Thirty-Five Years of Research on Climate Change, Sustainability, and Emergency Management: A Scientometric and Visualization Approach

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ABSTRACT

This paper examines publications on Climate Change, Sustainability, and Emergency Management. The publication data were retrieved from the Web of Science Database as of December 31st, 2023. The study period spans from 1988 to 2023, covering 26 years of cited research publications. A total of 5,777 cited research publications were extracted and analysed across various categories. The bibliometrix package (R-4.3.1 for Windows) and the biblioshiny app were utilized for data analysis, while VOSviewer 1.6.19 was used for network analysis. The study aims to analyse the annual scientific production and impact, the top ten most productive authors, the top ten authors' research impacts, the top ten affiliations, the top ten most productive countries and their impact, the top ten countries by corresponding authors, the top ten journals and their impact, the top five journals' production over time, and the top ten highly cited research papers. It was found that 5,777 cited research publications were published from 2,301 sources. Notably, WANG Y has authored 59 research papers in the field of climate change, sustainability, and emergency management. Beijing Normal Univ has contributed 189 research publications. Furthermore, the United States of America has contributed 5,463 research articles and received the highest number of 42,004 total citations. The International Journal of Disaster Risk Reduction has published the highest number of articles (190) with an h-index of 29 and a g-index of 41, receiving 3,112 total citations since its inception in 2012.

Keywords: Citation Analysis, Climate Change, Emergency Management, Scientometrics, Sustainability, Web of Science Database.

INTRODUCTION

In recent times, the concepts of climate change and sustainability have become crucial issues for emergency management. We are witnessing numerous natural calamities in India and worldwide, significantly impacting the daily lives of people and posing challenges for policymakers (Sangam and Savitha, 2019). The Ministry of Earth Sciences (MoES), through the Centre for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology (IITM) in Pune, undertakes various research activities to enhance understanding of climate change and improve assessments of regional climate responses to global climate change. The Department of Science and Technology, Ministry of Earth Sciences (MoES), Ministry of Environment, Forest and Climate Change, Indian Space Research Organisation (ISRO), Ministry of Agriculture and Farmers Welfare, and Council of Scientific and Industrial Research (CSIR) provide funding for research on climate change (Press Information Bureau, 2024). Centres for climate change and sustainability studies have been established in Mumbai, Tuljapur, Hyderabad, and Guwahati. Climate change education is important for equipping individuals with the knowledge and skills to confront its impact and foster sustainable development. Scientometrics, primarily focused on analyzing citations in academic literature, has become a crucial tool for measuring and evaluating research performance (Mingers and Leydesdorff, 2015). Scientometrics is a quantitative and statistical approach that analyzes research on various disciplines including information science, library science, natural science, technology, engineering, medical sciences, and social sciences and humanities. It originated from information/library science and has been widely adopted (Liu and He, 2023). Scientometrics is used for evaluating research performance, research assessment, and the internationalization of higher education and scientific institutions (Kholodov, 2015 and Zinchenko, *et al.*, 2023). Scientometric indicators are divided into three categories: productivity metrics, impact metrics, and hybrid metrics, which are used to measure the productivity, quality, and performance

of researchers, journals, research groups, and countries (Yazdani, *et al.*, 2015). Many other research institutes in the field have also undertaken research and contributed numerous research articles. In the present study, researchers aimed to measure scientific works using a Scientometric method and identify useful indicators in the field for researchers and policymakers.

Related works

(Bandara and Wijewardene, 2023) conducted a scientometric analysis on Hilsa shad research published in the Web of Science database between 2000 and 2022. (Zamorano *et al.*, 2023) described research on Physical Activity (PA) and transcranial stimulation that has been found in the scientific literature. Researchers analysed annual publication trends in this area, identifying the most productive and cited authors, journals, and countries with the highest number of publications, and the most cited documents and keywords. Sheeja, (Mathew, and Cherukodan, 2023) analysed the trend of Monkeypox research in the pre- and post-outbreak period. The study compared the growth pattern, major research areas, sources of publications, funding agencies, countries and institutions invested in Monkeypox research, and institutional and countrywide collaboration patterns in Monkeypox research in both periods. Shukla *et al.*, 2023) identified highly informative insights pertaining to publications, such as the best articles, research areas, most productive and influential journals, authors, and institutions. Studies are made on the top 50 most cited articles to identify the most influential Artificial Intelligence subcategories. (Vijay and Saravanan, 2023) examined sustainable consumer behaviour publications between 1984 and 2021. We discovered 4,916 related papers in the Scopus database using a keyword search. This bibliometric analysis comprised 3,408 articles based on inclusion and exclusion criteria. (Lianou and Fthenakis, 2022) described Greek sheep and goat research as primarily focused on milk production and udder diseases, with a significant increase in publications from 1997 to 2022. (Yang *et al.*, 2022) explored and exhibited the research status and developing trend of nanomedicines deployed in basic or clinical research in respiratory disease, the research ecosystem and exciting subareas were profiled based on the massive data mining and visualization from the relevant works reported from 2006 to 2021. (Oyewola and Dada, 2022) discovered the global structure of machine learning to ascertain the level of bibliographic coupling, collaboration among research institutions, co-authorship network of countries, and sources coupling in publications on machine learning techniques. (Jozi and Nourmohammadi, 2022) examined the extent of scientific publications and patents in pathology and forensic medicine globally and the citation relationship between them from 2011 to 2020, indexed in the Scopus database. (Kavitha, 2022) attempted to find the year-wise, language, document type, and keyword-wise distribution of articles in Climate Change research and to study the authorship pattern and collaboration in climate

change research. It attempted to present the exponential growth rate of Climate change and top-cited documents in Climate change research.

RESEARCH OBJECTIVES

The main objective of this study is to conduct a comprehensive scientometric analysis of research on climate change, sustainability, and emergency management published between 1988 and 2023.

The specific objectives of the study are to:

1. Examine the annual growth pattern of publications and citations in the selected research domains.

2. Identify the most productive countries, authors, and institutions contributing to this field.

3. Determine the most influential journals and sources publishing research on climate change, sustainability, and emergency management.

4. Analyze the keyword occurrences, thematic structures, and conceptual linkages to reveal emerging research trends.

5. Evaluate the collaboration networks among authors, institutions, and countries involved in these research areas.

RESEARCH QUESTIONS

This scientometric study seeks to explore and map the research landscape on climate change, sustainability, and emergency management during the period 1988-2023. The following research questions guided the study:

- **RQ1:** What are the overall publication and citation trends in research on climate change, sustainability, and emergency management from 1988 to 2023?

- **RQ2:** Which countries, authors, and institutions have made the most significant contributions to this field?

- **RQ3:** Which journals and sources have published the highest number of papers, and what is their relative impact in terms of productivity and citations?

- **RQ4:** What are the dominant themes, keyword clusters, and conceptual structures that characterize the research landscape?

- **RQ5:** What patterns of collaboration exist among authors, institutions, and countries in this area of research?

- **RQ6:** What policy implications and directions for future research can be drawn from the scientometric findings of this study?

METHODOLOGY

The publication data were collected from the Web of Science (Clarivate, 2024). Database because of Web of Science is a platform consisting of several literature search databases designed to support scientific and scholarly research (Clarivate, 2024). The researcher selected the title and topic and used the search terms "Climate Change," "Sustainability," and "Emergency Management." The study period covered 1988 to 2023. The year 1988 marks the establishment of the Intergovernmental Panel on Climate Change (IPCC), which triggered significant global research on climate change. The dataset was analyzed up to 2023 because data for 2024-2025 were incomplete at the time of extraction (December 31, 2023). Hence, the period 1988-2023 provides a complete and validated dataset for analysis. The results show 515,723 research publications published in the fields of Climate Change, Sustainability, and Emergency Management. The study only selected the cited research publications in the field. Of the 515,723 research publications, 5,777 were cited, and publication records were downloaded in BibTeX and Comma Separated Values (CSV) formats. The publication data were imported into the bibliometrix package (R-4.3.1 for Windows) and utilized the biblioshiny app (Aria and Cuccurullo, 2024) Bibliometrix is an open-source tool developed in statistical computing and the graphic R language for quantitative research in scientometrics and bibliometrics, encompassing all the main bibliometric methods of analysis. Biblioshiny is a shiny app providing a web interface for bibliometrix (Biblioshiny, 2024). The 5,777 cited article sources network and bibliographic coupling network (the collaboration map) were analyzed using

VOSviewer 1.6.19, (Eck and Waltman, 2024). Designed by Leiden University's Centre for Science and Technology, Netherlands, to visualize bibliometric networks. VOSviewer is a software tool for constructing and visualizing bibliometric networks. The study aims to analyze the annual scientific production, most relevant sources, most relevant authors, most relevant affiliations, countries' scientific production, most cited countries, most frequent words, most globally cited documents, and collaboration networks of authors, countries, and institutes. Figure 1 illustrates the data collection process, data analysis steps, and network maps. All the data were presented using descriptive statistics, and no statistical significance tests were performed.

RESULTS

Main information about data

Table 1 shows the main information about data of the research. The research study covers the period from 1988 to 2024. A comprehensive collection of 2301 sources, including journals, books, and other references, has been consulted for this study. A total of 5777 documents have been analysed, indicating a substantial volume of research in the field. The research demonstrates a steady growth rate, with an annual increase of 1.94% in the number of documents. Each document garners an average of 20.09 citations, indicating the impact and relevance of the research output. A vast array of 174,933 references has been cited across the analysed documents, highlighting the breadth and depth of the literature review undertaken. The research is enriched with 7890 keywords, enhancing the comprehensiveness and searchability of the content. A diverse pool of 17,812 authors

Table 1: Information about the Retrieved Data.

Sl. No.	Description	Results
1	Timespan	1988:2024
2	Sources (Journals, Books, etc.)	2301
3	Documents	5777
4	Annual Growth Rate %	1.94
5	Document Average Age	8.15
6	Average citations per doc	20.09
7	References	174933
	Document Contents	
8	Keywords Plus (ID)	7890
9	Author's Keywords (DE)	13788
	Authors	
10	Authors	17812
11	Authors of single-authored docs	445
	Authors Collaboration	
12	Single-authored docs	475
13	Co-Authors per Doc	4.2
14	International co-authorships %	20.08

has contributed to research papers, reflecting a broad range of expertise and perspectives. Among these authors, 445 have authored single-authored documents, showcasing individual contributions to the field.

Annual Scientific Production and Average Citations per year

The Table 2 and Figures 2 and 3 provides a comprehensive overview of scientific publications from 1988 to 2024, including metrics such as the number of articles, mean topic coverage per article, and the number of citable years. In 2020, 498 research publications were published in the field of Climate Change and Sustainability and Emergency Management and gathered 13.43 total citations per article for 5 years, followed by the year 2021, which saw the publication of 470 research articles and gathered 9 total citations per article for 4 years. The highest number of articles was published in 2020 with 498 publications, while the lowest publication years were 1989, 1990, 1992, and 1992, with no recorded publications. The highest mean topic coverage was observed in 2001 with 85.87, while the lowest was in 2024 with 1.00.
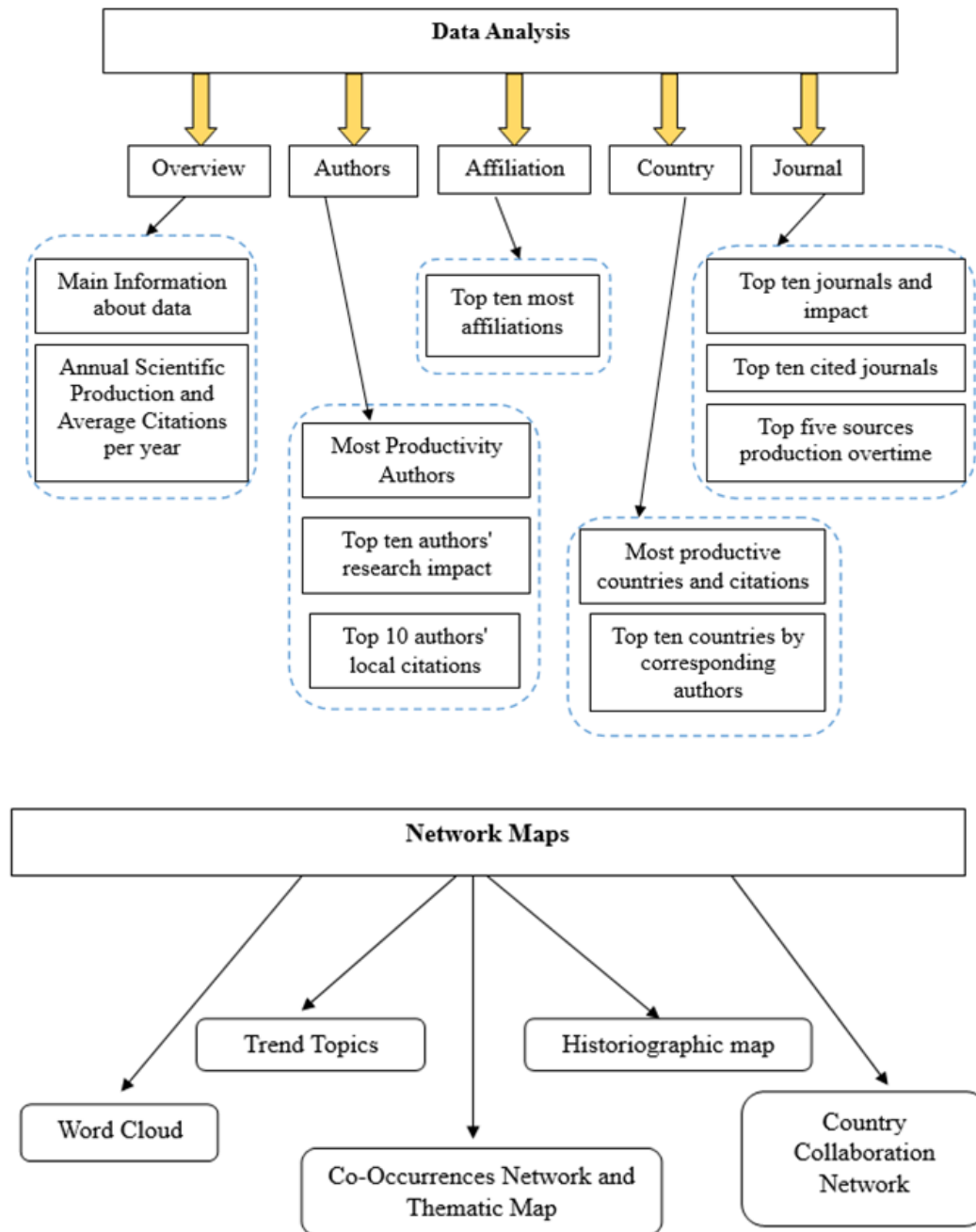
Most Productivity Authors

Table 3 presents the top authors based on the number of articles they have contributed to the field, as well as their fractionalized contribution. Fractional authorship quantifies an individual author's contribution to a published set of papers (Bibliometrix, 2024). It is found that WANG Y has published 59 articles and contributes approximately 15.70% of the total articles fractionalized, holding the top position, followed by LI J who has published 52 articles, contributing around 11.75% of the total articles fractionalized and occupying the second position. It is further found that LIU X and ZHANG L have published 36 research articles each, contributing 8.87 and 9.66 articles fractionalized, respectively, and are placed seventh. It is observed that LIU J has published fewer than 33 research publications, contributing 8.50 articles fractionalized and is placed tenth.

Top ten authors' research impact

The Table 4 presents bibliometric indices for several authors in the field. Notably, WANG Y holds an h-index of 16, a g-index of 23, and an m-index of 1.067, with a Total Citation count (TC) of 641 and 59 published papers since 2009. LI J follows closely with

Figure 1: Proposed Research Framework [adopted from Kushairi and Ahmi, 2021].

an h-index of 15, a g-index of 24, and an m-index of 0.882, with a TC of 687 and 52 papers since 2007. Among others, CHEN J has an h-index of 14, a g-index of 26, and an m-index of 0.56, with 680 citations and 28 papers since 1999. LI Y also shows comparable performance with an h-index of 14, a g-index of 23, and an m-index of 0.875, garnering 611 citations and publishing 42 papers since 2008. It is observed that Andersson L, Liu X, Liu Y, Wang J, and Xu Z have received an h-index of 12. Further analysis reveals that Liu Y and Wang J have attained an m-index of 0.75. Additionally, it is noted that Casagli N, with an h-index of 11 and a g-index of 14, showcases a moderate scholarly impact with 14 publications since 2004.

Top 10 authors' local citations

Table 5 displays the top ten authors with local citations, which measure how many times an author (or a document) included in this collection has been cited by the documents also included in the collection (Aria and Cuccurullo, 2023). Andersson L has received the highest number of local citations, with 221, securing the first rank, followed by Trope M with 115 local citations, placing second. Malmgren B and Tsukiboshi M have each received 75 local citations, earning them the fifth rank. Additionally, Lim LP and Sae-Lim V have garnered 66 local citations each, landing them in the eighth position. Furthermore, it is observed that

Andreasen JO has received the least number of local citations, with 65, placing them in the tenth position.

Top ten most affiliations

Table 6 shows the top ten most affiliations in the field of Climate Change and Sustainability and Emergency Management. It is found that Beijing Normal Univ has contributed 189 research articles and is ranked first, followed by Tsinghua Univ, which has contributed 134 research articles and is ranked second. Additionally, it is found that Louisiana State Univ has contributed a smaller number of 72 research articles and is ranked tenth.

Table 2: Annual Scientific Production and Average Citations per Year.

Sl. No.	Year	Articles	Mean TC per Article	Mean TC per Year	Citable Years
1	1988	1	1	0.03	37
2	1989	0			
3	1990	0			
4	1991	1	8	0.24	34
5	1992	0			
6	1993	1	1	0.03	32
7	1994	4	3.25	0.10	31
8	1995	2	3.5	0.12	30
9	1996	25	18.16	0.63	29
10	1997	40	13.43	0.48	28
11	1998	39	39.97	1.48	27
12	1999	58	46.93	1.80	26
13	2000	53	37.21	1.49	25
14	2001	61	85.87	3.58	24
15	2002	47	79.36	3.45	23
16	2003	57	30.61	1.39	22
17	2004	67	19.28	0.92	21
18	2005	98	28.88	1.44	20
19	2006	75	38.73	2.04	19
20	2007	142	44.06	2.45	18
21	2008	138	48.77	2.87	17
22	2009	199	19.29	1.21	16
23	2010	197	24.07	1.60	15
24	2011	185	24.92	1.78	14
25	2012	242	22.19	1.71	13
26	2013	282	19.48	1.62	12
27	2014	306	22.32	2.03	11
28	2015	319	20.16	2.02	10
29	2016	358	16.74	1.86	9
30	2017	356	17.32	2.16	8
31	2018	390	19.86	2.84	7
32	2019	392	18.09	3.02	6
33	2020	498	13.43	2.69	5
34	2021	470	9	2.25	4
35	2022	466	4.92	1.64	3
36	2023	206	2.54	1.27	2
37	2024	2	1	1.00	1

Table 3: Top Ten Most Productivity Authors.

Sl. No.	Authors	Articles	Articles Fractionalized	Rank
1	Wang Y	59	15.70	1
2	Li J	52	11.75	2
3	Liu Y	48	10.52	3
4	Li Y	42	10.22	4
5	Wang J	41	9.67	5
6	Wang H	38	9.11	6
7	Liu X	36	8.87	7
8	Zhang L	36	9.66	7
9	Zhang Y	35	7.46	9
10	Liu J	33	8.50	10

Table 4: Top Ten Authors' Research Impact.

Sl. No.	Element	h_index	g_index	m_index	TC	NP	PY_start
1	Wang Y	16	23	1.067	641	59	2009
2	Li J	15	24	0.882	687	52	2007
3	Chen J	14	26	0.56	680	28	1999
4	Li Y	14	23	0.875	611	42	2008
5	Andersson L	12	15	0.667	1153	15	2006
6	Liu X	12	23	0.75	581	36	2008
7	Liu Y	12	23	0.667	628	48	2006
8	Wang J	12	19	0.75	467	41	2008
9	Xu Z	12	20	1.333	422	21	2015
10	Casagli N	11	14	0.55	948	14	2004

Table 5: Top Ten Authors' Local Citations.

Rank	Author	Local Citations
1	Andersson L	221
2	Trope M	115
3	Al-Asfour A	93
4	Flores Mt	90
5	Malmgren B	75
5	Tsukiboshi M	75
7	Al-Jame Q	68
8	Lim Lp	66
8	Sae-Lim V	66
10	Andreasen Jo	65

Top ten most productive countries and impact

Table 7 indicates the top ten most productive countries and their impact. It is observed that the United States of America has published 5463 research articles and received the highest number of 42004 total citations, with an average of 30.40 citations per article. This is followed by China, which has contributed 4451 research articles and received 15475 total citations, with an average of 12.60 citations per article. Furthermore, Australia has contributed 1141 research articles and received 5970 total citations, with an average of 21.60 citations per article. Germany has contributed 1121 research articles. Compared to Australia, Germany has received the highest total citations of 6506 and gained an average of 22.40 citations per article.

Top ten countries by corresponding authors

Table 8 demonstrates data on scientific productivity and collaboration patterns among various countries by corresponding authors in the field of Climate Change and Sustainability and Emergency Management. The metrics analyzed include Single Co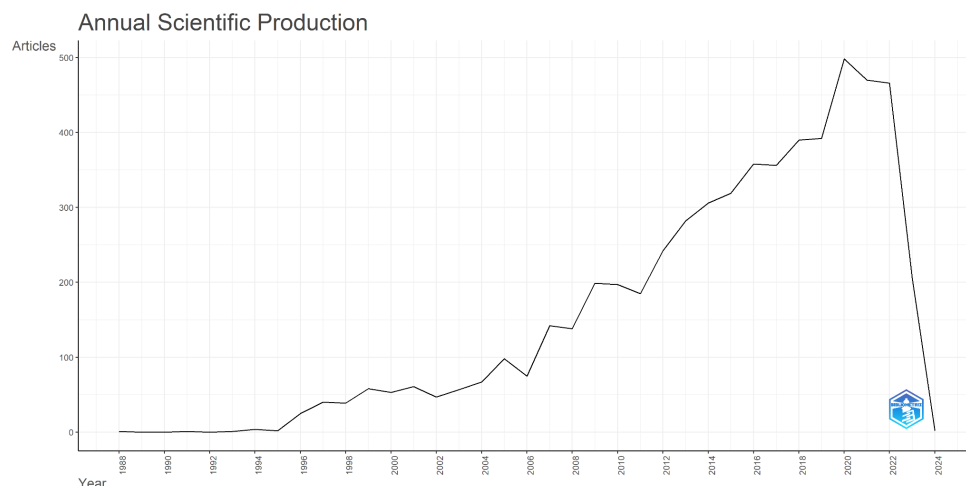untry Publications (SCP) (Intra-country collaboration), Multiple Country Publications (MCP) (Intercountry collaboration), Frequency (Freq), and Multiple Country Publications ratio. The United States of America has contributed 1380 research articles by corresponding authors, with 1224 articles published intra-country (Single Country Publications) and 156 articles published inter-country (Multiple Country Publications),

Table 6: Top Ten Most Affiliations.

Rank	Affiliation	Articles
1	Beijing Normal University	189
2	Tsinghua University	134
3	Texas A & M University	104
4	Tongji University	96
5	Monash University	90
6	University of Pennsylvania	82
7	Massey University	81
8	University of Melbourne	77
9	Sichuan University	73
10	Louisiana State University	72

Table 7: Top Ten Most Productive Countries and Impact.

Sl. No.	Region	Freq	TC	Average Article Citations
1	USA	5463	42004	30.40
2	China	4451	15475	12.60
3	Italy	1503	8267	18.90
4	UK	1220	7706	25.90
5	Australia	1141	5970	21.60
6	Germany	1121	6506	22.40
7	Canada	823	5720	30.30
8	France	727	2197	15.20
9	Spain	453	1893	15.80
10	Turkey	344	1724	16.00

Figure 2: Annual Scientific Production.

resulting in a frequency of 0.239, placing it in the first position. Following closely, China has published 1229 articles, with 1031 articles published intra-country (Single Country Publications) and 198 articles published inter-country (Multiple Country Publications), resulting in a frequency of 0.213. Additionally, the United Kingdom and Australia show significant Multiple Country Publications ratios, reflecting their active participation in international research collaborations. Canada stands out for having a relatively low number of articles published compared to other countries in the top ten; however, it demonstrates a high Multiple Country Publications ratio, indicating a strong propensity for international collaboration despite its lower research publications. Furthermore, it is observed that France, Spain, and Turkey, while featuring lower in the overall ranking, still contribute significantly to research in Climate Change, Sustainability, and Emergency Management.

Top ten journals and impact

The Table 9 displayed data on the top ten journals in the field of climate change and sustainability and emergency management, based on various metrics such as the number of articles, h-index, g-index, m-index, Total Citations (TC), the Number of Publications (NP), and the publication year start (PY_start). The International Journal of Disaster Risk Reduction has published the highest number of articles (190) and has the h-index (29) and g-index (41), receiving 3112 total citations since its start in 2012. Natural Hazards closely follows with 145 articles and the highest h-index (35) and g-index (58), reflecting a broad impact across a wide range of publications, and it received the highest number of citations, 4173, since its inception in 1999. In 2013, the International Journal of Environmental Research and Public Health and Remote Sensing began publishing research articles. Compared to Remote Sensing, the International Journal of Environmental Research and Public Health has published 82

Table 8: Top Ten Countries by Corresponding Authors.

Sl. No.	Country	Articles	SCP	MCP	Freq	MCP_Ratio
1	USA	1380	1224	156	0.239	0.113
2	China	1229	1031	198	0.213	0.161
3	Italy	437	342	95	0.076	0.217
4	United Kingdom	297	217	80	0.051	0.269
5	Germany	291	236	55	0.05	0.189
6	Australia	276	208	68	0.048	0.246
7	Canada	189	132	57	0.033	0.302
8	France	145	119	26	0.025	0.179
9	Spain	120	92	28	0.021	0.233
10	Turkey	108	87	21	0.019	0.194

Table 9: Top 10 Journals and Impact.

Sl. No.	Sources	Articles	h_index	g_index	m_index	TC	NP	PY_start
1	International Journal of Disaster Risk Reduction	190	29	41	2.417	3112	190	2012
2	Natural Hazards	145	35	58	1.25	4173	145	1996
3	Sustainability	128	19	27	1.462	1261	128	2011
4	Dental Traumatology	101	32	52	1.391	3172	101	2001
5	Disaster Medicine and Public Health Preparedness	83	12	17	0.923	559	83	2011
6	International Journal of Environmental Research and Public Health	82	17	26	1.545	954	82	2013
7	Safety Science	73	24	39	0.923	1730	73	1998
8	Natural Hazards and Earth System Sciences	53	19	30	0.905	1104	53	2003
9	Remote Sensing	40	13	25	1.182	719	40	2013
10	Prehospital and Disaster Medicine	37	11	21	0.786	507	37	2010

research articles and received an h-index of 17, a g-index of 26, and an m-index of 1.545, accumulating 954 total citations.

Top ten cited journals

The Table 10 lists the number of articles published by various sources. Dent Traumatol has published 2257 articles, followed by NAT HAZARDS with 1957 articles. The New England Journal of Medicine stands third with 1372 articles, while International Journal of Disaster Risk Reduction and Lancet follow closely with 1343 and 1100 articles respectively. Safety Science has contributed 1012 articles, while Natural Hazards and Earth System Sciences and European Journal of Operational Research have published 965 and 915 articles respectively. Journal of Hydrology and Stroke complete the list with 792 and 761 articles respectively. Top five sources of production overtime Table 11 illustrates the number of articles published each year by five different journals: International Journal of Disaster Risk Reduction, Natural Hazards,

Sustainability, Dental Traumatology, and Disaster Medicine and Public Health Preparedness, spanning from 1988 to 2024. In 2024, International Journal of Disaster Risk Reduction and Natural Hazards both published 190 articles, while Sustainability contributed 128 articles, Dental Traumatology published 101 articles, and Disaster Medicine and Public Health Preparedness published 83 articles. Over the years, there is a notable increase in the number of articles published by most journals. It is observed that both Natural Hazards and Dental Traumatology show a consistent rise in publications, with a peak from 2001 to 2024. From 2011 to 2024, the International Journal of Disaster Risk Reduction, Sustainability, and Disaster Medicine and Public Health Preparedness have increased their productivity.

Top 10 Highly Cited Research Papers

Table 12 presents the top ten highly cited research papers. "Hacke W, 2008, Cerebrovasc DIS" has received the highest number of
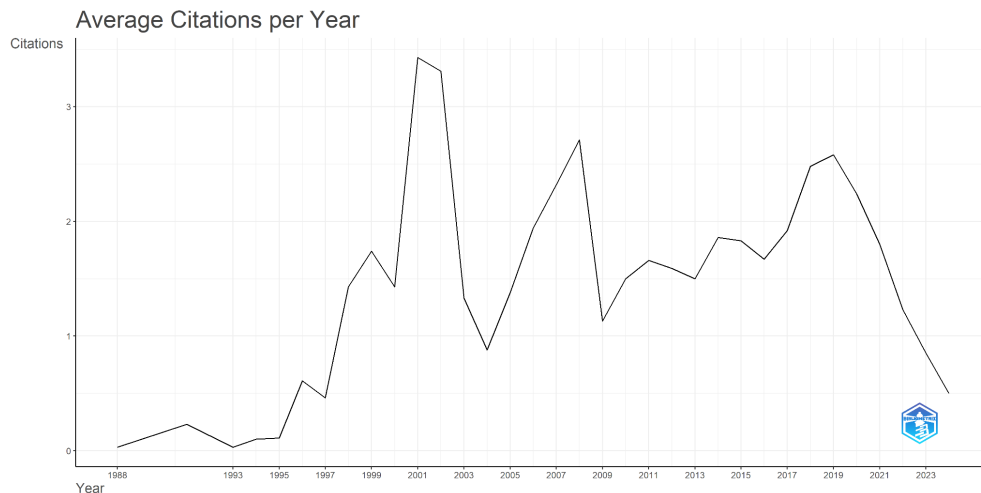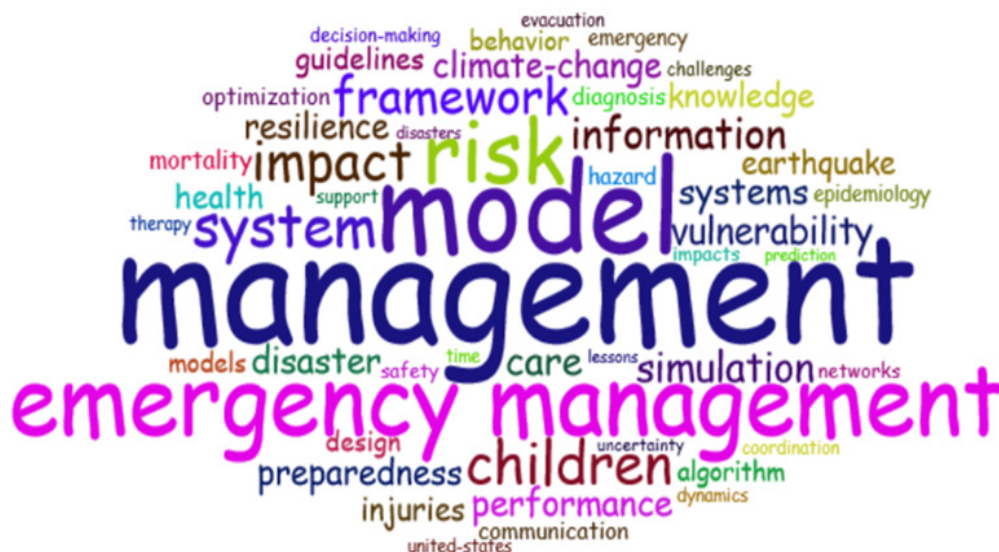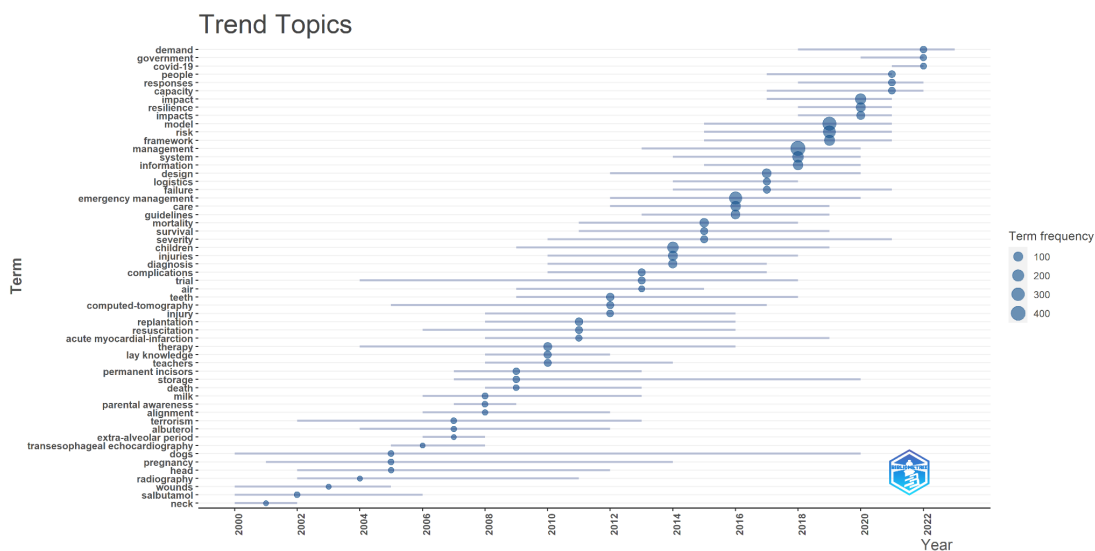

Figure 3: Average Citations per Year.

Figure 4: Wordcloud.

Table 10: Top Ten Cited Journals.

Sources	Articles
Dent Traumatol	2257
Nat Hazards	1957
New Engl J Med	1372
Int J Disast Risk Re	1343
Lancet	1100
Safety Sci	1012
Nat Hazard Earth Sys	965
Eur J Oper Res	915
J Hydrol	792
Stroke	761

Figure 5: Trend Topics.

citations, with 1911 in total, and maintains an average of 119.44 citations per year, resulting in a normalized total citation score of 39.19, securing the first rank. Followed by "Cornell CA, 2002, J Struct Eng," which has garnered 1366 citations, with an average of 62.09 citations per year, earning the second rank. A notable observation is that, compared to other articles, "Muraro A, 2014, Allergy" has received fewer citations, totalling 859, yet it boasts the highest number of citations per year at 85.90, leading to a normalized total citation score of 38.49, securing the ninth rank. It is found that "Cutter SL, 2008, Proc Natl Acad Sci USA" has received fewer citations, with a total of 744, placing it in the tenth rank.

Wordcloud

Figure 4 provides a representation of the frequency count of keywords extracted from research papers in the field of climate change and sustainability and emergency management. Keywords such as "management," "model," "emergency management," and "risk" prominently feature, indicating their high frequency within the research corpus. Additionally, other significant keywords include "system," "children," "impact," "framework," "information," "simulation," and "care," suggesting their substantial presence in the research literature. Key concepts pertinent to disaster management and risk assessment, such as "preparedness," "resilience," "vulnerability," "disaster," and "climate change," are also notable in the word cloud, underscoring their importance in the context of emergency management research. Specifically, it is observed that the term "management" occurs 480 times, while "emergency management" appears 280 times within the corpus of 5777 research papers.

Trend Topics

Figure 5 illustrates the trend topics in climate change, sustainability, and emergency management over the years. The picture displays the top three trend topics in each year, with the majority of trend topics emerging prominently in 2014, 2016, 2018, and 2019. In

2018, the predominant trend topics in research articles include management, system, and information. Similarly, in 2016, the trend topics revolved around emergency management, care, and guidelines. The year 2014 sees a focus on children, injuries, and diagnosis as the prominent trend topics. In 2019, the majority of research articles centre around model, risk, and framework. Especially, in 2022, the trend topics shift slightly towards demand, government, and COVID-19. The term "demand" appears 18 times, "government" 16 times, and "COVID-19" 12 times within the research articles of that year.

Table 11: Top Five Sources of Production over Time.

Year	International Journal of Disaster Risk Reduction	Natural Hazards	Sustainability	Dental Traumatology	Disaster Medicine and Public Health Preparedness
2024	190	145	128	101	83
2023	190	145	128	101	83
2022	180	140	115	99	79
2021	146	131	85	93	64
2020	105	121	59	84	51
2019	83	110	33	74	47
2018	59	105	22	73	38
2017	39	93	10	69	28
2016	29	87	5	67	25
2015	17	74	2	64	21
2014	9	63	1	60	19
2013	3	55	1	54	17
2012	2	41	1	52	9
2011	0	31	1	45	5
2010	0	27	0	42	0
2009	0	25	0	33	0
2008	0	24	0	21	0
2007	0	22	0	16	0
2006	0	18	0	10	0
2005	0	17	0	5	0
2004	0	10	0	3	0
2003	0	8	0	3	0
2002	0	6	0	3	0
2001	0	6	0	3	0
2000	0	5	0	0	0
1999	0	4	0	0	0
1998	0	4	0	0	0
1997	0	2	0	0	0
1996	0	1	0	0	0
1995	0	0	0	0	0
1994	0	0	0	0	0
1993	0	0	0	0	0
1992	0	0	0	0	0
1991	0	0	0	0	0
1990	0	0	0	0	0
1989	0	0	0	0	0
1988	0	0	0	0	0

Table 12: Top 10 Highly Cited Research Papers.

Paper	DOI	Total Citations	TC per Year	Normalized TC	R
Hacke W, 2008, Cerebrovasc Dis	10.1159/000131083	1911	119.44	39.19	1
Cornell Ca, 2002, J Struct Eng	10.1061/(ASCE)0733-9445(2002)128:4(526)	1366	62.09	17.21	2
Martinez Aw, 2008, Anal Chem	10.1021/ac800112r	1125	70.31	23.07	3
Arnon Ss, 2001, Jama-J Am Med Assoc	10.1001/jama.285.8.1059	1050	45.65	12.23	4
Dennis Dt, 2001, Jama-J Am Med Assoc	10.1001/jama.285.21.2763	1010	43.91	11.76	5
Stiell Ig, 2001, Lancet	10.1016/S0140-6736(00)04561-X	984	42.78	11.46	6
Altay N, 2006, Eur J Oper Res	10.1016/j.ejor.2005.05.016	938	52.11	24.22	7
Johnston Sc, 2007, Lancet	10.1016/S0140-6736(07)60150-0	901	53.00	20.45	8
Muraro A, 2014, Allergy	10.1111/all.12429	859	85.90	38.49	9
Cutter Sl, 2008, Proc Natl Acad Sci USA	10.1073/pnas.0710375105	744	46.50	15.26	10
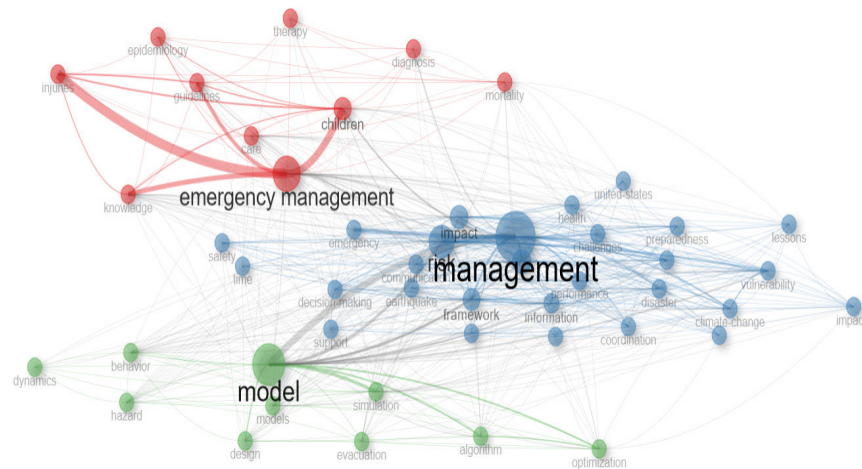
Figure 6: Co-Occurrences Network.

Co-Occurrences Network and Thematic Map

Figure 6 shows the co-occurrence network. The majority of research articles cover emergency management, management, and modeling. Co-occurrence analysis focuses on analyzing counts of co-occurring entities within a collection of units (Zhou *et al.*, 2022). This occurrence matrix represents a bipartite network that can be transformed into a collection of bibliographic networks such as coupling, co-citation, etc. (Aria and Cuccurullo, 2024).

Figure 7 indicates the thematic map. It creates a thematic map based on co-word network analysis and clustering. The methodology is inspired by the proposal of Cobo *et al.*, (2011) (Aria and Cuccurullo, 2024). The predominant themes in the research are management, emergency management, risk, impact,

health, climate change, system, model, information, performance, earthquake, vulnerability, and communications. These themes are mostly focused on climate change, sustainability, and emergency management.

Historiographic map

The historiographic map is a graph proposed by E. Garfield to represent a chronological network map of most relevant direct citations resulting from a bibliographic collection. histNetwork creates a historical citation network from a bibliographic data frame (Zhou *et al.*, 2022). Figure 8 depicts research papers focusing on the emergency management of dental trauma. The graph illustrates various aspects of knowledge and awareness
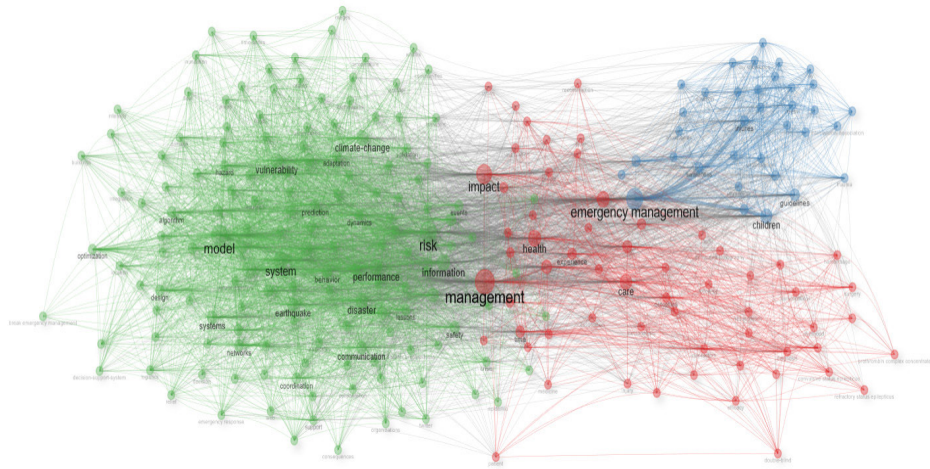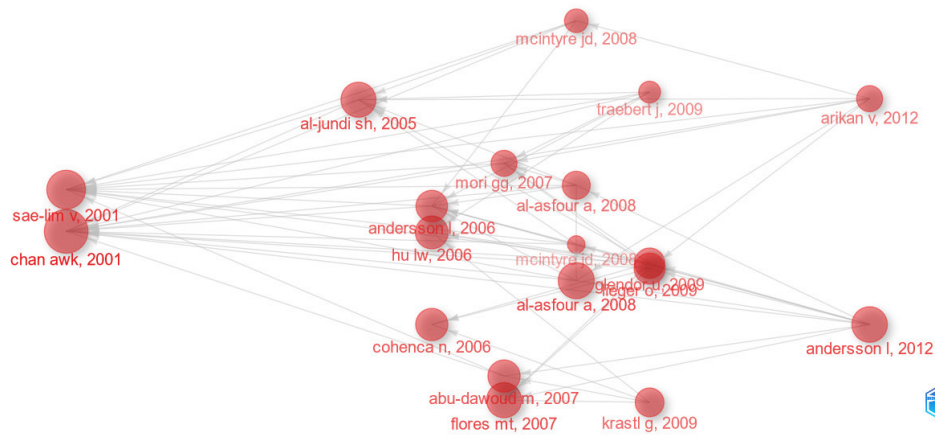
Figure 7: Thematic Map.

Figure 8: Historiographic Map.
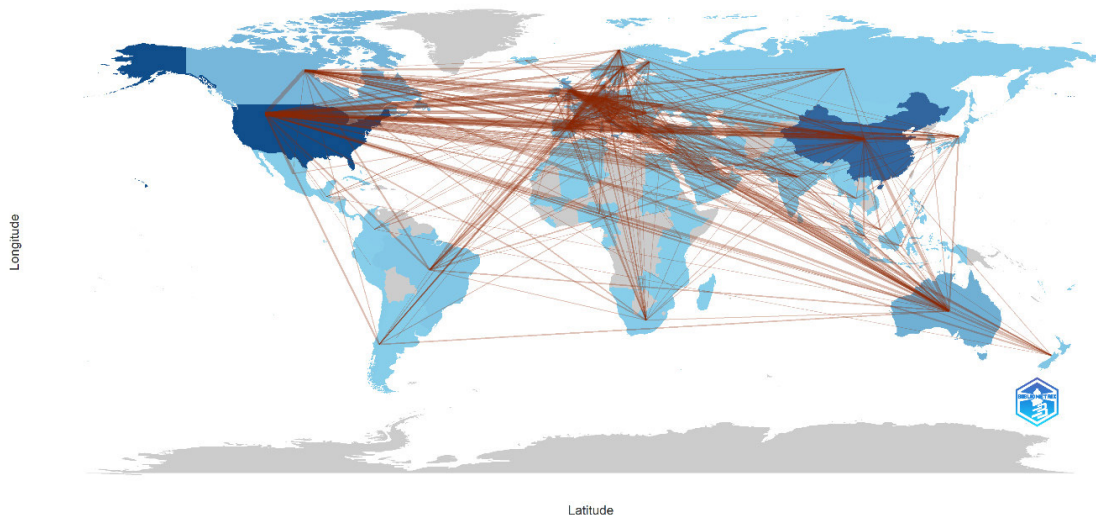
Country Collaboration Map

Figure 9: Country-Level Collaboration Network.

among different groups, such as teachers, regarding emergency management, particularly in educational settings. It is observed that Chan AWK, 2001, received a Global Citation Score (GCS) of 104 and a Local Citation Score (LCS) of 57, collaborating with the majority of research articles. Following this, Sae-Lim V, 2001, received a GCS of 77 and an LCS of 44 and is connected to other research articles as well.

Country Collaboration Network

Figure 9 illustrates the country's collaboration network. The USA has primarily collaborated with Canada, Mexico, Chile, Colombia, Brazil, Senegal, South Africa, Nigeria, Kenya, Yemen, Egypt, India, Saudi Arabia, Qatar, Kuwait, Jordan, Bangladesh, Russia, and Japan. Other countries have collaborated with three or four countries each.

CONCLUSION

The analysis of publications on Climate Change, Sustainability, and Emergency Management spanning 26 years provides valuable insights into the evolving landscape of research in these critical areas. With 5,777 cited research publications originating from 2,301 sources, it is evident that researchers and institutions worldwide are actively engaged in advancing knowledge and understanding of climate change, sustainability, and emergency management. Based on the above-mentioned study, the following are recommended:

1. Scientists, authors, and research and development organizations should come forward to increase the research output of publications on climate change, sustainability, and emergency management.

2. The analysis highlights the significant contribution of the USA, China, and Italy to research productivity in this field. The study recommends that other countries collaborate to produce a greater number of research studies.

3. Beijing Normal Univ has played a prominent role with 189 research publications. Other research institutions and scientists have collaborated with Beijing Normal Univ to secure more funding for research.

4. The findings emphasize the need for international collaboration and funding to address climate-related challenges. Policymakers should promote open-access data sharing, interdisciplinary research funding, and climate resilience programs. The scientometric insights can guide national research priorities, strengthen global partnerships, and inform sustainable policy frameworks aligned with the UN Sustainable Development Goals (SDGs).

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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