# World Literature on Environmental Management Research: A Scientometric Study

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Abstract

*The study of the analyses the Environmental Management research output from around the world during 1989-2014 on different parameters including the growth, global publications, contribution of major collaborative countries, most productivity institutions, contribution of various subjects fields and most productive journals. Web of Science database has been used to retrieve the data for 26 years (1989-2014) by search string is Environmental management. Totally 61877 records were retrieved from the database. The growth trend in booming taken the sample duration in this field of Environmental Management research output.*

Keywords

Environmental Management; Research Productivity; Growth rate; Scientometric analysis; collaboration.

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## INTRODUCTION

Environment literally means Surrounding in which we are living. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non living component like soil, air water. Environmental studies are the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It involves the mobilization of resources and the use of government to administer the use of both natural and economic goods and services. "Scientometrics" can be defined as the measuring of scientific and technological activity. Bibliometric is a branch of scientmetric that focuses principally on the quantitative study of scientific publication for statistical purpose.

## OBJECTIVES OF THE STUDY

1. To examine the growth rate and doubling time of Environmental Management output.
2. To identify the source wise research publications in the field.
3. To know the output with respect to the country.
4. To identify the core journal in the field of Environmental Management research.
5. To identify the institution wise distribution

## DATA SOURCE AND METHODOLOGY

There are various sources contributing to the research output in the field of Environmental Management research by the scientist all over the world. The necessary data were collected from database of SCI, SSCI, and A&HCI to (totally twenty six years) to download the records from web of Knowledge. An advanced search strategy involving "Environmental Management" as the search string used to search and download data using title, Abstract and Keywords field, resulting in downloading of 61877 records based on the above string. The data were analyzed by using the Histcite and MSExcel software application as per the objectives of the study.

## DATA ANALYSIS AND INTERPRETATIONS

### Relative Growth Rate and Doubling Time of Environmental Management Research

The analysis of the growth rate in Environmental Management research publications is one of the

prime aspects of discussion. Table 1 gives the year-wise distribution of articles in Environmental Management research. The number from year to year and increases in the number of articles from the year 1989-2014. Out of the total 61877 articles, the maximum number of articles in the year of 2014, contributing 6838 articles, which is 11.05% of total publication. In this connection, a study on the growth rate of publications provides some useful results. The rate of growth of literature on Environmental Management research is determined by calculating relative growth rate (0.19) and doubling time (23.13 years) of the publication.

**Table 1: Showing Growth Rate and Doubling time of Environment Management Research output**

| Year | R. o/p | Cum. o/p | $log_e 1^p$ | $log_e 2^p$ | Rt(P) | Dt(P) |
|---|---|---|---|---|---|---|
| 1989 | 48 | 48 | - | 3.871 | - | - |
| 1990 | 111 | 159 | 3.871 | 4.709 | 0.839 | 0.826 |
| 1991 | 465 | 624 | 4.709 | 6.142 | 1.432 | 0.484 |
| 1992 | 593 | 1217 | 6.142 | 6.385 | 0.243 | 2.850 |
| 1993 | 689 | 1906 | 6.385 | 6.535 | 0.150 | 4.613 |
| 1994 | 824 | 2730 | 6.535 | 6.714 | 0.179 | 3.868 |
| 1995 | 974 | 3704 | 6.714 | 6.881 | 0.167 | 4.140 |
| 1996 | 996 | 4700 | 6.881 | 6.903 | 0.023 | 30.465 |
| 1997 | 1099 | 5799 | 6.903 | 7.002 | 0.098 | 7.060 |
| 1998 | 1137 | 6936 | 7.002 | 7.036 | 0.034 | 20.294 |
| 1999 | 1268 | 8204 | 7.036 | 7.145 | 0.109 | 6.346 |
| 2000 | 1543 | 9747 | 7.145 | 7.341 | 0.196 | 3.527 |
| 2001 | 1532 | 11279 | 7.341 | 7.334 | 0.007 | 99.000 |
| 2002 | 1751 | 13030 | 7.334 | 7.467 | 0.134 | 5.174 |
| 2003 | 2012 | 15042 | 7.467 | 7.606 | 0.139 | 4.990 |
| 2004 | 2008 | 17050 | 7.606 | 7.604 | 0.002 | 346.500 |
| 2005 | 2319 | 19369 | 7.604 | 7.748 | 0.144 | 4.816 |
| 2006 | 2719 | 22088 | 7.748 | 7.908 | 0.159 | 4.358 |
| 2007 | 3144 | 25232 | 7.908 | 8.053 | 0.145 | 4.771 |
| 2008 | 3728 | 28960 | 8.053 | 8.223 | 0.171 | 4.061 |
| 2009 | 4266 | 33226 | 8.223 | 8.358 | 0.134 | 5.155 |
| 2010 | 4582 | 37808 | 8.358 | 8.429 | 0.072 | 9.640 |
| 2011 | 5215 | 43023 | 8.429 | 8.559 | 0.129 | 5.360 |
| 2012 | 5749 | 48772 | 8.559 | 8.656 | 0.098 | 7.087 |
| 2013 | 6267 | 55039 | 8.656 | 8.743 | 0.086 | 8.053 |
| 2014 | 6838 | 61877 | 8.743 | 8.830 | 0.087 | 7.943 |
| **Total** | **61877** | | | | 4.979 (0.19) | 601.38 (23.13) |

**Document wise Distribution of Publications**

Table 2 indicates that document wise output in Environmental Management research through various communication channels. Journal Articles channels are in the first position with 50360 (81.39%), followed by Review which occupies the second place with 4979 (8.05%) records. Article; Proceedings Paper occupy the third place with 4879 (7.88%) records of the remaining literature. Remaining 12 percent of articles were comes through in other format communication channels.

**Table 2: Source wise distribution of Environmental Management Research**

| Document Type | Recs. | LCS | GCS | Document Type | Recs. | LCS | GCS |
|---|---|---|---|---|---|---|---|
| Article | 50360 | 54147 | 644579 | Reprint | 21 | 9 | 723 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Review | 4979 | 8677 | 38 | Software Review | 6 | 1 | 191 |
| Article; Procs. Paper | 4879 | 4826 | 95617 | Discussion | 4 | 8 | 182854 |
| Editorial Material | 875 | 941 | 60 | Correction, Addition | 2 | 0 | 5212 |
| Book Review | 285 | 5 | 7 | Bibligraphical Item | 2 | 0 | 81 |
| Review; Book Chapter | 144 | 505 | 1 | Database Review | 1 | 0 | 551 |
| Meeting Abstract | 136 | 0 | 24 | Item About an Individual | 1 | 0 | 1 |
| Note | 42 | 41 | 9159 | Bibligraphy | 1 | 1 | 2 |
| News Item | 41 | 3 | 0 | Chronology | 1 | 0 | 0 |
| Article ;Book Chapter | 38 | 39 | 790 | Music Score | 1 | 0 | 0 |
| Letter | 36 | 129 | 0 | **Total** | **61877** | **69332** | **940030** |
| Correction | 22 | 0 | 140 | | | | |

Table 3 indicates that the top twenty most productivity countries in research publications on Environmental Management. Generally, same article will calculate tow or many times based on their collaborative trends. According to that, United States of America has the first place with 18140 (60.5%) records, and followed by United Kingdom with 6722 (22.0%) second position, Australia with 5113 (16.0%) third position, Canada with 4591 (15.1%) and Peoples R China with 3543 (9.7%) fourth and fifth position among these countries.

**Table 3: Most Productivity Countries (top 20 countries, totally 194 countries)**

| Country | Recs. | TLCS | TGCS | Country | Recs. | TLCS | TGCS |
|---|---|---|---|---|---|---|---|
| USA | 18140 | 23901 | 372885 | Netherlands | 2059 | 3492 | 46586 |
| UK | 6722 | 9860 | 137962 | Brazil | 1754 | 1150 | 12952 |
| Australia | 5113 | 8130 | 90905 | Sweden | 1357 | 2398 | 28760 |
| Canada | 4591 | 7338 | 85807 | Japan | 1154 | 1022 | 11170 |
| Peoples R China | 3543 | 4859 | 36093 | India | 1121 | 1002 | 13456 |
| Spain | 2862 | 2748 | 34001 | Unknown | 1094 | 1213 | 8275 |
| Germany | 2682 | 3681 | 39718 | Switzerland | 1032 | 1654 | 22732 |
| Unknown | 2657 | 1826 | 47669 | South Africa | 905 | 1056 | 13290 |
| France | 2528 | 2701 | 40050 | Denmark | 853 | 1905 | 16479 |
| Italy | 2475 | 2819 | 29271 | New Zealand | 848 | 1159 | 16277 |

**Journal wise Distribution of Publications**

The study found that the total research output of the Environmental Management for the study period (1989-2014) published in 6192 journals. The scientists have published the highest number of article in the Journal of Environmental Management, which is about 930 (2.9%), followed by Environmental Management 813 (2.9%) and Journal of Cleaner Production 812 (2.4%) occupied third and fourth positions.

**Table 4: Most Productivity Journals in Environmental Management Research**

| S.No | Journal Name | Recs. | % | TLCS | TGCS |
|---|---|---|---|---|---|
| 1 | Journal of Environmental Management | 930 | 2.9 | 2330 | 14297 |
| 2 | Environmental Management | 813 | 2.9 | 1377 | 11925 |
| 3 | Journal of Cleaner Production | 812 | 2.4 | 2572 | 10827 |
| 4 | Forest Ecology and Management | 522 | 1.6 | 585 | 10041 |

| | | | | | |
|---|---|---|---|---|---|
| 5 | Agriculture Ecosystem and Environments | 462 | 1.6 | 975 | 12141 |
| 6 | Ecological Economics | 455 | 1.4 | 1547 | 8808 |
| 7 | Science of the Total Environment | 445 | 1.4 | 693 | 7405 |
| 8 | Resources Conservation and Recycling | 384 | 1.2 | 927 | 5367 |
| 9 | Environmental Monitoring and Assessment | 380 | 1.2 | 274 | 3073 |
| 10 | PLOS One | 380 | 1.2 | 0 | 2107 |

**Language wise Distribution of Publications**

Research literature on Environmental Management has been published in various journals in various languages. Among them English ranks the first occupying nearly 96.84% of the total output. The second ranked language is German, French and Spanish languages follow this. This is a clear indication that any other despite his country of orgin or language publishes his research findings mainly in English rather than their own mother language

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**Table 5: Language wise Distribution of Environmental Management Research**

| Language | Recs. | Cum. Recs. | Cum.% | Language | Recs. | Cum. Recs. | Cum.% |
|---|---|---|---|---|---|---|---|
| English | 59922 | 59922 | 96.84 | Croatian | 13 | 61830 | 99.92 |
| German | 617 | 60539 | 97.84 | Chinese | 9 | 61839 | 99.93 |
| French | 483 | 61022 | 98.62 | Italian | 9 | 61848 | 99.94 |
| Spanish | 336 | 61358 | 99.16 | Norwegian | 8 | 61856 | 99.95 |
| Portuguese | 195 | 61553 | 99.48 | Dutch | 5 | 61861 | 99.96 |
| Japanese | 95 | 61648 | 99.63 | Rumanian | 4 | 61865 | 99.97 |
| Hungarian | 41 | 61689 | 99.7 | Serbian | 3 | 61868 | 100 |
| Czech | 38 | 61727 | 99.76 | Swedish | 3 | 61871 | - |
| Slovak | 34 | 61761 | 99.81 | Danish | 2 | 61873 | - |
| Russian | 24 | 61785 | 99.85 | Slovene | 2 | 61875 | - |
| Finnish | 17 | 61802 | 99.88 | Turkish | 2 | 61877 | - |
| Polish | 15 | 61817 | 99.9 | **Total** | **61877** | **61877** | **100** |

**Institution wise Distribution of Publication**

The below table analysis indicates Institution wise research productivity. It is noted that 28127 institutions were contributed of the total research productivity in the subject of Environmental Management. It is noted that Chinese Academy of Sciences contribute the highest number of research publication (963) at the same time it ranks first in terms of global citation score 12754.

**Table 6: Institution wise Distribution of Publications (Top 10)**

| S. No | Institution | Recs. | % | LCS | GCS | Country |
|---|---|---|---|---|---|---|
| 1 | Chinese Academy Sciences | 963 | 2.9 | 959 | 12754 | China |
| 2 | United States Department of Agriculture's- Agriculture Research Service (USDA-ARS) | 635 | 2.3 | 1000 | 17456 | USA |
| 3 | INRA- National Institute of Agricultural Research | 549 | 1.6 | 731 | 9107 | France |
| 4 | University of Florida | 537 | 1.8 | 606 | 11011 | USA |
| 5 | University of California Davis | 530 | 1.7 | 544 | 11616 | USA |
| 6 | United States Environmental Protection Agency | 497 | 1.7 | 648 | 10207 | USA |

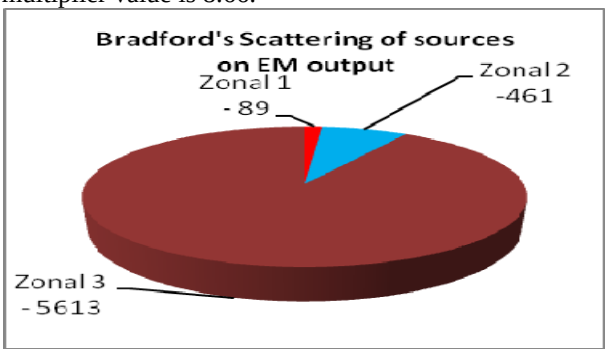
| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | University of Queensland | 467 | 1.3 | 719 | 7719 | Australia |
| 8 | University of Wisconsin | 463 | 1.5 | 570 | 10083 | USA |
| 9 | University of Melbourne | 405 | 1.2 | 728 | 7824 | Australia |
| 10 | University of Washington | 404 | 1.3 | 895 | 12048 | USA |

The below table 7 reveals that the zonal wise publications of journals on Management Information System research. It is concluded from the analysis that the first zone (forty) journals were found on nuclear or core sources (journals).

**Table 7: Showing Bradford's Distribution of sources in Environmental Management**

| Zone | No. of sources | No. of records | Multiplier factor |
|---|---|---|---|
| $Z_1$ | 89 (1.44) | 20576 (33.25) | - |
| $Z_2$ | 461 (7.48) | 20914 (33.80) | 5.18 |
| $Z_3$ | 5613 (91.08) | 20387 (32.95) | 12.18 |
| **Total** | **6163** | **61877** | **8.66** |

The researcher has grouped three types, such that; $Z_1$ – Zonal 1; $Z_2$ – Zonal 2 and $Z_3$ – Zonal 3. The first zone indicates the small groups of different types of sources, and it is called the nuclear or core zone. Here from this analysis, first zone representing 89 (1.44 %) of sources has produced 20576 (33.25 %) of articles. So those 89 journals (sources) were identified this subject research output in core journals. The second zone group of 461 (7.48 %) journals provides 20914 (33.8 %) articles, and the third largest zone of 5613 (91.08 %) of periodicals yield the remaining 20387 (32.95 %) articles. The Bradford multiplier between the number of references in zone 1 and zone 2 is 5.18 while it is 12.18 between zone 2 and zone 3. The average multiplier value is 8.66.



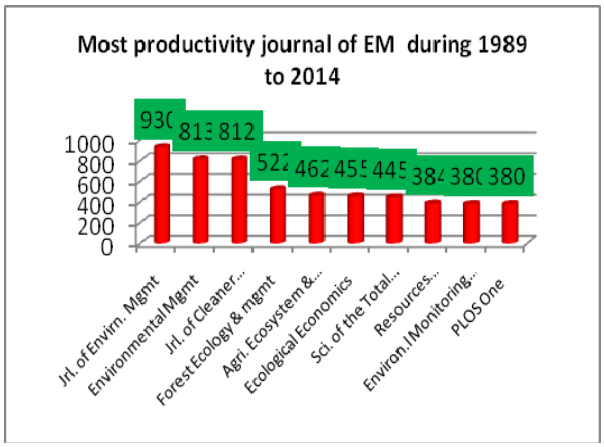




*Fig: zonal wise analysis and most productivity journal on Environmental Management*

According to *Bradford's* distribution, the relationship between the zone is 1: a: $n^2$. In contrast is the relationship in each of the present study i.e. 89:461:5613 which does not fit into *Braflord's* distribution. This is a clear indication that core zone is more concentrated and the other zone is much extended showing the scattering of journals on Management Information System research.

## FINDINGS AND CONCLUSION

It is observed that from the above analysis, the highest quantity of literature was produced during the period 2011-2014 and the largest numbers of articles were published in 2014. USA occupies the first place for its contribution of publications and highest number of citation, h-index in environmental management. India occupies the 15th position in the world in terms of Publication. The journal of "Journal of Environmental Management" has produced more articles and highest citation score. Chinese Academy of Sciences contributed the highest number of research publications in Environmental Management.

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