for landslide hazards and natural disasters. The fourth cluster concerns victims and injuries related to earthquakes, related care, and management, and one specific event—the Marmara earthquake.

In summarizing the results, I see that earthquake is a predominant hazard in some countries in the region, as is posttraumatic stress resulting from conflicts and earthquakes. Floods often occur, and health aspects, general preparedness, and management are often mentioned. The conceptual components of vulnerability and resilience are discussed in the context of most countries. The specific methodologies of GIS and remote sensing also often appear in a cluster.

3.3. Climate Change as a Research Topic in Western Asia

Many studies in Western Asia feature "climate change" as a top keyword. Our visualization of the top 50 keywords gave rise to 4 clusters (Figure 3). One cluster centers on adaptation and is mainly related to impact and vulnerability. It covers many fields, including agriculture, food security, health and policies, strategies, perceptions, and knowledge. It is also related to water, which connects it to other clusters. The second cluster is centered on the impacts of management and biodiversity conservation. The models used also linked this cluster to other clusters. One cluster concerns the models used to describe

the reliability and uncertainty of the impacts on water resources such as rivers, basins, and related runoffs, via simulations and projections. The final cluster concerns temperature and refers to precipitation and droughts that affect yields and growth. More details of the four clusters are provided in the Appendix A, Figure A6.

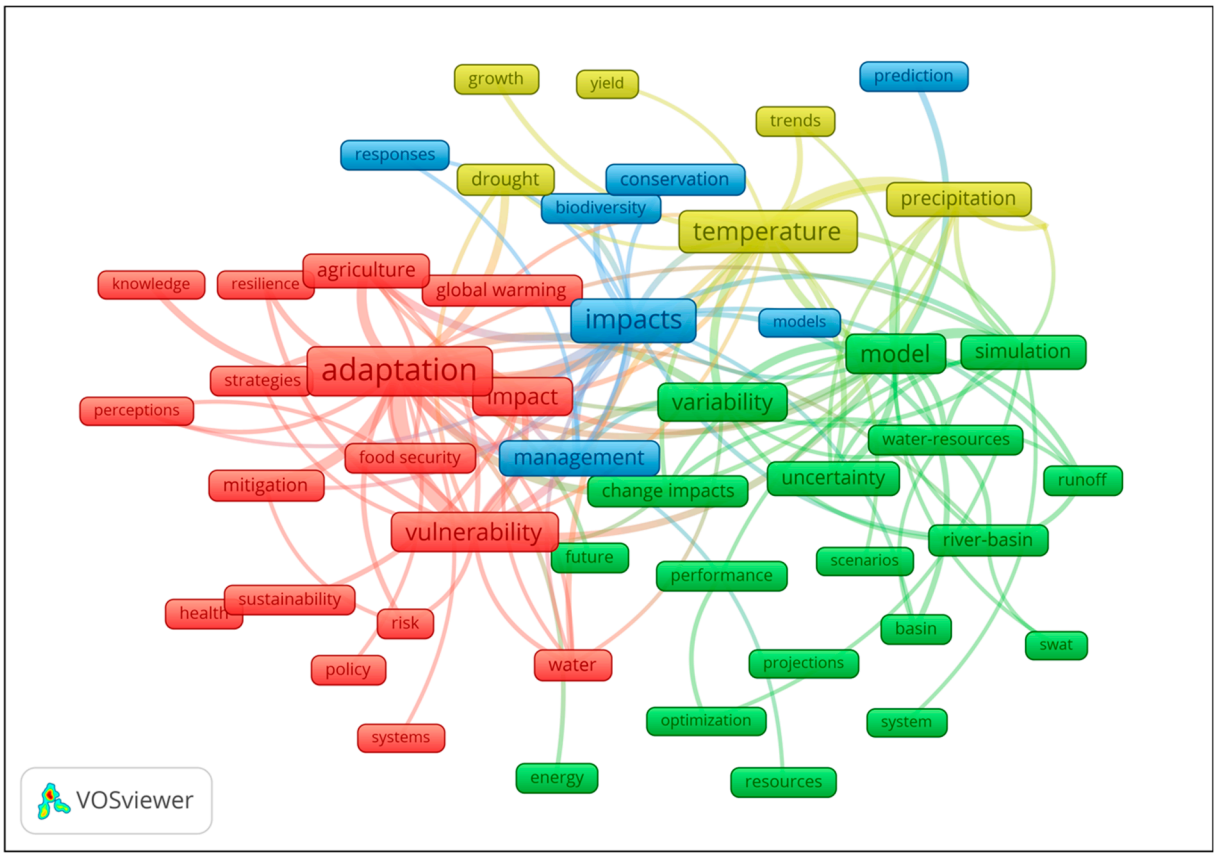

Figure 3. Results of the cluster analysis of the VOS viewer results for the search term "climate change" for Western Asia, n = 11,178, and cluster selection subsample, n = 50.

I searched for "climate change", "literature review", and "Asia" to enable comparisons and further interpretations. I assessed all 67 hits and found that few results addressed the Western Asian context, while there was a dominant focus on South and Pacific Asia. There are also many studies on Asia as a whole, but it is difficult to compare these with the Western Asian context, since Asia includes many other large countries and areas. Only three studies were identified that address the specific Western Asian context. One was unsuitable, since it focused on education and not on the topics address in this study, while another was too specialized, focusing on a specific crop species. Some literature reviews focus on specific contexts, such as water-borne diseases that are related to climate change, and increases in floods and droughts [46]. However, it is difficult to compare these findings with the results derived from the samples addressing all climate change topics in Western Asia. In the literature review, I found that water-borne diseases are analyzed in 27 articles, which explains why this topic does not feature in the clusters of Figure 3, based on a total sample of 1000 articles (see the Methods Section).

Analyzing "climate change" as the top keyword in the Iranian context revealed four clusters (Appendix A, Figure A7). The first cluster centers on droughts and global warming and is related to models of prediction and response. It relates to agriculture, impacts, risks, and vulnerability. The second cluster concerns scenarios, models, and temperature, and how they relate to water, irrigation, and yield. The third cluster centers on rainfall, rivers, basins and stream flows, precipitation, and evapotranspiration. The final cluster con-

cerns resources and water, resources and rivers, and basin management and optimization. Overall, in the context of climate change, Iran is mostly concerned with water, drought, and agriculture.

The analysis of climate change in Israel also revealed four clusters (Appendix A, Figure A8). The first cluster centers on precipitation and rainfall around the Mediterranean and Red Sea, and how these relate to temperature, trends, and variety, as well as biodiversity and conservation. The second cluster centers on water, desalinization, and irrigation. It shows a relation to the Middle East and conflicts. The third cluster centers on the eastern Mediterranean, the Negev desert, and paleo climates, with relations to the desert and the sea. Cluster number four centers on droughts, vegetation, and the adaptations of plants.

Studies on climate change in Saudi Arabia also fell into four clusters (Appendix A, Figure A9). The first cluster centers on CO_2 emissions, renewable energy, and sustainability. This cluster is related to energy policy and consumption, and water. The second cluster concerns drought and global warming, with relations to patterns in the Middle East, the Red Sea, and China. The third cluster centers on the challenges of management and models yielded using GIS and remote sensing, with a relation to dust. The last cluster centers on the Arabian Peninsula, rainfall, precipitation, and temperature, trends, variability, and indices.

Analyses of Turkey also resulted in four clusters (Appendix A, Figure A10). The first cluster concerns CO_2 emissions, global warming, and renewable energy. It shows a relation to sustainability and sustainable development, and to urbanization. The second cluster is around rivers and river basins with relation to precipitation, rainfall change impacts, basins, and the variability trends of water resources. The third cluster also centers on water in relation to agriculture, droughts, and regional management using simulations. The last cluster centers on models of the climate established for the conservation of vegetation.

In summarizing the results for the four countries, the most common clusters were around rainfall, variability, and water resources. Another topic of interest was energy and sustainability, while other topics included droughts, desert areas, agriculture, and education.

3.4. Urbanization Risk as a Research Topic in Western Asia

Searching for urbanization risk as a research topic in Western Asia revealed fewer academic studies than searches for climate change or disasters (547) (Figure 4). Again, four clusters emerged. One centers on the prevalence of risk factors related to the urban issues of health, population, obesity, disease, and other forms of public health. Here, "environment" is a key term that relates to both other clusters and the term "urban". Another cluster centers on climate change, focusing on its impacts, CO_2 emissions, and system variability when using methods such as GIS. The third cluster concerns pollution and contamination related to heavy metals in cities, and the effects on water, soil, and sediments. The last cluster concerns four terms related to children and mortality in the context of exposure to air pollution in an urban context (Appendix A, Figure A11).

I searched for "urbani* risk", "literature review", and "Asia", but found no studies in the Web of Science database that would provide validation. I therefore checked the selected studies in the dataset analyzed, which confirmed that the topics featured in the above clusters recur in studies on Western Asia.

The analysis of "urbanization risk" as a top keyword in Iran resulted in five clusters (Appendix A, Figure A12). The first cluster centers on contamination and pollution, and makes reference to rivers, water, and sediment. The second cluster centers on epidemiology, obesity, and other health aspects in the population, as well as their prevalence in urban contexts. The third cluster concerns climate change, its impacts, management approaches, and models. It also mentions the city of Tehran. Cluster four concerns diseases, mortality and prevention, and risk factors. Cluster five contains only two items—diseases and risk factors.

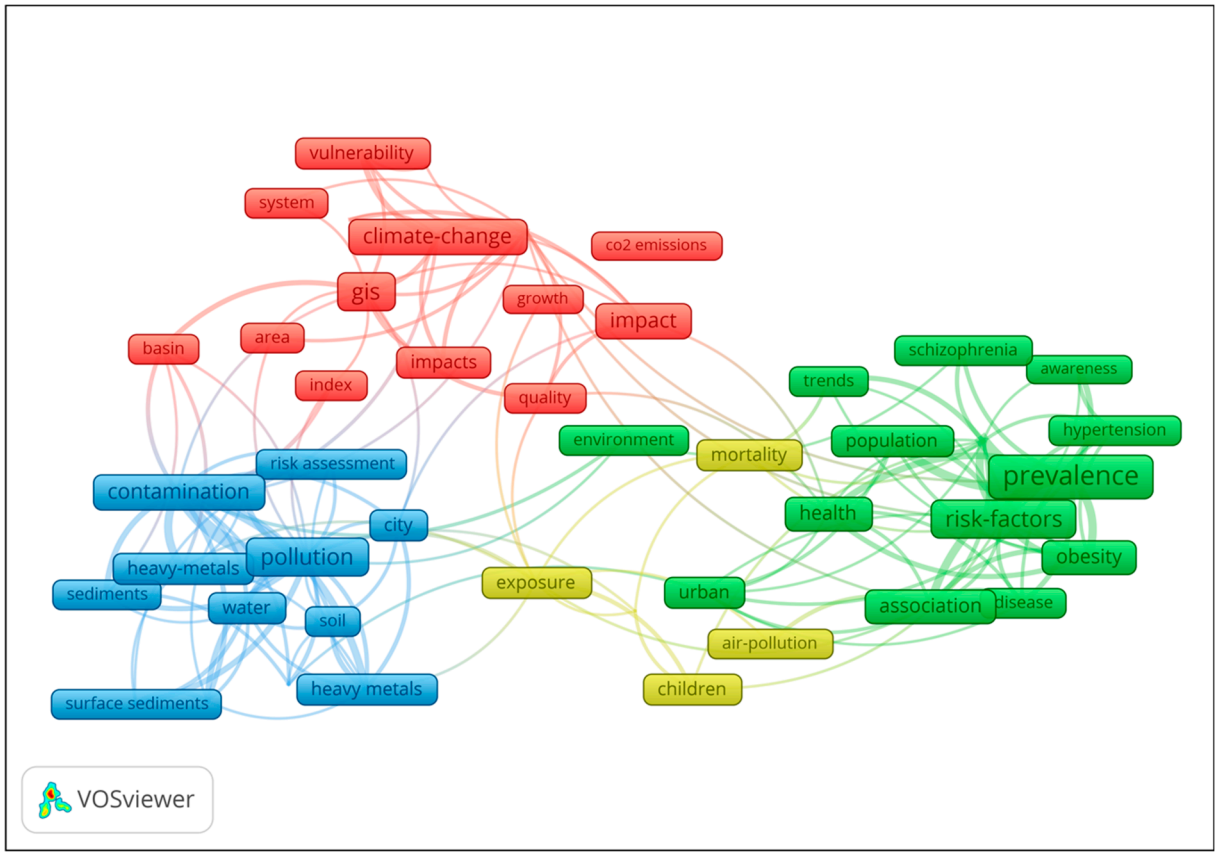

Figure 4. Results of the VOS viewer's cluster analysis of the search term "urbanization risk" in the form of keyword occurrences for Western Asia, $n = 547$, and cluster selection subsample, $n = 47$.

Analyzing "urbanization risk" as a top keyword in relation to studies in Saudi Arabia yielded four clusters (Appendix A, Figure A13). The first cluster concerns climate change and management related to rivers, basins, and runoff, as well as simulation using GIS and remote sensing. The second cluster centers on pollution, the contamination of rivers, and sediments in cities. The third cluster concerns epidemiology and diseases damaging to public health in the Middle East, as well as their prevalence and risk factors. The final cluster centers on epidemics, infections, and transmissions.

Assessing urbanization risk in studies on Turkey resulted in three clusters (Appendix A, Figure A14). The first cluster considers a variety of natural hazards and disasters, such as earthquakes, floods, and landslides. It has relations to Istanbul, as well as methodologies such as GIS and remote sensing. The second cluster is around heavy metals and pollution in cities, which shows relations to accumulation, sediments, and soil. The third cluster concerns epidemiology, urban health risks, community, and gender.

Comparing the four countries in terms of urbanization risk yielded a much more diverse picture than comparisons via climate change or disasters. There were some common themes in the clusters, such as contamination, pollution, and public health risks. Climate change-related natural hazards were present in a more heterogeneous manner.

3.5. Representation of Countries in Western Asia in Research

Analyzing which countries are highly active in, or visible with, their research on the topics of climate change, disaster, and urbanization risks in Western Asia yielded interesting results. We found correlations between the largest countries in terms of population size and the highest numbers of scientific studies per search term (Table 5). Iran, Israel, Saudi Arabia, and Turkey showed the highest numbers of studies related to the fields associated with the specific search terms. These numbers must be treated cautiously, and a deeper

assessment of the numbers of studies per total population would be fruitful. Still, as a global comparative study, it is important to note that certain smaller countries are less represented in the research than larger countries in a given region. However, certain countries on the list with large total populations, such as Oman and Yemen, are still underrepresented. Therefore, it is also likely that language barriers, cultural traditions, and academic practices play a role. Table 5 compares the data of countries in Western Asia with data from five other typical countries with very high publication rates. The United States of America and China predominate as regards almost all search terms. Germany was selected for comparison due to the origin of the author, and because it also shows relatively high numbers. In comparison, the topics of climate change, disasters, and urban risk are covered much less widely in Western Asia than in the USA and China, which may indicate another bias due to language and disciplinary context, as well as scientific and political ambition. In addition, the research and development budgets were checked against the OECD data (stats.oecd.org; accessed 18 May 2023). In the last ten years, the highest research funds were allocated in the USA, China, Japan, Germany, and the Republic of Korea. In Western Asia, Turkey ranks within the top 10, and Israel within the top 20. For comparison, other years were checked, using World Bank data (data.worldbank.org, accessed on 18 May 2023) as an alternative. We thus found that the ranks changed over the years, and the 20 countries in Western Asia varied very widely in terms of their rankings. This makes a quick assessment and comparison based on budget very difficult and prone to error. I have, therefore, selected neighboring countries in Northeast Africa and Southern Europe for further comparisons of research output, as shown in Table 5. I selected Spain, with a similar budget to that of Turkey, and Egypt, similar to Tunisia and the United Arab Emirates.

Table 5. Comparison of search term hits per country in Western Asia.

Countries in Middle East	"Natural Hazard"	"Multi-Hazard Risk"	Multi-Risk	"Multiple Risk"	"Climate Risk"	"Climate Change"	"Urbani * Risk"	"Disaster"
Armenia	1					42	2	22
Azerbaijan	1					38	1	7
Bahrain	1			3	1	52	2	9
Cyprus	2	1		6		412	9	39
Gaza Strip/Westbank (Palestine)	1	2				60	6	15
Georgia	2		1	2		118	1	11
Iran	73	25	1	33	8	2950	128	975
Iraq	4			1		251	15	56
Israel	14	6	1	74	1	1788	51	576
Jordan	1			5	4	224	7	56
Kuwait	3			6	1	126	10	19
Lebanon	2	1		9	1	221	24	91
Oman	5	1		3	3	215	13	43
Qatar	2			6	2	290	20	69
Saudi Arabia	27	3	2	35	2	1794	103	420
Syria	0					74	1	7
Turkey	46	10	2	60		2691	161	964
United Arab Emirates	6	1		8	4	665	34	111

Table 5. *Cont.*

Countries in Middle East	"Natural Hazard"	"Multi-Hazard Risk"	Multi-Risk	"Multiple Risk"	"Climate Risk"	"Climate Change"	"Urbani * Risk"	"Disaster"
Yemen	0			1		35	2	23
USA	589	136	38	2714	434	93,271		23,787
China	270	101	41	451	125	45,823		15,896
Germany	197	41	20	226	117	27,131		2707
Spain *	85	9	18	104	50	15,474	285	1240
Egypt *	26	0	0	25	4	1346	83	282

* Additional search on 18 May 2023.

3.6. Disaster Risk, Urban Hazards, and Community Resilience in Western Asia

In the following analysis, certain key search terms were selected that are of relevance to the context of this paper. However, the sample size yielded by these search terms was insufficient to permit individual assessments of individual countries. Therefore, they were analyzed together for all the countries in Western Asia. Out of the relevant search terms regarding hazards related to disaster, risk, and climate change, as well as impacts on urbanization and urbanized areas, three search terms yielded sufficient sample sizes across at least 100 studies.

The first search term, "disaster risk", was referred to in many studies in Western Asia (233). The most prevalent terms related to disaster risk were vulnerability, disaster risk reduction, and resilience. The hazards explicitly mentioned in the top 10 studies were earthquakes and climate change. That said, frameworks, management, and models also featured as topics that are highly related to disaster risk in the research (Figure 5).

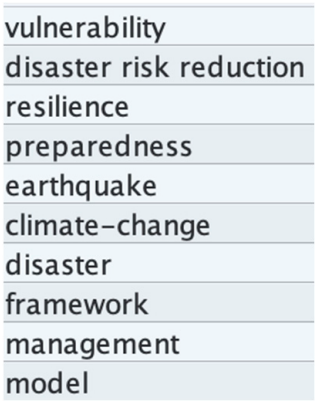

Figure 5. Top 10 with the search term "disaster risk", *n* = 233.

By applying cluster analysis under the VOS viewer, I could reveal five clusters within the sample (Figure 6). The first cluster, focusing on disaster risk in Western Asia, refers to earthquake and health aspects relevant to communities and cities. The aspects of education, performance, and preparedness relate to resilience and risk management. In the second cluster, GIS and remote sensing are listed as tools for management, policymaking, disaster management, disaster risk management, and disaster risk reduction. These are also featured under the Sendai framework. The third cluster concerns urban resilience and climate change in cities, as well as their modes of adaptation, mitigation, vulnerability, and community resilience. Cluster four concerns COVID-19, flood risks, seismic risks related to natural hazards, and knowledge. The last cluster is more general, centering on risk perception, natural disasters, areas, and hazards.

Cluster 1 (15 items)	Cluster 2 (13 items)	Cluster 3 (9 items)	Cluster 4 (6 items)
challenges	ahp	adaptation	covid-19
city	disaster management	cities	flood risk
community	disaster risk managen	climate-change	impact
disaster	disaster risk reductior	community resilience	knowledge
disasters	gis	framework	natural hazards
earthquake	hazards	mitigation	seismic risk
education	information	recovery	Cluster 5 (4 items)
emergency	management	urban resilience	area
health	policy	vulnerability	hazard
model	remote sensing		natural disasters
performance	risk		risk perception
preparedness	sendai framework		
resilience	systems		
risk management			
risk reduction			

Figure 6. "Disaster risk" keyword occurrences for Western Asia, n = 233, and cluster selection subsample, n = 47.

The keyword "urbanization" was found in 150 studies in Western Asia (Figure 7). The first cluster centers on earthquakes and landslides, with relations to growth and the region, and it mentions the city of Istanbul. The second cluster concerns the contamination of groundwater and has relations to heavy metals and pollution in cities. It is also related to children, as a specific population group. The third cluster is centered on hydrology, rainfall, and runoff modeling using GIS and remote sensing. The fourth cluster concerns climate change and different models of machine learning and classification. It also has relations to susceptibility, vulnerability, and adaptation.

Cluster 1 (12 items)	Cluster 2 (11 items)	Cluster 3 (11 items)	Cluster 4 (10 items)
areas	accumulation	area	adaptation
earthquake	basin	gis	classification
framework	children	hydrology	climate change
growth	city	impacts	climate-change
hazards	contamination	model	machine learning
impact	exposure	rainfall	management
istanbul	groundwater	remote sensing	models
land-use	health	risk	random forest
landslide	heavy metals	runoff	susceptibility
precipitation	heavy-metals	simulation	vulnerability
region	pollution	system	
sustainability			

Figure 7. Occurrences of "urbanization hazard" keywords in Western Asia, n = 150, and cluster selection subsample, n = 44.

Community resilience was a top keyword in Western Asian studies and was addressed in 138 studies (Figure 8). The first cluster centers on earthquakes, cities, and climate change. It has relations to social vulnerability, sustainability, and urban resilience, but it also mentions disaster, resilience, and vulnerability in general. It also has relations to the management and models of cities. The second cluster is centered on posttraumatic stress, war, and trauma, and explicitly mentions the gulf war. Social support, sense of

danger, community, and coherence are also mentioned, as are symptoms and stress. The specific population groups here are children, the community, and families. The third cluster centers around COVID-19 and terrorism and shows relations to health impacts and social resilience.

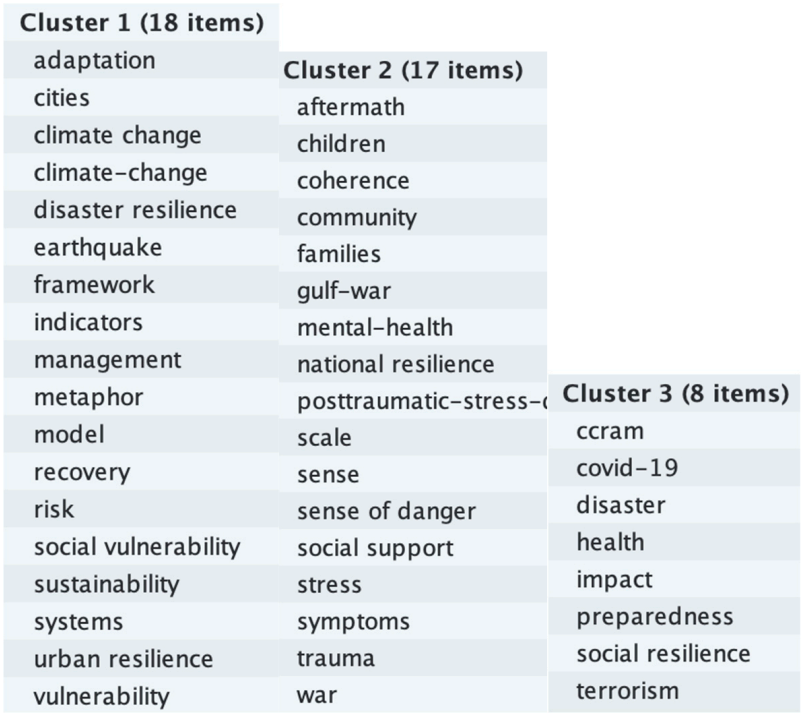

Figure 8. Occurrences of "community resilience" keywords in Western Asia, n = 138, and cluster selection subsample, n = 43.

All three search terms analyzed in this section showed a certain degree of heterogeneity and similarity in their clusters. Again, the most common themes centered on certain hazard contexts, especially earthquake, climate change, war, and trauma. Another cluster type related to the methodologies of GIS and remote sensing. The different population groups' keywords were fairly scattered and underrepresented in comparison to keywords related to models and methods, hazards, and conceptual components, such as vulnerability and resilience.

4. Conclusions

Climate change is increasingly causing disasters around the globe. This study selected Western Asia as a region, as it displays a heterogeneous distribution of natural and man-made disasters, as well as an array of geographical and social–economic conditions. The area was analyzed with consideration of how the numbers and types of disasters already recorded can be used to measure climate change's impacts. In addition, urbanization was considered since regions with high densities of humans are more exposed to climate change and its related disasters. Urbanization exacerbates both spatial and temporal exposure, as well as differences in the degree of vulnerability and socioeconomic conditions.

The analysis of disasters reported in the EM-DAT database revealed that disaster types significantly vary between neighboring countries, due to different degrees of exposure to coastal, seismic, and meteorological hazards. The analysis of the literature revealed different clusters in each of the countries of Western Asia, with differences in terms of the specific risks discussed herein. For example, the specific hazards are often associated with specific concepts and quantitative methods. Posttraumatic stress and the psychological consequences of a disaster are related to other hazards and academic concepts. Governance

and management is also an important and recurring topic in the clusters. Food security and agriculture are also typical topics and keywords in different countries' contexts.

Four countries were analyzed more thoroughly, Iran, Israel, Saudi Arabia, and Turkey, since they had the highest numbers of associated publications. The clusters related to the search terms revealed differences between these four countries, as well as general similarities in terms of research directions and the combinations of hazards with certain methodologies and scientific concepts. The findings can help us to understand how climate change research is heterogeneously distributed amongst neighboring countries in a region, as well as to identify countries with a sufficient research output for more detailed analysis using bibliometric approaches. The results also revealed, on the other hand, how other countries in Western Asia are lacking research. The limitations encountered here include using just one academic search engine, and the predominance of English literature. This study can also help us to identify clusters of academic topics of interest for each country and compare these with the disaster occurrence data measured elsewhere. This also suggests that certain hazards and disaster types do not receive the same attention in the academic research of a country as in that of others, indicating further research is needed.

When using one disaster database and comparing its contents with a literature analysis, it is important to represent the full picture of disasters, types, and impacts in an area or country. However, this approach cannot reveal the full picture of academic research and awareness. Many studies may be excluded due to the different languages being used, and the cluster analysis approach only identifies keywords that are highly used in the sample analyzed. Therefore, this depends on the writing style and academic standards in certain fields, with different emphases on the use of keywords. Caution must also be taken in relation to the regional boundary used. "Western Asia" is a term used for statistical division by the United Nations, and in this region in particular, boundaries and delineations of countries are highly political and problematic. The "Middle East" is just one of the alternative terms that are used more often, but discussions using this term are also problematic. However, using the regional list of countries provided by the United Nations has the advantage of enabling comparisons with other regions around the world. In another study, I analyzed 20 countries in East Africa, and found that the characteristics of the countries varied due to the size of a country and its climatic conditions.

As regards the future, studies of this kind are currently popular and may be useful for developing a better overview when comparing countries. In contemporary climate negotiations and strategy documents, certain countries are cited more often than others. This study can also offer a starting point in considering which countries have been underrepresented so far. This may be because they have been less affected by climate change so far, but greater consideration of the resources within and around a country may also be necessary. In concession, climate change can currently be measured via disasters' impacts, and these patterns vary between countries' contexts, even in localized areas. An alternative to measuring disaster impacts using damage and loss databases was presented and analyzed here, using academic outputs in relation to a standardized literature review.

Interestingly, this resulted in different patterns of disaster types that are more prevalent in some countries and the academic literature, when compared to disasters measured by impacts in terms of deaths and people affected. This may also inform ongoing research and policy discussions considering loss and damage [47]. Going further and analyzing climate change, disasters, and risk in urban contexts revealed slightly different prioritizations of topics in the academic research. Public health and daily living conditions often represent a major cluster, but specific disaster types, such as earthquakes or floods, are also highly represented. Epidemics, vector-borne diseases, and pollution also constitute clusters in certain countries. The variety of the clusters and patterns shows that human vulnerability is not only impacted by climatic conditions, but also by the interplay of social and economic conditions, management structures, and awareness of daily risks and extreme events. It is important to more effectively integrate the fields of daily risk, public health, and urbanization with considerations of climate change and related disasters in order to better

understand and mediate their relations. However, integration is one of many solutions, and creates new problems that might even hinder transformation [48]. It is therefore important to follow both paths, analyzing integration as well as countries' specific contexts.

Funding: This research received no external funding.

Data Availability Statement: The search term query and results tables are available upon request.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A

Cluster 1 (17 items)	Cluster 2 (11 items)	Cluster 3 (9 items)	Cluster 4 (8 items)
algorithm	challenges		
demand	disaster medicine	children	disaster risk reduction
disaster management	disaster preparedness	earthquake	gis
disaster response	education	health	natural disasters
emergency response	emergency	impact	performance
evacuation	emergency preparedne	lessons	recovery
facility location	knowledge	natural disaster	resilience
framework	management	posttraumatic-stress	risk
humanitarian logistics	nurses	ptsd	vulnerability
location	perceptions	trauma	
logistics	preparedness		
model			
network			
optimization			
or/ms research			
system			
uncertainty			

Figure A1. Disaster, n = 3363, and a subsample of occurrences for better presentation, n = 45.

Cluster 1 (19 items)	Cluster 2 (11 items)	Cluster 3 (9 items)
bam	climate change	
challenges	climate-change	classification
covid-19	drought	frequency ratio
design	health	gis
disaster management	impact	hazard
earthquake	natural disasters	index
earthquakes	recovery	logistic-regression
flood	resilience	prediction
framework	risk	remote sensing
lessons	systems	spatial prediction
management	vulnerability	
model		
natural disaster		
optimization		
performance		
preparedness		
system		
tehran		
uncertainty		

Figure A2. Disaster Iran, n = 742, and cluster subsample, n = 39.

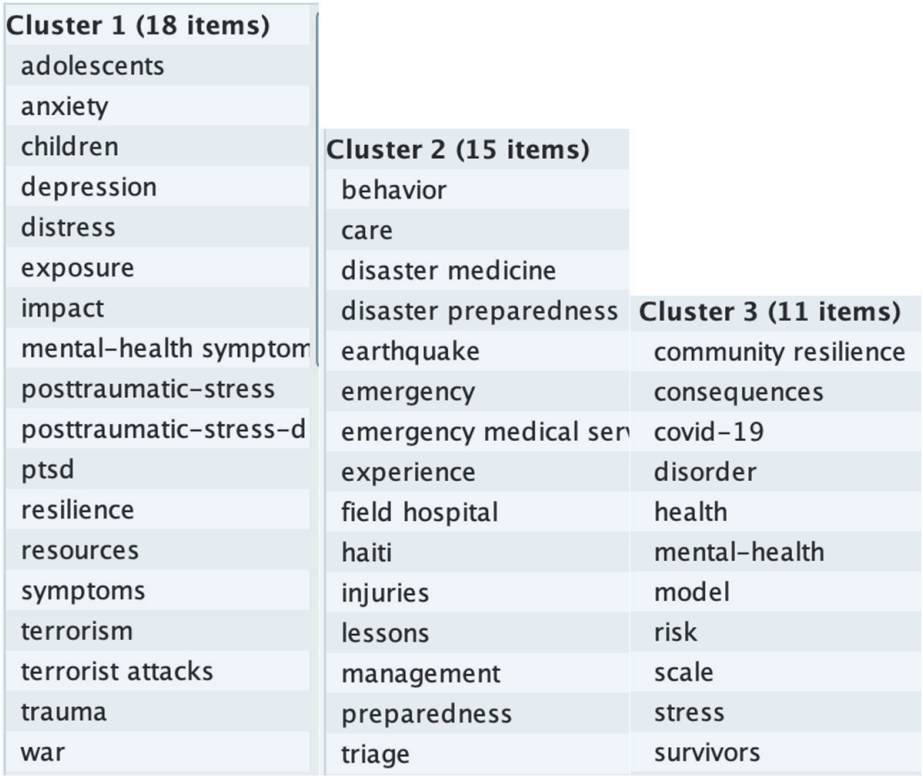

Figure A3. Disaster keyword occurrences for Israel, n = 277, and cluster selection subsample, n = 44.

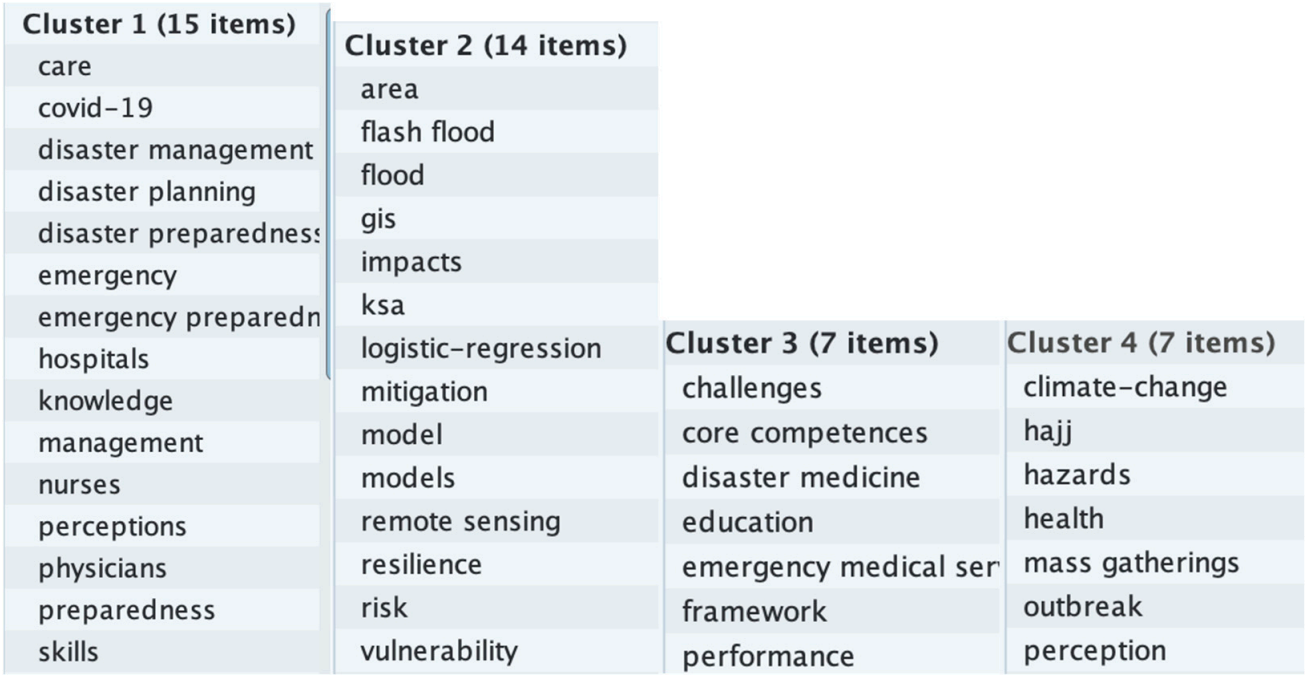

Figure A4. Disaster keyword occurrences for Saudi Arabia, n = 128, and cluster selection subsample, n = 43.

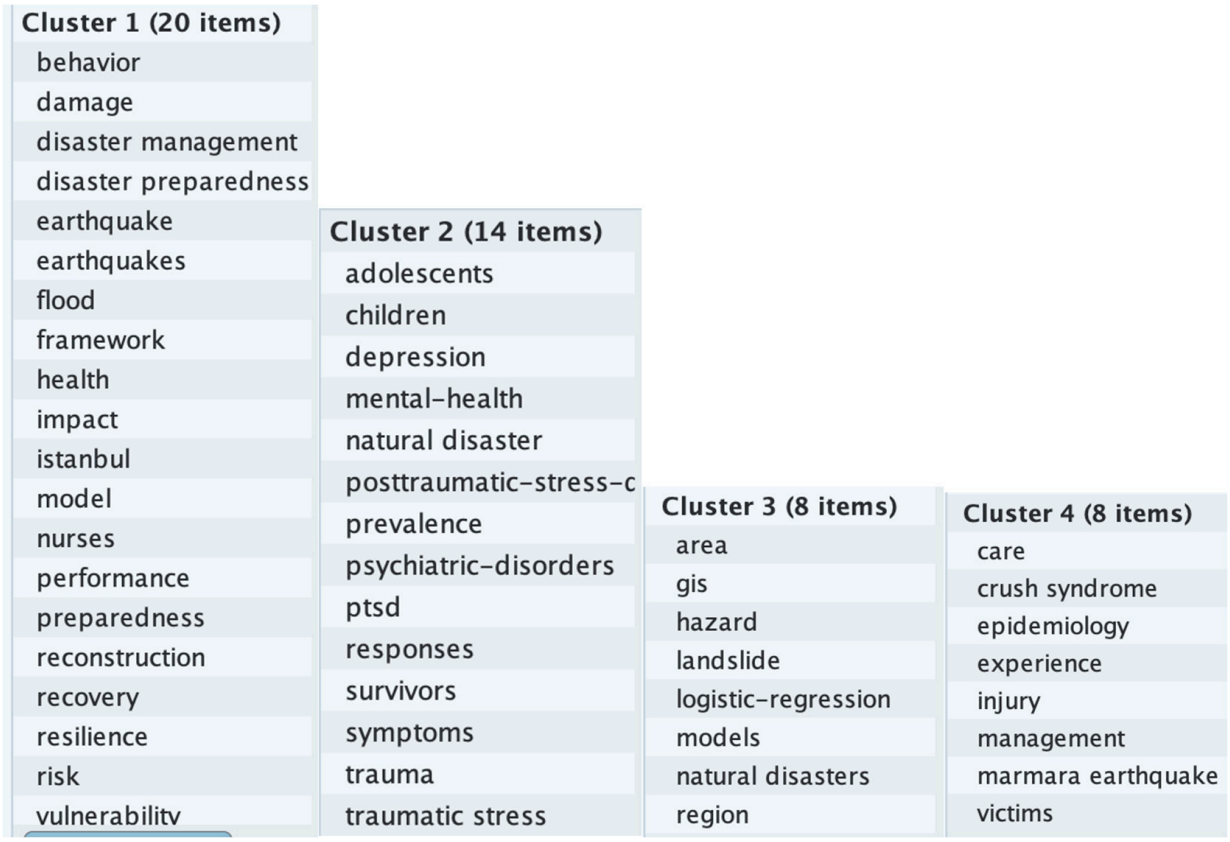

Figure A5. Disaster Turkey, n = 787, and subsample, n = 50.

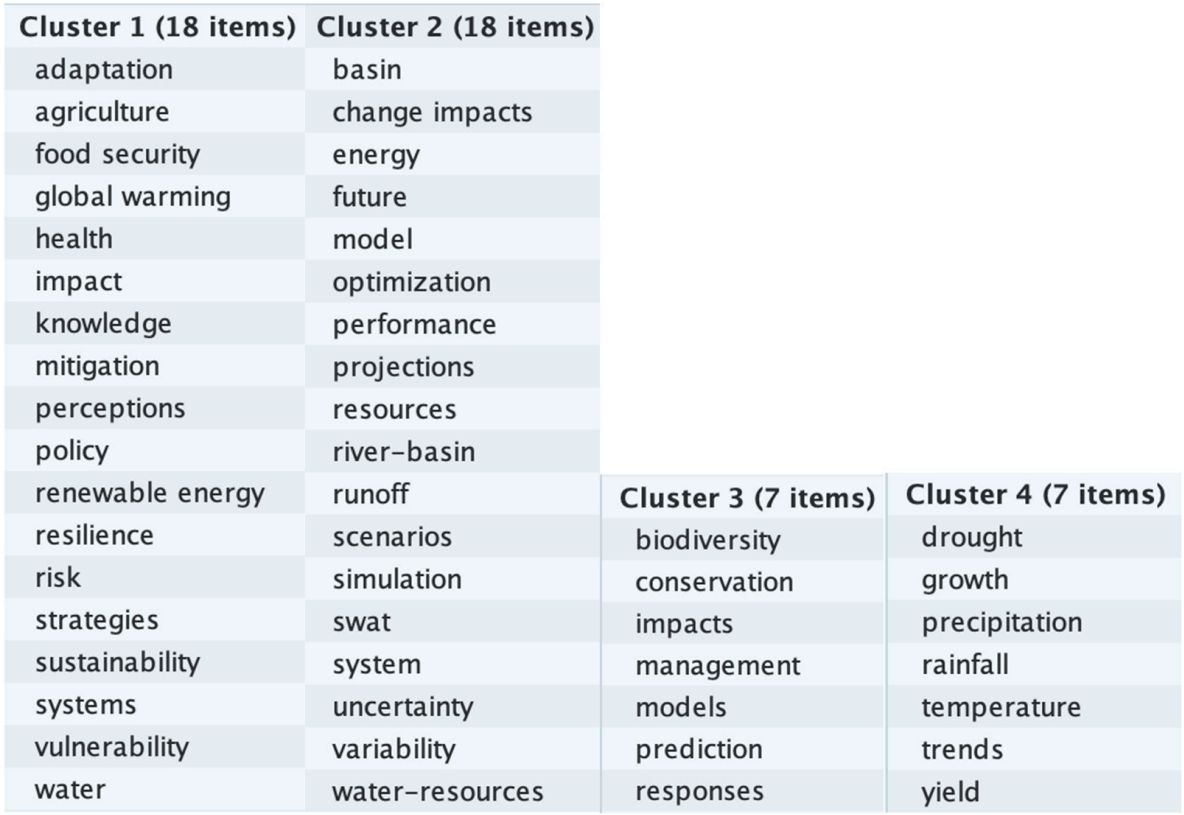

Figure A6. Climate change keyword occurrences for Western Asia, n = 11,178, and cluster selection subsample, n = 50.

Cluster 1 (16 items)	Cluster 2 (11 items)	Cluster 3 (10 items)	Cluster 4 (8 items)
adaptation	change impacts	china	basin
agriculture	downscaling	evapotranspiration	management
climate	irrigation	precipitation	optimization
conservation	lars-wg	rainfall	performance
drought	model	river-basin	resources
framework	scenarios	runoff	river
future	simulation	streamflow	system
global warming	temperature	swat	water-resources
impact	uncertainty	trends	
impacts	water	variability	
models	yield		
prediction			
responses			
risk			
species distribution m			
vulnerability			

Figure A7. Climate change keyword occurrences for Iran, n = 2061, and cluster selection subsample, n = 45.

Cluster 1 (12 items)	Cluster 2 (10 items)	Cluster 3 (10 items)	Cluster 4 (9 items)
biodiversity	conflict	climate	adaptation
conservation	desalination	desert	diversity
eastern mediterranear	environment	eastern mediterranea	drought
mediterranean	impacts	events	dynamics
mediterranean sea	irrigation	holocene	growth
patterns	management	negev desert	impact
precipitation	middle east	paleoclimate	plants
rainfall	model	region	responses
red-sea	remote sensing	sea	vegetation
temperature	water	soreq cave	
trends			
variability			

Figure A8. Climate change keyword occurrences for Israel, n = 541, and cluster selection subsample, n = 41.

Cluster 1 (15 items)	Cluster 2 (12 items)	Cluster 3 (12 items)	Cluster 4 (8 items)
adaptation	china	challenges	arabian peninsula
co2 emissions	drought	climate	circulation
consumption	evolution	dust	indexes
economic-growth	global warming	dynamics	precipitation
energy	growth	gis	rainfall
environment	impacts	impact	temperature
middle east	middle-east	management	trends
optimization	patterns	model	variability
policy	red sea	region	
quality	red-sea	remote sensing	
renewable energy	resources	risk	
strategies	storage	simulation	
sustainability			
systems			
water			

Figure A9. Climate change keyword occurrences for Saudi Arabia, n = 447, and cluster selection subsample, n = 47.

Cluster 1 (16 items)	Cluster 2 (13 items)	Cluster 3 (9 items)	Cluster 4 (7 items)
co2 emissions	basin	adaptation	climate
energy	change impacts	agriculture	conservation
europe	model	drought	evolution
future	precipitation	impacts	holocene
gis	rainfall	management	models
global warming	river	region	record
growth	river-basin	simulation	vegetation
impact	streamflow	vulnerability	
patterns	temperature	water	
power	trend analysis		
quality	trends		
renewable energy	variability		
risk	water-resources		
sustainability			
sustainable developme			
urbanization			

Figure A10. Climate change keyword occurrences for Turkey, n = 1554, and cluster selection subsample, n = 45.

Cluster 1 (15 items)	Cluster 2 (14 items)	Cluster 3 (13 items)	Cluster 4 (5 items)
area	association	accumulation	air pollution
basin	awareness	city	air-pollution
climate-change	disease	contamination	children
co2 emissions	environment	heavy metals	exposure
gis	epidemiology	heavy-metals	mortality
growth	health	pollution	
hazard	hypertension	risk assessment	
impact	obesity	river	
impacts	population	sediment	
index	prevalence	sediments	
management	risk-factors	soil	
model	schizophrenia	surface sediments	
quality	trends	water	
system	urban		
vulnerability			

Figure A11. Urbanization risk keyword occurrences for Western Asia, n = 547, and cluster selection subsample, n = 47.

Cluster 1 (11 items)	Cluster 2 (8 items)	Cluster 3 (7 items)	Cluster 4 (7 items)	Cluster 5 (2 items)
children	association	climate-change	disease	diseases
china	epidemiology	impact	global burden	risk factors
contamination	multiple sclerosis	impacts	hypertension	
exposure	obesity	management	mortality	
gis	physical-activity	model	prevention	
pollution	population	random forest	risk-factors	
quality	prevalence	tehran	trends	
region	urban			
river				
sediment				
water				

Figure A12. Urbanization risk keyword occurrences for Iran, n = 92, and cluster selection subsample, n = 35.

Cluster 1 (11 items)	Cluster 2 (6 items)	Cluster 3 (6 items)	Cluster 4 (4 items)
area	city	epidemiology	epidemic
basin	contamination	mellitus	infection
climate-change	pollution	middle east	system
frequency	quality	obesity	transmission
gis	river	prevalence	
impacts	sediments	risk-factors	
management			
remote sensing			
river-basin			
runoff			
simulation			

Figure A13. Urbanization risk keyword occurrences for Saudi Arabia, n = 50, and cluster selection subsample, n = 27.

Cluster 1 (13 items)	Cluster 2 (8 items)	Cluster 3 (8 items)
ahp	accumulation	community
area	city	environment
basin	contamination	epidemiology
earthquake	heavy-metals	gender
flood	pollution	health
gis	sediments	prevalence
impact	soil	schizophrenia
istanbul	trace-metals	urban
landslide		
management		
region		
remote sensing		
vulnerability		

Figure A14. Urbanization risk keyword occurrences for Turkey, n = 98, and cluster selection subsample, n = 29.

References

1. Schroeder, H. The history of international climate change politics: Three decades of progress, process and procrastination. In *The Politics of Climate Change A Survey*; Boykoff, M.T., Ed.; Routledge: London, UK, 2010; pp. 26–41. ISBN 9780415613569.
2. Depledge, J. Overcoming stalled implementation: A reply to 'Why do climate change negotiations stall? Scientific evidence and solutions for some structural problems', by Ulrich Frey and Jazmin Burgess. *Glob. Discourse* **2022**, *1*, 1–5. [CrossRef]
3. Fekete, A.; Fuchs, S.; Garschagen, M.; Hutter, G.; Klepp, S.; Lüder, C.; Neise, T.; Sett, D.; von Elverfeldt, K.; Wannewitz, M. Adjustment or transformation? Disaster risk intervention examples from Austria, Indonesia, Kiribati and South Africa. *Land Use Policy* **2022**, *120*, 106230. [CrossRef]
4. IPCC. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change—IPCC*; Field, C.B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.-K., Allen, S.K., et al., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2012.
5. Weingart, P.; Engels, A.; Pansegrau, P. Risks of communication: Discourses on climate change in science, politics, and the mass media. *Public Underst. Sci.* **2000**, *9*, 261. [CrossRef]
6. Weber, E.U. What shapes perceptions of climate change? *Wiley Interdiscip. Rev. Clim. Chang.* **2010**, *1*, 332–342. [CrossRef]
7. Whitmarsh, L.; Capstick, S. Perceptions of climate change. In *Psychology and Climate Change*; Elsevier: Amsterdam, The Netherlands, 2018; pp. 13–33.
8. Demeritt, D. Science studies, climate change and the prospects for constructivist critique. *Econ. Soc.* **2006**, *35*, 453–479. [CrossRef]
9. Lefsrud, L.M.; Meyer, R.E. Science or science fiction? Professionals' discursive construction of climate change. *Organ. Stud.* **2012**, *33*, 1477–1506. [CrossRef]
10. Anderegg, W.R.; Prall, J.W.; Harold, J.; Schneider, S.H. Expert credibility in climate change. *Proc. Natl. Acad. Sci. USA* **2010**, *107*, 12107–12109. [CrossRef]
11. Van Nes, E.H.; Scheffer, M.; Brovkin, V.; Lenton, T.M.; Ye, H.; Deyle, E.; Sugihara, G. Causal feedbacks in climate change. *Nat. Clim. Chang.* **2015**, *5*, 445–448. [CrossRef]
12. Lesnikowski, A.C.; Ford, J.D.; Berrang-Ford, L.; Barrera, M.; Heymann, J. How are we adapting to climate change? A global assessment. *Mitig. Adapt. Strateg. Glob. Chang.* **2015**, *20*, 277–293. [CrossRef]
13. Van Aalst, M.K. The impacts of climate change on the risk of natural disasters. *Disasters* **2006**, *30*, 5–18. [CrossRef]
14. Lahsen, M.; Ribot, J. Politics of attributing extreme events and disasters to climate change. *Wiley Interdiscip. Rev. Clim. Chang.* **2022**, *13*, e750. [CrossRef]
15. Banerjee, A.; Bhavnani, R.; Burtonboy, C.H.; Hamad, O.; Linares-Rivas Barandiaran, A.; Safaie, S.; Tewari, D.; Zanon, A. Natural disasters in the Middle East and North Africa: A regional overview (French). *Disclosure* **2014**.
16. Waha, K.; Krummenauer, L.; Adams, S.; Aich, V.; Baarsch, F.; Coumou, D.; Fader, M.; Hoff, H.; Jobbins, G.; Marcus, R. Climate change impacts in the Middle East and Northern Africa (MENA) region and their implications for vulnerable population groups. *Reg. Environ. Chang.* **2017**, *17*, 1623–1638. [CrossRef]
17. Selvaraju, R. Implications of climate change for agriculture and food security in the Western Asia and Northern Africa region. *Clim. Chang. Food Secur. West Asia N. Afr.* **2013**, 27–51. [CrossRef]
18. Cannon, T.; Müller-Mahn, D. Vulnerability, resilience and development discourses in context of climate change. *Nat. Hazards* **2010**, *55*, 621–635. [CrossRef]

19. Birkmann, J.; Cardona, O.D.; Carreño, M.L.; Barbat, A.H.; Pelling, M.; Schneiderbauer, S.; Kienberger, S.; Keiler, M.; Alexander, D.; Zeil, P.; et al. Framing vulnerability, risk and societal responses: The MOVE framework. *Nat. Hazards* **2013**, *67*, 193–211. [CrossRef]
20. Pelling, M. *Adaptation to Climate Change: From Resilience to Transformation*; Routledge: Oxon, UK, 2011.
21. Berkes, F.; Folke, C. Linking social and ecological systems for resilience and sustainability. In *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*; Cambridge University Press: Cambridge, UK, 1998.
22. Folke, C. Social-Ecological Resilience and Behavioral Responses. In *Individual and Structural Determinants of Environmental Practice*; Biel, A., Hansson, B., Mårtensson, M., Eds.; Ashgate Publishers: London, UK, 2003; pp. 226–287.
23. Walker, B.; Gunderson, L.; Kinzig, A.; Folke, C.; Carpenter, S.; Schultz, L. A handful of heuristics and some propositions for understanding resilience in social-ecological systems. *Ecol. Soc.* **2006**, *11*, 1–15. [CrossRef]
24. Cutter, S.L.; Boruff, B.J.; Shirley, W.L. Social Vulnerability to Environmental Hazards. *Soc. Sci. Q.* **2003**, *84*, 242–261. [CrossRef]
25. Cutter, S.L.; Burton, C.G.; Emrich, C.T. Disaster Resilience Indicators for Benchmarking Baseline Conditions. *J. Homel. Secur. Emerg. Manag.* **2010**, *7*, 1–22. [CrossRef]
26. Cutter, S.L.; Barnes, L.; Berry, M.; Burton, C.; Evans, E.; Tate, E.; Webb, J. A place-based model for understanding community resilience. *Glob. Environ. Chang.* **2008**, *18*, 598–606. [CrossRef]
27. United Nations. *Sendai Framework for Disaster Risk Reduction 2015–2030*; United Nations Office for Disaster Risk Reduction: Geneva, Switzerland, 2015.
28. Asadzadeh, A.; Kötter, T.; Salehi, P.; Birkmann, J. Operationalizing a concept: The systematic review of composite indicator building for measuring community disaster resilience. *Int. J. Disaster Risk Reduct.* **2017**, *25*, 147–162. [CrossRef]
29. Anderson, M.B.; Woodrow, P.J. *Rising from the Ashes: Development Strategies in Times of Disaster*, 1998th ed.; Lynne Rienner: Boulder, NV, USA, 1998.
30. Baird, A.; O'Keefe, P.; Westgate, K.N.; Wisner, B. *Towards an Explanation and Reduction of Disaster Proneness*; Occasional Paper no.11; University of Bradford, Disaster Research Unit: Bradford, UK, 1975.
31. Wisner, B.; Blaikie, P.; Cannon, T.; Davis, I. *At Risk—Natural Hazards, People's Vulnerability and Disasters*, 2nd ed.; Routledge: London, UK, 2004.
32. FEMA. *Developing and Maintaining Emergency Operations Plans. Comprehensive Preparedness Guide (CPG) 101 Version 2.0*; Federal Emergency Management Agency: Washington, DC, USA, 2010; p. 17.
33. UN/HABITAT. *New Urban Agenda*; United Nations, Habitat III Secretariat: Quito, Ecuador, 2017; p. 65.
34. Pelling, M. *The Vulnerability of Cities: Natural Disasters and Social Resilience*; Routledge: London, UK, 2003; p. 224.
35. Solecki, W.; Pelling, M.; Garschagen, M. Transitions between risk management regimes in cities. *Ecol. Soc.* **2017**, *22*. Available online: https://ieeexplore.ieee.org/document/8808978 (accessed on 16 March 2023). [CrossRef]
36. Rufat, S. Spectroscopy of urban vulnerability. *Ann. Assoc. Am. Geogr.* **2013**, *103*, 505–525. [CrossRef]
37. Kraff, N.J.; Taubenböck, H.; Wurm, M. How dynamic are slums? EO-based assessment of Kibera's morphologic transformation. In Proceedings of the 2019 Joint Urban Remote Sensing Event (JURSE), Vannes, France, 22–24 May 2019; pp. 1–4.
38. IPCC. *Climate Change 2001: Mitigation, Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2001.
39. Coaffee, J.; Lee, P. *Urban Resilience. Planning for Risk, Crisis and Uncertainty*; Palgrave: London, UK, 2016; p. 306.
40. Renn, O.; Klinke, A.; Van Asselt, M. Coping with complexity, uncertainty and ambiguity in risk governance: A synthesis. *Ambio* **2011**, *40*, 231–246. [CrossRef]
41. Kovaleva, M.; Filho, W.L.; Borgemeister, C. Gender issues within climate change research: A bibliometric analysis. *Clim. Dev.* **2022**, *14*, 725–740. [CrossRef]
42. Van Eck, N.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **2010**, *84*, 523–538. [CrossRef]
43. Guha-Sapir, D.; D'Aoust, O.; Vos, F.; Hoyois, P. *The Frequency and Impact of Natural Disasters*; Oxford University Press: Oxford, UK, 2013.
44. O'Keefe, P.; Westgate, K.; Wisner, B. Taking the naturalness out of natural disasters. *Nature* **1976**, *260*, 566–567. [CrossRef]
45. Smith, N. There's No Such Thing as a Natural Disaster. Available online: http://understandingkatrina.ssrc.org/Smith/ (accessed on 17 January 2007).
46. Teymouri, P.; Dehghanzadeh, R. Climate change and water-related diseases in developing countries of Western Asia: A systematic literature review. *Clim. Dev.* **2022**, *14*, 222–238. [CrossRef]
47. Warner, K.; Zakieldeen, S.A. *Loss and Damage Due to Climate Change. An Overview of the UNFCCC Negotiations*; European Capacity Building Initiative: Oxford, UK, 2012; p. 12.
48. Klenk, N.; Meehan, K. Climate change and transdisciplinary science: Problematizing the integration imperative. *Environ. Sci. Policy* **2015**, *54*, 160–167. [CrossRef]