

**Review Paper**

# Scientometrics Exploration of Research Publications on Himalayas during the Year 1989-2014: A Scientific Review

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**Abstract**

The Himalayan region with its diversified bioresources, ethnicity, environmental and geological resources has attracted researchers throughout the world for advancement of scientific understanding and proposals of solutions to some of the intrinsic problem of the mountain region. These enormous knowledge products are manifested in the form of scientific articles or reviews in journals. However, little effort is made to evaluate country-wise contribution to the cumulative knowledge product of the Himalayan research. Therefore, this research paper is focused on scientometric analysis of Scopus database to evaluate research publications on Himalaya. This study analyses research output during 1989–2014 on different parameters including global publications share, Indian publication share and citation impact, etc. As per global publication concern, a total of 17076 papers were published which received 255179 citations with an average of 14.94 citations per paper and as per Indian scenario total of 7277 papers were published which received 56134 citations with an average of 7.71 citations per paper during the reporting year 1989-2014. India has contributed 35.93 percentage share of publication and secured first position. Moreover, collaboration at different levels such as author, institution is measured along with the status of collaboration at international level. This paper finds trend towards collaborative research is gaining momentum.

**Key Words:** Himalaya, scientometric, scopus, publication, bibliometric, etc.

**Introduction**

The Himalayas or Himalaya is a mountain range in the Indian subcontinent, which separates the Indo-Gangetic Plain from the Tibetan Plateau. The Himalaya region consists of series of parallel and converging mountain ranges forming the highest mountain region (with more than 30 peaks above 25000 ft) in the world and extends over 3500 km<sup>2</sup> length and cover an area of 43 lakh km<sup>2</sup> across the countries of Afghanistan, Pakistan, China, India, Nepal, Bhutan, Bangladesh and Myanmar<sup>1</sup>. The Himalayan region is highly rich in natural resources, forestry, wildlife, flora, fauna and biodiversity, snow, ice and water bodies, traditional knowledge and mountain agriculture but is still considered as underdeveloped with poor infrastructure<sup>2</sup>. The Himalayas have tremendously influenced the climate of the Indian sub-continent. Many countries and research organizations invested huge amount of intellectual, human and economic resources on the Himalayan research. The Indian Himalayan region (IHR) has a wide width (with 250-300 km at its widest part with an average width of 80 Km) stretches over 2,500 km and covers partially/fully twelve states of India, viz., Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and hills of Assam & West Bengal. It is inhabited by 3,96,28,311 people from multiple ethnic compositions and representing different cultural and biological diversity, representing about 16.2% of total area and 3.86% of total population of India, respectively<sup>3-6</sup>.

Few publications deal with the Himalayan R&D analysis. Sivasekaran and Srinivasaragava<sup>7</sup> examined 3841 global publications in Himalayan R&D during 2001-11, with focus on literature growth, authorship pattern, the extent of collaboration and identification of top 10 most productive institutions, authors and journals. Wangi and Ma<sup>8</sup> coupled the bibliometric and geographical information system technologies and by using spatial information mining and visualization techniques studied Quanghai-Tibet Plateau's region literature of China Himalayan region. There are many scientometric studies which are focused on various areas closely related to Himalayan R&D, such as plate tectonics<sup>9</sup>, geographical information system<sup>10-12</sup>, remote sensing<sup>13-14</sup>, climate change<sup>15-16</sup>, earthquake<sup>17</sup>, sediment related research in earth science<sup>19</sup>, water resources<sup>21-22</sup>, medicinal plants<sup>23-24</sup>, and Himalayan R&D<sup>5</sup>.

Periodicals are the primary source of information and an important media for communication. They play a major role for communicating the latest research findings and publishing the articles containing the current development in any field of

knowledge. Information is one of the most important resources for a nation and forms the integral base for the economic. Information has been growing out in an exponential rate which is often referred to as information explosion. Similarly, the periodical publication has also been increasing day by day since the first scientific journal started publication in 1665. An attempt has been made to study the research trends on the Himalayas with the help of scientometrics methods. The public-funded research needs to be measured because the resources are limited and public fund should be allocated properly, expenditure on research is growing continuously, inputs are required for policy making and contribution of institution and individual researcher should be highlighted. The G.B. Pant Institute of Himalayan Environment and Development (GBPIHED) is a premier organization of the country engaged in research and development on various aspects of the Indian Himalayan Region (IHR). Scientometric, which deals with the study of measuring and analyzing science, technology and innovation, is used for the analysis. The objective of the study is to obtain an analytical account of overall research output and current status of GBPIHED in the recent past. Quantitative evaluation of publications and citation data are the fundamental methods to measure the impact and influence of research and identify the significant of research outputs. Counting of cited references is highly efficient and productive because it relies upon the judgements of authors/researchers; they are more familiar with the content of published literature. Although citations do not fully indicate the quality of a paper, they serve as a key to evaluating impact and influence of research. Realizing the growing importance of the Himalayas in today's complex environmental condition, the present study aims at analyzing the research trends and output on the Himalayas in general.

The major objectives framed for the purpose of the study are, therefore, to analyze the Indian research performance in Himalayan R&D during 1989-2014, based on publications output, as indexed in Scopus database. In particular, the study focuses on the following objectives:

- To identify and analyze the rate of growth of the published literature on the Himalayas.
- To study the global and Indian research output with citation impact.
- To measure and calculate the relative growth rate of publications.
- To study the geographical distribution of the research output.
- To analyze the authorship pattern and examine the extent of the research collaboration.
- To examine the pattern of output according to performing sectors and the impact of the output as seen by Relative Citation Impact (RCI) and Average Citation per paper (ACPP)
- To assess the Institution wise research concentration on the Himalayas.

## Materials and Methods

### Methodology

The present study aims at analyzing the research output in the field of Himalayan studies. The Scientometric methodology was followed to compute various parameters like Average Citation Per Paper (ACPP), Cited Percentage (CP), proportion of Highly Cited Papers (HiCP) and Internationally Collaborated Papers (ICP), and different quality indexes (h-index, g-index, hg-index, P-index). The keyword "himalay\*" was used in "title, abstract and keyword" tag and restricting it to the period 1989-2014 in "date range tag" for searching the global publication data in the study and this was the main search string. The publications are mostly in the form of primary Journals, Notes, Letters, reviews, Editorial materials, Meeting abstracts, Bibliographic items and Discussions. The data were then manually checked to avoid redundancy and anomalies and non-relevant records were removed. The present papers and articles are retrieved and downloaded from the Scopus database (<http://www.scopus.com>) for the period 1989-2014 which includes research publications of the world and 10 most productive countries in Himalayan R&D. The authorship pattern has been identified along with top collaborative authors. The top productive authors were identified and their performances were accessed based on their publications' impact. The most collaborating institutions and countries have been recognized using extraction of information from affiliation text.

Defining a research domain via a set of queries is not a simple task. In this paper, the main string used to retrieve data on "Himalaya" was as follows:

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{TITLE-ABS-KEY (himalay*) AND TITLE-ABS-KEY (himalay*)}
AND PUBYEAR > 1988 AND PUBYEAR < 2015.
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This may be too simple an approach, using "himalay\*" as the query to define Himalayan region and considering it to be a useful approach when the domain is interdisciplinary and difficult to define; often experts in the field are themselves unable to agree on the precise nature of Himalayan research.

### Analysis and Discussion

During 1989-2014 a total of 17076 publications appeared globally on Himalayan R&D, while from India a total of 7277 publication came across. The annual average growth rate for Global and Indian publication during 1989-2014 calculated as 8.59 % and 15.53%. The average citation per paper observed as 14.94 and 7.71 for Global and Indian publications in Himalayan R&D during 1989-2014 (Table 1).

During 1989-2014 articles appeared as major group (82.42%), followed by conference papers (4.89%), however, unidentified publication were found 5.09 % of total publications (Table 2).

**Table1.** Growth and citation impact of Global and India in Himalayan R&D during 1989-2014.

Year of publication	Global			India		
	Total Publications	Total citations	Average Citation Per Paper	Total Publications	Total Citation	Average Citation Per Paper
1989	286	6125	21.42	42	446	10.62
1990	201	3704	18.43	37	328	8.86
1991	223	4048	18.15	44	417	9.48
1992	221	6827	30.89	37	986	26.65
1993	301	8514	28.29	50	699	13.98
1994	250	5767	23.07	52	628	12.08
1995	239	6163	25.79	53	660	12.45
1996	411	12382	30.13	144	1639	11.38
1997	410	9983	24.35	173	1855	10.72
1998	396	11712	29.58	137	2177	15.89
1999	416	10662	25.63	155	1724	11.12
2000	479	15761	32.90	164	2092	12.76
2001	486	15331	31.55	172	2570	14.94
2002	481	10561	21.96	195	2587	13.27
2003	490	12943	26.41	215	2678	12.46
2004	591	15003	25.39	254	3968	15.62
2005	673	13446	19.98	301	4864	16.16
2006	787	13465	17.11	321	3726	11.61
2007	901	13247	14.70	390	3727	9.56
2008	918	13818	15.05	434	3378	7.78
2009	972	11266	11.59	472	3410	7.22
2010	1194	12261	10.27	601	4266	7.10
2011	1272	9349	7.35	685	2919	4.26
2012	1326	6524	4.92	677	2279	3.37
2013	1529	4586	3.00	707	1539	2.18
2014	1623	1731	1.07	765	572	0.75
1989-2014	17076	255179	14.94	7277	56134	7.71

**Table 2.** Types of publications in Himalayan R&D during 1989-2014.

Type	1989-2014	% value
Article	13928	82.42
Article in Press	141	0.83
Book	65	0.38
Book Chapter	162	0.96
Business Article	3	0.02
Conference Paper	827	4.89
Conference Review	17	0.10
Editorial	36	0.21
Erratum	46	0.27
Letter	101	0.60
Note	100	0.59
Review	570	3.37
Short Survey	49	0.29
Undefined	854	5.05

During 1989-2014 total 121 countries contributed in the research output in Himalayan R&D, of which 69 countries published 1 to 10 papers, 17 countries 11 to 30, 4 countries 31 to 50, 12 countries 51-100, 11 countries 101 to 500, 4 countries 501 to 1000, 3 countries 1001 to 3000 publications and 1 country 3001 to 8000 publications. India appeared as most publishing (7391) country followed by United States (2506) and China (2357) during 1989-2014. During 1989-2014 the global publication share of top 10 countries ranged from 2.09% to 35.93%. India's share (35.93%) counted as highest followed by United States (12.18%) and China (11.46%) presented in Table 3.

Table 4 summarized the research output in Himalayan R&D by top 20 countries during 1989-2014. However, India appeared at top during 1989-1998, 1999-2008 and 2009-2014 but it shows an increase of 4.59% share during 1999-2008 to 2009-2014, during this period United States share declined by 2.64%.

**Table 3.** The global publication share of top 10 countries in Himalayan R&D during 1989-2014.

Sl. No.	Country	% share in global publication
1	India	35.93
2	United States	12.18
3	China	11.46
4	United Kingdom	5.47
5	Germany	3.96
6	France	3.15
7	Japan	2.98
8	Nepal	2.92
9	Canada	2.35
10	Pakistan	2.09

**Table 4.** Number of publication and % contribution of top 20 most productive countries in Himalayan R&D during 1989-2014.

S. No.	Country	1989-1998	%	1999-2008	%	2009-2014	%	Total	% contribution
1	India	770	33.68	2600	33.57	4021	38.16	7391	35.93
2	United States	382	16.71	1018	13.14	1106	10.50	2506	12.18
3	China	113	4.94	934	12.06	1310	12.43	2357	11.46
4	United Kingdom	208	9.10	450	5.81	468	4.44	1126	5.47
5	Germany	108	4.72	317	4.09	389	3.69	814	3.96
6	France	105	4.59	286	3.69	256	2.43	647	3.15
7	Japan	94	4.11	280	3.62	239	2.27	613	2.98
8	Nepal	39	1.71	257	3.32	305	2.89	601	2.92
9	Canada	62	2.71	196	2.53	225	2.14	483	2.35
10	Pakistan	35	1.53	133	1.72	261	2.48	429	2.09
11	Italy	62	2.71	131	1.69	197	1.87	390	1.90
12	Australia	44	1.92	128	1.65	190	1.80	362	1.76
13	Switzerland	41	1.79	143	1.85	137	1.30	321	1.56
14	Austria	20	0.87	93	1.20	82	0.78	195	0.95
15	Norway	20	0.87	64	0.83	108	1.02	192	0.93
16	Netherlands	11	0.48	49	0.63	111	1.05	171	0.83
17	Russian Federation	22	0.96	71	0.92	76	0.72	169	0.82
18	Sweden	13	0.57	35	0.45	57	0.54	105	0.51
19	New Zealand	14	0.61	43	0.56	46	0.44	103	0.50
20	South Korea	3	0.13	24	0.31	69	0.65	96	0.47

Contribution of top 20 global institutions during 1989-2014 is being presented in Table 5. Attaining top 3 positions total 13 Indian institutions occupied place in list. 6 institutions from China and 1 from Nepal appeared in top 20 global institutions list.

**Table 5.** Top 20 Institutions during 1989-2014 as per Scopus database Keyword = Himalay\*

Sl. No.	Name of Institution	Total Number of Publications
1	Wadia Institute of Himalayan Geology	571
2	Govind Ballabh Pant Institute of Himalayan Environment and Development	475
3	Kumaun University India	419
4	Chinese Academy of Sciences	399
5	Hemwati Nandan Bahuguna Garhwal University	365
6	Indian Institute of Technology Roorkee	364
7	China University of Geosciences	343
8	Chinese Academy of Geological Sciences	253
9	University of Delhi	242
10	National Geophysical Research Institute India	203
11	Tribhuvan University	188
12	Institute of Geology and Geophysics Chinese Academy of Sciences	187
13	University of Kashmir	176
14	Jawaharlal Nehru University	149
15	Institute of Himalayan Bioresource Technology India	147
16	Kunming Institute of Botany Chinese Academy of Sciences	137
17	Birbal Sahni Institute of Palaeobotany	133
18	Indian Space Research Organization	130
19	Graduate University of Chinese Academy of Sciences	127
20	Physical Research Laboratory India	124

Table 6 provides a list of top 30 authors who contributed good number of research publication on Himalayan R&D during 1989-2014. Searle, MP, Maikhuri, RK and Singh, SP occupied the first three positions. Among the Top 30 authors, 25 authors were from India.

**Table 6.** Scientometric profile of top 30 most productive authors in Himalayan R&D during 1989-2014

S. No.	No of Publications	Author Name	Country
1	89	Searle, M.P.	Tibet
2	85	Maikhuri, R.K.	India
3	69	Singh, S.P.	India
4	67	Garzanti, E.	Italy
5	66	France-Lanord, C.	France
6	62	Owen, L.A.	USA
7	58	Rao, K.S.	India
8	55	Harris, N.	UK
9	49	Yao, T.	China
10	48	Rawal, R.S.	India
11	44	Todaria, N.P.	India
12	43	Gupta, H.S.	India
13	42	Bhatt, B.P.	India
14	42	Gupta, R.C.	India
15	40	Palni, L.M.S.	India
16	40	Upreti, D.K.	India
17	39	Pandey, A.	India
18	39	Rawat, G.S.	India
19	39	Sharma, C.M.	India
20	39	Sharma, E.	India
21	38	Ding, L.	India
22	38	Samant, S.S.	India
23	37	Kotlia, B.S.	India
24	37	Kumar, R.	India
25	37	Kumar, S.	India
26	36	Rai, S.C.	India
27	35	Ahmad, T.	India
28	35	Dhar, U.	India
29	35	Hodges, K.V.	India
30	35	Kuniyal, J.C.	India

Table 7 depicts the top 20 journals in which majority of articles appeared during 1989-2014. With 551 articles the journal "Current Science" found obtaining top position followed by the "Journal of Asian Earth Science" (335) and "Journal of the Geological Society of India" (314) respectively.

**Table 7.** Distribution of publications in top 20 journals

Sl.	Name of journal	No of publications
1	Current Science	551
2	Journal of Asian Earth Sciences	335
3	Journal of the Geological Society of India	314
4	Earth and Planetary Science Letters	243
5	Tectonophysics	216
6	Geology	176
7	Mountain Research and Development	143
8	Geological Society Special Publication	138
9	Acta Petrologica Sinica	127
10	Tectonics	121
11	Geophysical Research Letters	104
12	Himalayan Geology	104
13	Indian Journal of Agricultural Sciences	96
14	Geomorphology	92
15	Gondwana Research	88
16	Natural Hazards	87
17	Bulletin of the Geological Society of America	81
18	Journal Geological Society of India	81
19	International Journal of Remote Sensing	80
20	Geophysical Journal International	76

Analysis of subject-wise of distribution of publication during 1989-2014 reflects the fact that highest publication output coming from "Earth and Planetary sciences" followed by Agricultural and Biological Sciences" and "Environmental Sciences" (Table 8).

**Table 8.** Subject-wise distributions of publication output in Himalayan R&D during 1989-2014

Sl.	Subject area	1989-1998	1999-2008	2009-2014	Total
1	Earth and Planetary Sciences	1838	2876	3240	7954
2	Agricultural and Biological Sciences	567	1832	2364	4763
3	Environmental Science	1135	1042	1432	3609
4	Social Sciences	148	391	657	1196
5	Medicine	159	317	676	1152
6	Biochemistry, Genetics and Molecular Biology	137	325	662	1124
7	Engineering	151	286	390	827
8	Multidisciplinary	97	401	304	802
9	Pharmacology, Toxicology and Pharmaceutics	59	69	303	431
10	Energy	32	129	211	372
11	Immunology and Microbiology	22	114	189	325
12	Physics and Astronomy	34	150	139	323
13	Chemistry	37	113	162	312
14	Arts and Humanities	10	79	179	268
15	Computer Science	10	42	168	220
16	Veterinary	39	76	75	190
17	Health Professions	18	59	64	141
18	Business, Management and Accounting	17	55	48	120
19	Chemical Engineering	5	31	80	116
20	Materials Science	12	26	45	83
21	Economics, Econometrics and Finance	4	18	52	74
22	Mathematics	12	15	40	67
23	Nursing	0	8	20	28
24	Neuroscience	11	8	8	27
25	Psychology	6	7	11	24
26	Undefined	9	11	1	21
27	Decision Sciences	6	4	9	19
28	Dentistry	4	1	3	8

## Conclusion

This study presents result of a detailed scientometric analysis of research publications on Himalaya during the period 1989-2014. The publications indexed in Scopus have been analyzed and different scientometric indicators were obtained. These results may be useful for prospective students, researchers and research policy makers in the institution and other relevant bodies. As per scientometric analysis, India, rank first in publication output among top 10 most productive countries in Himalayan R&D and G.B. Pant Institute of Himalayan Environment and Development is in second position among top 20 Institution of the world as per scopus database keyword "Himalay\*". Total 25 authors from India contributed good number of research publications on Himalayan R&D during 1989-2014 among top 30 most productive authors of the world.

Networking and extensive collaboration can play a key role in raising good research questions and hypothesis and subsequently improve the citation impact of research. The quality of research is also affected by inadequate expertise, lack of uniform methodologies and instrumentation and data collection and synthesis protocols. There is also a need for introduction of better field research facilities and system of rewards and establishment of long-term ecological monitoring sites to collect and monitor regular data.

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