

Research Productivity On Forestry: A Scientometric Study

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Abstract

In this study, the authors have examined the research productivity on forestry. For this purpose, the authors have used search term ‘forestry’ in Web of Science database published from the year 2015 to 2019. From the study, it is found that there is a steady growth in publication. Among the authors, Wingfield MJ has published highest number of articles (41) followed anonymous by 36 articles. In the country-wise publication, USA and China were the top most countries published 1495 (18.85%) and 772 (9.74%) and India stands 19th position with 168 (2.12%). League of European Research Universities LERU and Swedish University of Agricultural Sciences were the top most organizations have published more records and Forest Ecology and Management and Forest Policy and Economics were the top most sources through which much of the documents were published. This study will enable the academic and research community to select the top most authors, organizations and countries for their collaborative study and find the high impact factor journals for their studies.

Keywords: Scientometrics; Research output; Research productivity; Metric study; Forestry

Introduction

The word Scientometrics and Bibliometrics are more or less synonymous terms used for measuring the literature in science on various aspects. It helps to identify the pattern of publications in various aspects such as year-wise, author-wise, subject-wise, language-wise, country-wise and so on (Anandahalli & Achha, 2018).

Scientimetric study has become very popular across the globe and the tools are powerful for measuring and analyzing science, technology and innovation. The study was once used to find out the measures such as the number of authors published their articles, institutions and other scientific work. But, today, there are number of parameters through which the scientometric study is measured such as citations, journal ranking, h-index, and so on. It is referred as science about science and helps the authors to measure the research productivity and for the development of scientometric study. There are several prominent academics – for example, Robert King Merton, Derek J. de Solla Price and Eugene Garfield have worked for the study (Verma and Shukla, 2019). In this study, the authors were interested to study the research trends in forestry as forestry protects both human as well as animals.

A forest is an area with a high density of trees and may vary significantly in size & have different classifications according to how and of what the forest is composed (Pawar and Rothkar, 2015). Forests are considered as very important for our planet healthy. There are more organisms in a handful of soil than there are people on the planet. Forest is considered as home for about 80% of life on earth and all size of animals depend for forests, which provide them fruits, nuts, and plants to live their life happily. It acts as barrier against erosion, landslides and avalanches. The roots of the trees give the soil the structure it needs to absorb and retain water when it rains, avoiding floods that would otherwise wash away perfectly fertile soil, when we need in order to grow food. Considering the importance of forestry, the authors wanted to find out the research trends in forestry. (Fatima, n.d.).

Objectives of the study

Following are the objectives of the study

- To find out the productivity of year-wise publications
- To find out the top most productive authors

- To find out the country-wise publication of documents
- To find out the organization-wise distribution of publications
- To find out source-wise distribution of documents
- To find out highly cited articles

Review of literature

Literature review will help the researchers to find out whether the researcher undertaken is conducted anywhere and how to conduct the study. Some of the reviews are listed below.

Dwivedi has conducted a study to find out the research productivity in global allergy research. Science Citation Index Expanded (SCI-E), was used for searching the results for the study. The study period is 20 years (1994-2013) and the total numbers of records were 34,783. The findings of the study revealed that continuous raising trend found between 1994-1994 and 2006-2013, but decreasing trend found in the years 2000 and 2002. Remained constant in some years and slight increase in 2005 and slight decrease in 2006. Highest number of publications found in 2013 with 2269 papers and lowest (1032) in 1994. Nineteen countries have contributed 89% of the total output. Harvard university of USA published highest output of 872 papers followed by 790 papers by University of California (USA).

Dutt and Nikam (2016) conducted a study on scientometric analysis of global solar cell research. For the study, the authors have downloaded the data from Web of Science for five different years i.e. 1991, 1995, 2000, 2005 and 2010. The findings of the study revealed that among eleven thousand papers published globally, about hundred countries received more than three lakhs citations, thereby receiving an average of 30 citations per paper. Among the countries, USA, China, Japan, Germany and Korea accounted more than half of the publications. In the citations, USA and UK had the world's highest citations while India fell low. The major output emerged from academic institutions and subject was chemical sciences. Chinese academy of sciences outperformed when comparing with other institutions, but impact found lower than other prolific institutions.

A study on "Authorship Trends and Collaboration Pattern in the Marine Sciences Literature: A scientometric study" was conducted by Elango and Rajendran (2012). For the analysis purpose, data have been collected from Indian Journal of Marine Sciences published from 2001 to 2010. The findings of the study revealed that majority of the papers are contributed by multi authors and only 11.5% of the papers were contributed by single authors. Hence, multi-

authored publications dominated over the single authored publications with regard to marine sciences. Collaboration Index ranged from 2.82 to 3.91 within an average of 3.4 per joint authored paper. Among the authors, Srinivas, K topped the rank with 0.88 dominance factor.

A study on “A scientometric study on literatures of the journal ‘Scientometrics’ was conducted by Asnani and Vyas (2020). The study explored the various scientometric indicators of the journal ‘scientometrics’ published during 2015 to 2019 and indexed by Web of Science. There were 1872 publications which were having 15711 citations. Maximum number of publications 398 (21.26%) published in 2018 followed by 396 (21.15%) in 2017, 379 (20.25%) in 2016, 366 (19.5%) in 2015 and 333 (17.79%) in 2019. Positive growth was identified except the year 2019. China, USA and Spain were the dominant countries associated with the journal ‘Scientometrics’.

Methodology of the study

For this study, the authors used Web of Science, a research database consists of bibliographic records published in high impact factor journals indexed by web of science. Scientometric study enables to count the records in the literature based on many scientometric indicators such as year-wise productivity, author productivity, source-wise, country-wise, document-wise, language-wise and so on. Forestry was the search term and five years period as the range of years (2015 to 2019) used for retrieving the bibliographical records for the study. There were 7930 records which includes articles, review articles, editorial materials, conference proceedings and so on.

Table 1: Year-wise publication of documents

Year	Nos.	%	Cumulative Numbers	Cumulative Percentage
2015	1408	17.76	1408	17.76
2016	1437	18.12	2845	35.88
2017	1517	19.13	4362	55.01
2018	1677	21.15	6039	76.15
2019	1891	23.85	7930	100.00

The distribution of annual publication of articles for 5 year period is shown in the Table 1. The total publication for the five year period i.e. 2015-2019 was found 7930 records. The publication expanded from 1408 in 2015 to 1891 in 2019. Out of the total records, 1891 (23.85%) in 2019 was the highest numbers followed by 1677 (21.15%) in 2018, 1517 (19.13%) in 2017, 1437 (18.12%) in 2016 and 1408 (17.76%) in 2015 which is the lowest in the five years period. There is a steady growth in publication has been found from the study.

Table 2: Document-wise distribution of articles

Documents	Nos.	%
Articles	7100	89.53
Review Articles	572	7.21
Editorial Materials	167	2.11
Proceedings Papers	140	1.77
Book Reviews	28	0.35
News items	20	0.25
Corrections	13	0.16
Book Chapters	12	0.15
Biographical Items	11	0.14
Data Papers	10	0.13
Letters	9	0.11
Meeting Abstracts	7	0.09
Reprints	2	0.03
Bibliographies	1	0.01
Retracted Publications	1	0.01

Table 2 provides the document-wise distribution of records on forestry during the period. Among the different sources published in web of science database, it is found that articles dominated highest among the publications 7100 (89.53%) followed by review articles with 572 (7.21%), editorial materials with 167 (2.11%), proceedings papers 140 (1.77%), and other documents were

published less than 100. Publication of other documents details are provided in the table 2.

Table 3: Top 10 most productive authors

Author's name	No. of publications
Wingfield MJ	41
Anonymous	36
Spinelli R	28
Giessen L	24
Maryudi A	22
Pukkala T	22
Toppinen A	21
Bolding MC	18
Aust WM	17
Laudon H	17

Table 3 provides top 10 most productive authors contributed from the year 2015 to 2019. Among the contributors, Wingfield MJ has contributed 41 articles stood first position in contribution of articles in forestry research followed Anonymous with 36 articles and Spinelli R published 28 articles.

Table 4: Top 10 country-wise publication

Country	Nos.	%
USA	1495	18.85
Peoples R China	772	9.74
Canada	642	8.10
Germany	609	7.68
Sweden	525	6.62

Australia	511	6.44
Finland	478	6.03
Brazil	466	5.88
Italy	428	5.40
England	407	5.13
India 19 th Position	168	2.12

Table 4 provides details regarding the number of published documents in country-wise for the period 2015 to 2019. It was found from the above table that USA has published 1495 (18.55%) articles followed by Peoples R China published 772 (9.74%) stands second position, Canada with 642 (8.10%), Germany with 609 (7.68%), and Sweden with 525 (6.62%) stands third, fourth and fifth positions respectively. It was also found that India has published 168 (2.12%) articles by standing 19th position. The table provides publication of top 10 countries according to the number of publications.

Table 5: Top 10 most languages

Language	Nos	%
English	7489	94.44
Spanish	97	1.22
Polish	92	1.16
Portuguese	89	1.12
German	52	0.66
Croatian	44	0.55
French	28	0.35
Japanese	9	0.11
Chinese	6	0.08
Turkish	5	0.06

Top 10 most documents published in different languages are provided in the table 5. It is found that English was the top most language in which 7489 (94.44%) of the documents were published for the study period i.e. 2015 to 2019. Followed by English, Spanish 97 (1.22), Polish 92 (1.16%), Portuguese 89 (1.12%) and German with 52 (0.66%) published in web of science database. Other top ten languages results are provided in the table.

Table 6: Top 10 most organizations

Organization	Nos	%
League of European Research Universities LERU	397	5.01
Swedish University of Agricultural Sciences	324	4.09
United States Department of Agriculture USDA	216	2.72
United States Forest Service	185	2.33
University of Helsinki	164	2.07
Natural Resources Institute Finland LUKE	150	1.89
Chinese Academy of Sciences	127	1.60
University of Eastern Finland	127	1.60
INRAE	125	1.58
University of British Columbia	124	1.56

Among the top 10 most organisations, it was found that ‘League of European Research Universities LERU’ published 397 documents stood first position followed by Swedish University of Agricultural Sciences, United States Department of Agriculture USDA, United States Forest Service and University of Helsinki published second, third, fourth and fifth highest number of publications i.e. 324 (4.09%), 216 (2.72%), 185 (2.33%) and 165 (2.07%). Other organisations which have occupied top 10 positions are displayed in the table 6.

Table 7: Source-wise distribution of articles

Source	Nos.	%
Forest Ecology and Management	308	3.88
Forest Policy and Economics	288	3.63
Forests	280	3.53
Land Use Policy	126	1.59
Sustainability	118	1.49
Urban Forestry Urban Greening	115	1.45
Journal of Forestry	97	1.22
PLOS	95	1.20
Scandinavian Journal of Forest Research	93	1.17
International Forestry Review	87	1.10

Table 7 provides the top ten sources published documents for the study period i.e. 2015 to 2019. Among the top twenty sources, Forest Ecology and Management, was the journal published highest number of articles with 308 (3.88%) followed by Forest Policy and Economics, Forest, Land and use Policy and Sustainability were the next highest published articles i.e. 288 (3.63%). 280 (3.53%), 126 (1.59%) and 118 (1.49%). Other journals included in the top 20 sources have been listed in the table 7.

Table 8: Top 10 most cited articles

S.N.	Article	Citations
1	Heatmapper: web-enabled heat mapping for all Babicki, S; Arndt, D; (...); Wishart, DS Jul 8 2016 NUCLEIC ACIDS RESEARCH 44 (W1) , pp.W147-W153	811
2	Classifying drivers of global forest loss Curtis, PG; Slay, CM; (...); Hansen, MC Sep 14 2018 SCIENCE 361 (6407) , pp.1108-1111	554
3	The role of biomass and bioenergy in a future bioeconomy: Policies and facts Scarlat, N; Dallemand, JF; (...); Nita, V Jul 2015 ENVIRONMENTAL DEVELOPMENT 15 , pp.3-34	408
4	Microplastics en route: Field measurements in the Dutch river delta and Amsterdam canals, wastewater treatment plants, North Sea sediments and biota Leslie, HA; Brandsma, SH; (...); Vethaak, AD Apr 2017 ENVIRONMENT INTERNATIONAL 101 , pp.133-142	404
5	Hyperspectral Imaging: A Review on UAV-Based Sensors, Data Processing and Applications for Agriculture and Forestry Adao, T; Hruska, J; (...); Sousa, JJ Nov 2017 REMOTE SENSING 9 (11)	376
6	Greenhouse gas emissions from soils A review Oertel, C; Matschullat, J; (...); Erasmi, S 2016 CHEMIE DER ERDE-GEOCHEMISTRY 76 (3) , pp.327-352	369
7	Review of studies on tree species classification from remotely sensed data Fassnacht, FE; Latifi, H; (...); Ghosh, A Dec 1 2016 REMOTE SENSING OF ENVIRONMENT 186 , pp.64-87	362

8	100% Clean and Renewable Wind, Water, and Sunlight All-Sector Energy Roadmaps for 139 Countries of the World Jacobson, MZ; Delucchi, MA; (...); Yachanin, AS Sep 6 2017 JOULE 1 (1) , pp.108-121	359
9	The wood from the trees: The use of timber in construction Ramage, MH; Burrige, HC; (...); Scherman, O Feb 2017 RENEWABLE & SUSTAINABLE ENERGY REVIEWS 68 , pp.333-359	349
10	Go greener, feel better? The positive effects of biodiversity on the well-being of individuals visiting, urban and peri-urban green areas Carrus, G; Scopelliti, M; (...); Sanesi, G Feb 2015 LANDSCAPE AND URBAN PLANNING 134 , pp.221-228	330

In the top 10 cited articles, it was found that ‘Heatmapper: web-enabled heat mapping for all’ was the top most article received 811 citations stands first position followed by ‘**Classifying drivers of global forest loss** and The role of biomass and bioenergy in a future bioeconomy: Policies and facts’ have received second and third highest citations such as 554 and 408 respectively. The other top cited articles are listed in the table 8.

Conclusion

Search through web of science database has provided 7930 records for the search term ‘forestry’ for the period of 5 years i.e. 2015 to 2019. In the year-wise distribution of publications, there was steady growth found from 2015 to 2019 and the year 2019 witnessed highest number of documents 1891 (23.85%) and 2015 had lowest number of documents with 1408 (17.76%). Among the authors, Wingfield MJ has published 41 records followed by Anonymous authors published 36 records. In the country-wise records, USA stood first with 1495 (18.85%) followed by Peoples R China and Canada published 772 (9.74%) and 642 (8.10%) documents stood second and third positions respectively. Among the countries, India stood 19th position with total publication 168 (2.12%). In the organization-wise distribution, “League of European Research Universities LERU, published highest number documents with 397 (5.01%) followed by Swedish University of Agricultural Sciences’ stands second position with 324 (4.09%). Forest Ecology and Management was the major source published 308 (3.88%)

documents followed by Forest Policy and Economics published with 288 (3.63%) documents took second position. Scientometric study has enabled to study the publication activities in different parameters such as author-wise, year-wise, country-wise and so on. Through the study, research on forestry found steady growth. The study also helps the researchers to find out who are the top most productive authors, organizations and country to have fruitful discussions and collaboration with those authors. It will help the librarians to subscribe the top ranked journals to their libraries.

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