

Biodiversity Research in India: A Bibliometric Analysis

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(Received on 03 May 2011 and accepted on 28 May 2011)

Abstract

The study examines India's performance based on its publication output in Biodiversity during 1992-2009, based on several parameters, including the country annual average growth rate, global publication share, rank among ten countries of the world, national publication output, authorship pattern, high productive Indian Institutes etc. The study uses 18 years (1992-2009) publications data in Biodiversity of India and other countries drawn from Scopus International Multidisciplinary Bibliographical Database.

Keywords: Bibliometrics, Biodiversity Research

1. INTRODUCTION

The variety of life on Earth, its biological diversity is commonly referred as biodiversity. The number of species of plants, animals and microorganism, the enormous diversity of genes in there species, the different ecosystems on the plant, such as deserts, rainforests and coral reefs are all part of a biological diverse earth. Biodiversity encompasses the variety of all life on earth. India is one of the 12-mega diverse countries of the world. With only 2.5% of the land area, India already accounts for 7.8% of the global recorded species. India is also rich in traditional and indigenous knowledge, both coded and informal [1].

Biodiversity is a multi-disciplinary subject involving diverse activities and actions. The stakeholders in biological diversity include the Central Government, State Governments, Institutions of local self-governmental organizations, industry, etc. One of the major challenges before India lies in adopting an instrument, which helps realize the objectives of equitable sharing of benefits enshrined in the convention on Biological Diversity.

1.1 Bibliometrics

Measures of a scientific writer's influence are called Bibliometrics. Techniques for discerning this influence, or impact, range from simple counts of publications to sophisticated mathematical equations.

Pritchard (1969) emphasized that the purpose of bibliometrics is "to shed light on the processes of written communication and of the nature and course of development of a discipline, by means of counting and analyzing the various facets of written communication [2]."

Bibliometrics is a set of methods used to study or measure texts and information. Citation analysis and content analysis are commonly used bibliometric methods. While bibliometric methods are most often used in the field of library and information science, bibliometrics have wide applications in other areas. In fact, many research fields use bibliometric methods to explore the impact of their field [3], the impact of a set of researchers, or the impact of a particular paper. Bibliometrics are now used in quantitative research assessment exercises of academic output which is starting to threaten practice based research.

2. OBJECTIVES

The main focus of the study is:

- i To identify the annual distribution and growth of Biodiversity in India during the period 1992-2009.
- ii To analyze the status, publication share, rank and growth of India's research output during the period 1992-2009 in biodiversity.
- iii To analyze the productivity of Indian research output in biodiversity.

- iv To analyze the productivity of 20 major Indian institutions participating in research in biodiversity.
- v To identify the authorship pattern and the degree of collaboration of Indian authors in the field of biodiversity.

3. METHODOLOGY

This study is based on the publications output as indexed by Scopus database for the period 1992-2009.

4. DATA ANALYSIS AND INTERPRETATION

Table 1 Year-wise Distribution of Biodiversity Articles of India's Research Output (1992-2009)

Sl. No.	Year	Frequency	%	Cumulative	Cumulative %
1	1992	1	.0	1	.0
2	1993	2	.0	3	.1
3	1994	5	.1	8	.2
4	1995	4	.1	12	.3
5	1996	46	1.0	58	1.3
6	1997	84	1.9	142	3.2
7	1998	75	1.7	217	4.9
8	1999	89	2.0	306	6.9
9	2000	165	3.7	471	10.7
10	2001	210	4.8	681	15.4
11	2002	222	5.0	903	20.4
12	2003	255	5.8	1158	26.2
13	2004	347	7.9	1505	34.1
14	2005	439	9.9	1944	44.0
15	2006	511	11.6	2455	55.6
16	2007	562	12.7	3017	68.3
17	2008	649	14.7	3666	83.0
18	2009	751	17.0	4417	100
	Total	4417	100	-	-

The year-wise growth of India's research output of biodiversity is presented in Table 2 by three blocks of six years. Of the total publication output of biodiversity, only 142 papers (3.21%) have been published during the first 6 years (1992-1997) and the majority research output (73.78%) was publishing in the current six years (2004-2009).

The study uses 18 years publications data from 1992 to 2009 on India and other countries in the area of biodiversity as defined in Scopus database classification. Scopus classifies the entire S&T literature under four broad subjects, such as physical sciences, life sciences, engineering sciences, and health sciences.

Table 2 Growth of India's Research Output of Biodiversity - 6 Years Block (1992-2009)

Sl. No.	6 Years Block	No. of Records	%
1	1992-1997	142	3.21
2	1998-2003	1016	23.00
3	2004-2009	3259	73.78
	Total	4417	100

Table 3 shows that India holds 7th rank among the ten countries of the world in biodiversity, with its global publications share of 2.81% as computed from cumulative world publications output data for 1992-2009. India has shown rise in its global publication share, rising from 0.51% to 3.30% from the year 1992 to 2009.

Table 3 Research Outputs of Biodiversity Publications (1992-2009)

Sl. No.	Country	Total Paper			% Share of Papers		
		1992	2009	1992-2009	1992	2009	1992-2009
1	USA	41	5598	44895	21.03	24.58	28.52
2	UK	17	2218	17252	8.72	9.74	10.96
3	Germany	7	1746	10320	3.59	7.67	6.56
4	Canada	2	1297	10082	1.03	5.69	6.40
5	China	0	1875	7974	0.00	8.23	5.07
6	Japan	1	686	4816	0.51	3.01	3.06
7	India	1	751	4417	0.51	3.30	2.81
8	Taiwan	0	227	1060	0.00	1.00	0.67
9	S.Korea	0	193	1002	0.00	0.85	0.64
10	Indonesia	0	109	690	0.00	0.48	0.44
	Others	126	8075	54913	64.62	35.46	34.88
	Total	195	22775	157421	100.00	100.00	-

These publications have been further analysed on “Single Author”, “Two Authors”, “Three Authors” and “More than three authors”. Further “Degree of Collaboration” has also been calculated and the same is shown in Table 4.

Degree of Collaboration

Subramaniam [4] proposed a mathematical formula for calculating author’s degree of collaboration in a discipline. The degree of collaboration among authors is the ratio of the number of collaborative publications in the total number of publications published in a discipline during certain period of time. The values of degree of collaboration can be calculated both for publications and citations. It is expressed mathematically as:

$$G = \frac{N_m}{N_m + N_s}$$

- Where g = Group Coefficient of a discipline
- N_m = Number of multiple authors during a specific period in a discipline
- N_s = Number of single authored works in a discipline during a given period of time.

Degree of Collaboration = 0.86

Table 4 Authorship Pattern

Sl.No.	No. of Authors	No. of Records	%
1	Single Author	615	13.92
2	Two Authors	1197	27.10
3	Three Authors	1027	23.25
4	More than three authors	1578	35.73
	Total	4417	100

Table 5 shows that the largest number of publications (416) were published in Current Science, followed by Ecology Environment and Conservation (97), Zoos Print Journal (96), Biodiversity and Conservation (79), and Tropical Econology (77).

Table 5 Top 25 Journals of Indian Contributions on Biodiversity

Sl. No.	Journal	No. of Records	Rank
1	Current Science	416	1
2	Ecology Environment and Conservation	97	2
3	Zoos Print Journal	96	3
4	Biodiversity and Conservation	79	4
5	Tropical Ecology	77	5
6	International Journal of Ecology and Environmental Sciences	67	6
7	Journal of Environmental Biology	63	7
8	Asian Journal of Microbiology Biotechnology and Environmental Sciences	57	8
9	Indian Journal of Experimental Biology	56	9
10	Chemistry and Biodiversity	55	10
11	Indian Forester	38	11
12	Genetic Resources and Crop Evolution	35	12
13	Pollution Research	32	13
14	World Journal of Microbiology and Biotechnology	32	13
15	Journal of Tropical Forest Science	30	15
16	Asian Agri History	28	16
17	Zootaxa	28	16
18	Journal of Biosciences	28	16
19	Indian Journal of Animal Sciences	27	19
20	Indian Journal of Marine Sciences	27	19
21	Forest Ecology and Management	27	19
22	Environmental Conservation	27	19
23	Bioresource Technology	25	23
24	Theoretical and Applied Genetics	24	24
25	Environmental Monitoring and Assessment	24	24

The contributions of the Indian Institutions has been analysed and the same is shown in Table 6.

Based on the average citations per paper the Jawaharlal Nehru University holds the first position (13.42 ACPP), followed by Indian Institute of Science (11.70) and International Crops Research Institute for the Semi-Arid Tropics (10.67).

Table 6 Top 25 Indian Institutions

Sl. No.	Affiliation	Articles	Citations	ACPP
1	Indian Institute of Science	155	1814	11.70
2	Govind Ballabh Pant Institute of Himalayan Environment and Development	137	849	6.20
3	Banaras Hindu University	108	851	7.88
4	University of Delhi	108	693	6.42
5	Wildlife Institute of India	83	651	7.84
6	Pondichery University	77	763	9.91
7	National Botanical Research Institute India	72	343	4.76
8	Ashoka Trust for Research in Ecology and the Environment	63	432	6.86
9	National Institute of Oceanography India	61	387	6.34
10	North Eastern Hill University India	56	195	3.48
11	M/S Swaminathan Research Foundation	52	235	4.52
12	Indian Agricultural Research Institute	52	384	7.38
13	Jawaharlal Nehru University	50	671	13.42
14	International Crops Research Institute for the Semi-Arid Tropics	48	512	10.67
15	Indian Institute of Chemical Technology	48	471	9.81
16	Hemwati Nandan Bahuguna Garhwal University	46	108	2.35
17	St. Xavier's College Palayamkottai	42	68	1.62
18	Mangalore University India	41	306	7.46
19	University of Calcutta	40	202	5.05
20	University of Madras	39	252	6.46
21	The Energy and Resources Institute India	38	390	10.26
22	Indian Institute of Remote Sensing	34	190	5.59
23	University of Agricultural Sciences, Bangalore	33	321	9.73
24	National Bureau of Plant Genetic Resources India	33	82	2.48
25	Panjab University	33	269	8.15

Table 7 shows the profile of Indian authors in the field of biodiversity with the publication of more than 20 articles.

5. CONCLUSION

India published 4417 research papers in biodiversity during 1992-2009, with an average output of 245 papers per year. India holds 7th rank among the ten countries of the world in biodiversity, with its global publications share of 2.81%.

Collaborative research can be seen in biodiversity contribution. 86.08% of the research outputs are of collaborative in nature. Only 13.92% of Research contributions are of solo research.

Table 7 Indian Authors with more than 20 Articles Publications

Sl. No.	Name of the Author	Affiliation	No. of Records
1	Parthasarathy, N.	Salim Ali Sch. Ecol. Environ. Sci., Pondicherry University, Pondicherry 605 014, India	35
2	Singh, M.	Chemistry Research Lab., Deshbandhu College, University of Delhi, New Delhi-110019, India	31
3	Roy, P.S.	National Remote Sensing Agency (NRSA), Hyderabad, 500 037, India	26
4	Maikhuri, R.K.	G.B. Pant Inst. Himalayan E., Garhwal Unit, P.Box-92, Srinagar Garhwal, 246174, U.P., India	26
5	Ganeshiah, K.N.	Tata Energy Research Institute, 5017 Palace Road, Bangalore 560 052, India	25
6	Davidar, P.	Salim Ali Sch. of Ecol./Environ. S., Pondicherry Univ., Kalapet, Pondicherry 605 014, India	25
7	Dhar, U.	G.B. Pant Institute of Himalayan Environment and Development, Almora, 263643 Uttaranchal, India.	25
8	Saxena, K.G.	School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India	23
9	Sridhar, K.R.	Department of Biosciences, Mangalore University, D.K. 574 199, Mangalore, Kamataka, India	23
10	Singh, J.S.	Department of Botany, Banaras Hindu University, Varanasi 221 005, India	22
11	Rawat, G.S.	Rawat, G.S., Wildlife Institute of India, Post bagno. 18, Dehradun 248 001, Uttaranchal, India	21
12	Gadgil, M.	Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012, India	21
13	Bawa, K.S.	Ashoka Trust for Research in Ecology and the Environment, 659 5th A Main Road, Hebbal, Bangalore 560 024, India	20
14	Bhat, D.J.	Bhat, D.J., Department of Botany, Goa University, Goa-403 206, India	20

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Among the top 25 Indian Institutions, the Jawaharlal Nehru University holds the first position based on the Average Citations Per Paper (13.42) (ACPP), followed by Indian Institute of Science (11.70), and International Crops Research Institute for the Semi-Arid Tropics (10.67).

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