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Research Assessment of Climate Change Data: A Scientometric Construct

Prof. Shabahat Husain[1] and Dr. Muzamil Mushtaq[2]

[1]Department of Library and Information Science, Aligarh Muslim University, Aligarh, U.P., India
[2]Department of Library and Information Science, Aligarh Muslim University, Aligarh, U.P., India

Abstract: As we perceive it in the contemporary sense, we smell that climate change is the buzz blemish of research for governmental agencies, research institutes, academics in general and environmentalist in particular.
There are vibrant and prominent climatic changes occurring all around the globe as can be visualized by the volume of research output produced in different corners of the world and the attention towards these arenas lead to many specialized researches to conduct the assessment and evaluation of the data produced. The present study analysed the climate change data in the last five years (2009-2013) as produced in the field of environmental science and ecology. The source of data used for the study is Web of Science and it was found that about 17, 266 publications are produced in the field from different research-based institutes around the globe.
The published data were highest in the year 2013 i.e., 4788 number of publications, and the lowest was that of the year 2009 i.e., 2238 publications. The highest number of publications was produced from USA followed by England. W. Thuiller followed by P. Smith were the most prolific authors in the field of climate change. The articles were the most widely used document forms followed by reviews.
The prolific journals were *Climatic Change* and *Global Change Biology*. The study also assessed the citation patterns received by these articles and provides a comprehensive outline of the different aspects of the citations including the average, self and unique citations received.

Keywords: Climate change; environment sciences; ecology; scientometric study; Citation analysis; research assessment.

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1. Introduction

Climate change, global warming, natural habitats destruction, carbon footprint, reducing carbon emissions, green business and greener earth, depletion of the natural resources are the most ruminating research topics and emerging trends in the environment sciences research. These are also the most important environmental challenges at global level, impacting livelihoods and raising concerns for food production and security, water supply, health, and energy. Climate Change has become an urgent and pervasive preoccupation across the globe, which calls for international strategies and ambitious global response of dealing with it sincerely (Alex & Preedip Balaji, 2010). It is now widely regarded as one of the most serious challenges with adverse consequences going far beyond human apprehension and effecting the environment we live in.

Generally speaking, climate change refers to an alteration in the state of the climate that can be identified by changes in the mean and/or the variability of its properties that persists for an extended period, typically decades or longer (Intergovernmental Panel on Climate Change, 2008). Climate change reflects abnormal variations in the Earth's atmosphere and subsequent effects on other parts of the planet, such as on crop lands, reducing the annual yield (Challinor et al., 2007), and the melting of polar ice leading to a rise in sea level and flooding of low-lying countries and the plains that provide food (Wassmann et al., 2004). The oceans are growing more acidic because of CO2 absorption, which makes it harder for animals like corals and clams to build and maintain their shells and skeletons. Moreover, climate change can result in higher future ozone levels over polluted areas. Global warming, greenhouse gases, and limitations on CO2 emissions are at the top of the political agenda. Some countries have committed to reducing their anthropogenic greenhouse gas emissions, namely CO2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride, by at least 5% below 1990 levels, during the commitment period 2008 to 2012 (Li, Wang, & Ho, 2011). The current state of literature shows that there is an increasing trend worldwide in the research publication and majority of the researches have been concentrated in environmental science and ecology, and geology. The developed countries have contributed more in the climate change research. About 60% of the researches carried out on climate change are sponsored by funding agencies which is a positive move in the field of environmental climate change (Venkatesan, Gopalakrishnan, & Gnanasekaran, 2013).

The impact of the climate change phenomenon is being assessed both at the national and international level in the areas of water resources, agriculture, coastal lines, forestry, renewable energy and health areas. In the context of the initiated aspects, it is pertinent to inspect the current state of scientific research on climate change data. The analysis would be useful to inform policy discussions surrounding environmental climate change, to suggest future research directions on the topic and to provide a baseline for similar analysis designed to monitor future developments in the area.

2. Objectives

The study is undertaken by the following objectives:

1. To examine worldwide the year wise production of literature in climate change data during the period 2009-2013.
2. To examine the country wise growth of literature in climate change data.
3. To analyse the document type of the publications in climate change.
4. To identify and analyse the source titles used for publishing the research output.
5. To identify the language wise distribution of Publications in climate change data.
6. To identify most prolific authors contributing their research output in the field.
7. To identify the organisations producing the research in climate change.
8. To analyse the citations of the articles and their patterns during the select period.

3. Methodology

The study used the scientometric approach of analysing the research publications in climate change data. The Web of Science (an international multidisciplinary indexing and abstracting database) was used for collecting the relevant data and the search term used was 'Climate Change' in the field of environmental science and ecology. A total of 17, 266 records were identified in the field during the period of 2009-2013. The whole data were exported into MS Excel where the final analysis was done. The analysis was according to the yearwise and country wise distribution, document types, languages used, source titles, prolific authors, etc. in order to mine out the coherent revelations and to infer the results.

4. Research Implication and Validity

The present study takes its roots from the concerns raised by the environmentalists and the ecologists related to climate change and hence the study can be a strategic pathway to analyse and overview the scenario of the problem and its researches at global level. The selection of the most recent years adds the coherent value to the topic of contemporary discussion and can lead to a more current picture of the research in the climate change field. The study may be useful for higher policy making decisions regarding the tackling of environmental issues and challenges and can be a source of allocating the funds for the research in the area.

5. Analysis and Interpretation

5.1 Yearwise Distribution

Table 1 represents the distribution of publications among the five years. It is found that with every passing year, the number of publications in climate change data increases. The most recent year i.e., 2013 has the largest number of publications in the field and the year 2009 has the lesser number of publications. It can be stated that the increasing awareness and the global focus on the environmental issues in general and climate change in particular may be the reason for the increasing trend of the research publications with the passage of the years.

Table 1. Yearwise Distribution

S. No.	Publication Years	Publications	%
1	2013	4788	27.73
2	2012	3954	22.90
3	2011	3537	20.48
4	2010	2749	15.92
5	2009	2238	12.96
Total = 17266			100

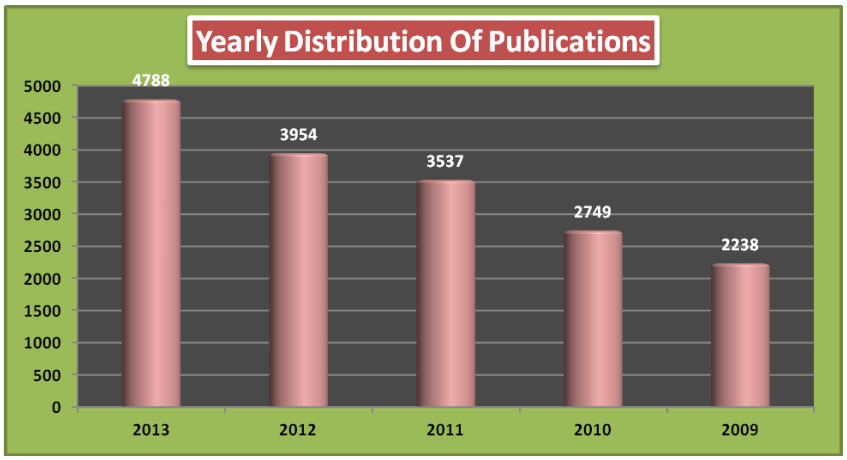

Figure 1

5.2 Distribution among Countries

As we know that climate change is a buzz word in every corner of the world and thus the research publications were produced from around the globe. But the growth of the publications varies among different nations and it was found that USA (6423) contributes the highest number of the publications followed by England (2177) and Australia (1956). Table 2 shows the country wise output of the publications and here only top 20 countries have been enlisted.

Table 2. Top 20 Countries

S. No.	Countries/Territories	Publications	%
1	USA	6423	37.2
2	England	2177	12.609
3	Australia	1956	11.329
4	Canada	1674	9.695
5	Germany	1664	9.637
6	Peoples Republic of China	1244	7.205
7	France	1011	5.855
8	Spain	932	5.398
9	Netherlands	915	5.299
10	Sweden	798	4.622
11	Switzerland	679	3.933
12	Italy	634	3.672
13	Norway	566	3.278
14	Denmark	493	2.855
15	Scotland	461	2.67
16	Finland	427	2.473
17	Japan	422	2.444
18	Austria	302	1.749
19	New Zealand	288	1.668
20	South Africa	279	1.616

5.3 Types of documents used for publications

The whole number of the research publications produced in the field of climate change constitutes different variety of document forms and it is being found that the journal articles are the most widely used forms for producing the research output in the field contributing about 88.29% of the literature in the field. The articles are the main means of research publications and the very essence of the research activities are in the modes of journal publications and hence the articles are the main channels of research publication in the field of climate change data.

This is followed by the reviews, editorial material, proceeding papers, books chapters and so on respectively by about 5.91%, 2.52%, 1.16%, and 0.75%. The table 3 below visualizes the different document types for the publication of the climate change data.

Table 3. Document types

S. No.	Document Types	Publications	%
1	Article	15245	88.29
2	Review	1021	5.91
3	Editorial Material	436	2.52
4	Proceedings Paper	201	1.16
5	Book Chapter	131	0.75
6	Letter	101	0.58
7	News Item	61	0.35
8	Correction	34	0.19
9	Book Review	31	0.17
10	Meeting Abstract	4	0.02
11	Book	1	0.005

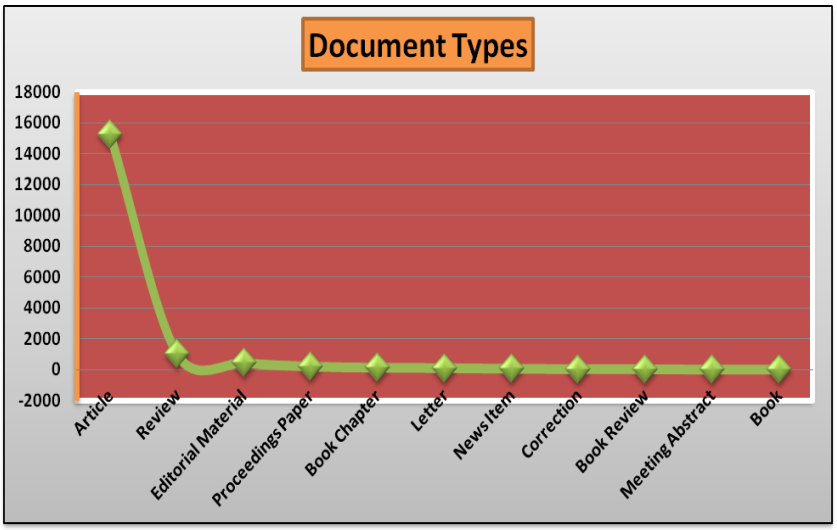

Figure 2

5.4 Distribution of publications among source titles

Table-4 shows the top 20 different types of source titles used for publishing the research data in the field of climate change. The most prolific and highly ranked journal comes out to be the 'Climatic Change' journal with 936 number of publications constituting about 5.421% of the total share. This is immediately followed by 'Global Change Biology' with 921 number of publications constituting about 5.334% of the total share. Hereafter, the number of research publications is greatly decreasing in 'Energy Policy' journal which is having 527 (3.052%) number of publications in its share.

Table 4. Top 20 Source Titles

S. No.	Source Titles	Pubs	%
1	*Climatic Change*	936	5.421
2	*Global Change Biology*	921	5.334
3	*Energy Policy*	527	3.052
4	*Environmental Research Letters*	378	2.189
5	*Marine Ecology Progress Series*	350	2.027
6	*Global Environmental Change Human And Policy Dimensions*	331	1.917
7	*Nature Climate Change*	301	1.743
8	*Climate Research*	264	1.529
9	*Biogeosciences*	261	1.512
10	*Water Resources Research*	256	1.483
11	*Ecological Modelling*	247	1.431
12	*Journal Of Biogeography*	227	1.315
13	*Biological Conservation*	219	1.268
14	*Ecology*	212	1.228
15	Science Of The Total Environment	211	1.222
16	*Environmental Science Technology*	200	1.158
17	*Molecular Ecology*	194	1.124
18	*Proceedings Of The Royal Society B Biological Sciences*	187	1.083
19	*Environmental Science Policy*	186	1.077
20	*Ecological Economics*	185	1.071

5.5 Languages used for communicating the research output

A language is said to be the carrier of the message and when it comes the communication of scholarly research, it adds more weight to it. From all the

publications used for communicating the research output, there are only 8 languages in which the literature on climate change has been published. It is found that the English language constitutes the major share of almost all of the publications with 17197 (99.60%) of publications produced in the language as shown in Table 5. While the German, Spanish and French languages are in two-digit figures and the remaining four are in one-digit figures constituting a little proportion to the overall share of the research production the field under study.

Table 5. Languages used for communication

S. No.	Languages	Publications	%
1	English	17197	99.60
2	German	33	0.19
3	Spanish	18	0.10
4	French	11	0.06
5	Italian	3	0.01
6	Dutch	2	0.01
7	Polish	1	0.006
8	Portuguese	1	0.006

5.6 Prolific authors of the publications

One of the main concerns of any scientometric/bibliometric study is the prolificity of the authors, who are the machineries of the research output. In the present study, there were large number of authors who had produced research publications in the climate change field but the list in the Table 6 below shows only the top 20 prolific authors. It is found that Thuiller is the most prolific author, who has been able to contribute about 56 (0.324%) research publications in the field. Smith, with 40 (0.232%), Araujo, with 38 (0.22), and Ciais, with 37 (0.214) publications occupy the second, third, fourth rank respectively in the list.

Table 6. Top 20 Authors

S. No.	Authors	Publications	%
1	Thuiller, W.	56	0.324
2	Smith, P.	40	0.232
3	Araujo, M.B.	38	0.22
4	Ciais, P.	37	0.214
5	Guisan, A.	35	0.203
6	Mcguire, A.D.	35	0.203
7	Brook, B.W.	33	0.191
8	Luo, Y.Q.	33	0.191

9	Penuelas, J.	31	0.18
10	Ford, J.D.	30	0.174
11	Thomas, C.D.	30	0.174
12	Callaghan, T.V.	29	0.168
13	Duarte, C.M.	28	0.162
14	Stenseth, N.C.	28	0.162
15	Bugmann, H.	27	0.156
16	Tol, R.S.J.	27	0.156
17	Visser, M.E.	27	0.156
18	Van Vuuren, D.P.	26	0.151
19	Zimmermann, N.E.	26	0.151
20	Chown, S.L.	25	0.145

5.7 Contribution of Research Institutes

There are different types of institutes from which the contribution in the field of climate change has emerged and amongst the list, most of the contributions are from the specialized institutes in science and technology with a bent towards environmental sciences. Table 7 below provides the list of the top 20 institutes that have produced research contributions in the field and the Chinese Academy of Sciences tops the whole list with 613 publications constituting about 3.55% of the total share. This is followed by US Geological Survey with 348 (2.016%), University California Berkeley with 255 (1.47%), James Cook University with 249 (1.44%) publications and so on as can be visualized below in the Table 7.

Table 7. Top 20 Institutes

S. No.	Organizations	Publications	% age
1	Chinese Academy of Sciences	613	3.55
2	US Geological Survey	348	2.016
3	University California Berkeley	255	1.477
4	James Cook University	249	1.442
5	US Forest Services	247	1.431
6	University California Davis	243	1.407
7	University Oxford	241	1.396
8	University British Columbia	236	1.367
9	University Washington	224	1.297
10	CSIC	215	1.245
11	University Copenhagen	209	1.21
12	University Queensland	200	1.158
13	University Helsinki	192	1.112

14	University Wisconsin	191	1.106
15	Wageningen University	187	1.083
16	University Colorado	178	1.031
17	University Melbourne	173	1.002
18	Australian National University	171	0.99
19	Lund University	171	0.99
20	ETH	169	0.979

5.8 Citations and their pattern

Table 8 gives the citation pattern of the research publications of the climate change data for the last five years selected for the study. The highest number of citations are in the year 2009 i.e., 47370 and the least in the year 2013 with 4534 citations. On the basis of the citations, the h-index is also highest in the year 2009 and least in the year 2013. It can be ascertained that the research output after the publication takes a span of time in order to visualize it to the scholarly community and in some cases, these are not getting the citations immediately. It is for the same reason that the earlier years of the study are receiving more citations than the recent years.

Table 8. Citations Pattern

S. No	Years	Citations Received	Without Self Citations	Average Citations per Item	h-Index
1	2009	47370	46951	21.17	80
2	2010	40002	39309	14.55	64
3	2011	30726	29846	8.69	46
4	2012	17502	16603	4.43	33
5	2013	4534	3312	0.95	13

The figure 3 and 4 below shows the comparative outline of the year-wise publications and the citations received by these publications. It is visualized that with each passing year, the number of publications go on increasing while as the number of citations go on decreasing.

Figure 3

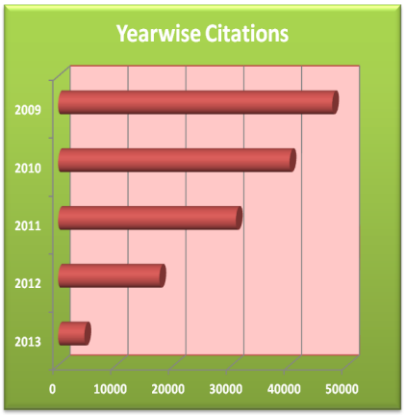

Figure 4

6. Conclusion

Any type of research is actually a reflection of the demand and desire of the intellectual brains to orient their resources towards those areas which are full of potential and dynamicity. When an area possesses the features of escalation in its intension and extension of boundaries, more work forces are driven up to that field. Climate change can be connotated to the same potentiality and the timely response from all corners of the world towards this environment challenge. It is both the requirement and the need of the hour and is a viable area for research. The publication productivity in the climate change research area proportionates a comparable figure in the last five years.

A large number of institutes from across the globe are undertaking research in the area, as was reflected from the distribution of publications among the nations and the institutes of the world. The recent years are more productive than the earlier years and the opposite is true for the number of citations received by the publications. The journal articles are the main vehicles for publishing with almost all of the literature being communicated in English language. The USA as a country and the Chinese Academy of Sciences as an institute of research are the most prolific names in the field of climate change research. Having such faceted inferences of the study, the climate change research area can be said to be on the shoulders of the researchers to undermine and undertake the areas on newer and nascent directions and frontiers in order to unleash the various pros and cons of climate change to the whole screen of the world.

References:

Alex. P & Preedip Balaji B. (2010). Mapping climate change research in India: a bibliometric approach. *Sixth International Conference on Webometrics, Informetrics and Scientometrics & Eleventh COLLNET Meeting*, October 19 – 22, 2010, University of Mysore, India.

Challinor, A.J., Wheeler, T.R., Craufurd, P.Q., Ferro, C.A.T., Stephenson, D.B., (2007). Adaptation of crops to climate change through genotypic responses to mean and extreme temperatures. *Agriculture, Ecosystems and Environment*, 119, pp. 190–204.

Intergovernmental Panel on Climate Change (2008). Climate Change 2007: *Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. In: Core Writing Team, Pachauri, R.K., Reisinger, A. (Eds.), IPCC, Geneva, Switzerland. Retrieved from, http://www.eoearth.org/view/article/153646/

Jinfeng Li, J., Wang, M.-H., & Ho, Y.-S. (2011). Trends in research on global climate change: A Science Citation Index Expanded-based analysis. *Global and Planetary Change*, 77, pp. 13–20.

Venkatesan, M., Gopalakrishnan, S., & Gnanasekaran, D. (2013). Growth of Literature on Climate Change Research: A Scientometric Study. *Journal of Advances in Library and Information Science*, 2 (4), 236-242.

Wassmann, R., Hien, N.X., Hoanh, C.T., Tuong, T.P., (2004). Sea level rise affecting the Vietnamese Mekong delta: water elevation in the flood season and implications for rice production. *Climate Change*, 66, pp. 89–107. Retrieved from, http://www2.gtz.de/wbf/4tDx9kw63gma/en-implication_slr_mekong_rice_production-2004.pdf