**Research Productivity and Open Access Research Productivity of the Wildlife Institute of India, Dehradun: A Bibliometric Analysis**

**ABSTRACT**

1. **INTRODUCTION**

The Wildlife Institute of India (WII) is situated on a 180-acre campus in Dehradun, Uttarakhand. WII is responsible for advising the government on wildlife management and conservation, producing research to improve such conservation, teaching and promoting certificate courses for government officials involved in wildlife management and conservation, as well as graduate-level education in wildlife science. WII has been designated a Tiger Center and an Elephant Center, meaning that WII has a specific charge from the government to produce research on the conservation of these two species.

WII departments include Animal Ecology and Conservation Biology; Ecodevelopment Planning and Participatory Management; Endangered Species Management; Habitat Ecology; Landscape Level Planning and Management; Protected Area Network, Wildlife Management, and Conservation Education; Population Management, Capture, and Rehabilitation; and Wildlife Health Management. Degrees offered by WII include a Master of Science in wildlife science and a post-graduate certificate in Advanced Wildlife Management. Also located on the WII campus is a UNESCO Category 2 Centre on World Natural Heritage Management and Training for Asia and the Pacific Region. The UNESCO Category 2 Centre also provides graduate-level education through its M.Sc. In Heritage Conservation & Management. WII is an institution of the Indian Ministry of Environment, Forest, and Climate Change. Similar institutions include the Indian Institute of Forest Management, the Indian Institute of Ecology and Environment, and the Indian Council of Forestry Research and Education.

A number of studies have been previously published that look at institutional productivity of Indian universities and departments,[[1]](#endnote-1) and some of those studies have mentioned collaborations between universities and Indian research institutes.[[2]](#endnote-2) This study makes a unique contribution to the literature by looking at the productivity of a research institute and by assessing the changes in publication patterns wrought by India’s new commitment to OA.

1. **OBJECTIVES**

The objectives of this study are to observe trends of research productivity and research collaboration for researchers and faculty at the Wildlife Institute of India, and to compare general research output with open access (OA) research output. Specifically, this study examines:

* Research productivity by year for WII researchers and OA research productivity
* Lead authors for WII and lead OA authors
* Scope of publication outlets for WII researchers and scope of OA publication outlets
* Subject coverage of WII researchers’ articles and OA subject coverage
* Types of OA licenses being used by WII researchers

1. **METHODOLOGY**

WII faculty publication data was extracted from eight databases in the Web of Science service. The Web of Science platform includes over 34,000 journals, as well as conference proceedings, and data sets, and contains 159 million records, covering 1900 to 2020.[[3]](#endnote-3) However, it is not a comprehensive list of all scholarly work.

Web of Science data was extracted in May 2020, using the search string in Table 1 below. The search string identified publications in all Web of Science databases that had the Wildlife Institute of India in the address field, published between 1984 and 2019, in every data type except corrections. Out of the total of 1,495 unduplicated results, 775 were from Web of Science Core Collection, 376 from Zoological Record, 336 from BIOSIS Citation Index, 5 from MEDLINE, 2 from Current Contents Connect, and 1 from Data Citation Index.

Records were downloaded from each individual database in a plain text format, with additional metadata fields such as author address and identifiers such as OrcID numbers included. The plain text files from each database were appended together to create one larger plain text file. That file was then imported into the bibliometrix[[4]](#endnote-4) package. The bibliometrix package can be added to R or RStudio to enable bibliometric analysis of citation data. Once loaded, the file was converted to a data frame.

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| |  |  | | --- | --- | |  | (AD=(wildlife institute of india) OR AD=(wildlife inst india) OR AD=(wii AND india)) AND (PY=( 2010 OR 2001 OR 1992 OR 2019 OR 2009 OR 2000 OR 1991 OR 2018 OR 2008 OR 1999 OR 1990 OR 2017 OR 2007 OR 1998 OR 1989 OR 2016 OR 2006 OR 1997 OR 1988 OR 2015 OR 2005 OR 1996 OR 1987 OR 2014 OR 2004 OR 1995 OR 1986 OR 2013 OR 2003 OR 1994 OR 1985 OR 2012 OR 2002 OR 1993 OR 1984 OR 2011 )) AND (DT=( ARTICLE OR EDITORIAL OR CASE REPORT OR CLINICAL TRIAL OR OTHER OR LETTER OR DATA PAPER OR MEETING OR REVIEW OR UNSPECIFIED OR DATA SET OR BOOK OR ABSTRACT OR NEWS OR EARLY ACCESS )) | |

Table 1. Web of Science search criteria.

* 1. **Data Cleanup and Analysis with OpenRefine**

Prior to analysis, OpenRefine[[5]](#endnote-5) was used to clean the data. Email addresses were removed from the Author column, and spelling and punctuation of author names were standardized using the Cluster & Edit option. The cleaned author entries were copied individually into the R data matrix.

* 1. **Data Analysis with bibliometrix**

The bibliometrix package was used to analyze the full data set containing 1,495 records. The open access data set was created by filtering the full data set for only those articles that were listed as having an open access license, resulting in 301 articles. This study primarily uses descriptive methods to assess the research productivity of WII, [[6]](#endnote-6) including assessing productivity over time, most productive researchers, and relationships between researchers.

1. **LIMITATIONS**

Using Web of Science databases to assess WII researcher productivity necessarily results in a limited picture of their total productivity. WII faculty produce multiple types of research and publications, not all of which are represented by Web of Science. WII researchers are often involved in field work, meaning that some of their work is in data collection and building of data sets. WII researchers’ theses and presentations are often stored locally, in the WII web site and in the institution’s library and repository. Additionally, while Web of Science includes a variety of journals in the sciences, WII faculty may publish in journals that are not included in Web of Science, including newer and more specialized journals.

1. **RESULTS & ANALYSIS**

The full data set included 1,495 items, ranging in publication year from 1984 to 2019, and included one item published in 2019 with a 2020 publication date. Of those, 1,321 were articles, 55 were papers from proceedings or meetings, 35 were book chapters, and the remaining 84 were various publication types including reviews, notes, and letters. There were 1,765 authors represented in the data set, most appearing on multiple publications, with an average of 3.51 co-authors per document.

Publications listed as available under an open access (OA) license were separated from the full data set. The OA data set included 301 documents, with a total of 852 authors and 98 sources. Of those documents, 256 were articles, 13 were letters, ten were editorial materials, eight were reviews, six were proceedings papers, five were corrections, two were book chapters, and one was a news item. A total of 852 authors were represented in the open access publications, with an average of 5.08 co-authors per document.

* 1. **Research productivity by year for WII researchers**

A steady rise in publications is evident over the years in question, as shown by Figure 1. The years of lowest publication were 1984 and 1989, with four publications each. The years of highest publication are 2019 (100 publications), 2011 (99), and 2010 (92).

Figure 1 also demonstrates an increase in OA publication, particularly since 2015. The years 2017 and 2019 are tied for the largest number of OA publications, at 38 each, with 2018 having 34 OA publications, 2016 having 32, and 2015 having 30. Since 1998, at least one paper is available in open access every year.

Figure 1. Total number of publications by publication year.

* 1. **Lead WII authors**

A total of 1,764 individual authors were represented in the full data set, with 5,246 author appearances. The average documents per author was 0.848, indicating that most authors in this data set have produced fewer than one document. Nonetheless, several WII researchers have produced multiple articles. As indicated in Table 2, 31 authors had produced more than 20 articles. Another 32 authors had produced between 11 and 20 articles; 88 authors between 6 and 10 articles, 510 authors between 2 and 5 articles, and 1103 had produced one article.

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| **AUTHOR** | **ARTICLES WRITTEN** |
| Rawat, GS | 120 |
| Qureshi, Q | 110 |
| Goyal, SP | 96 |
| Jhala, YV | 87 |
| Sivakumar, K | 86 |
| Choudhury, BC | 79 |
| Sathyakumar, S | 78 |
| Hussain, SA | 73 |
| Vasudevan, Karthikeyan | 63 |
| Johnsingh, AJT | 61 |
| Habib, B | 56 |
| Pandav, B | 51 |
| Mathur, VB | 47 |
| Sankar, K | 45 |
| Adhikari, BS | 44 |
| Nigam Parag | 41 |
| Sankar Kalyanasundaram | 41 |
| Uniyal, VP | 41 |
| Badola, R | 38 |
| Chauhan, NPS | 35 |
| Gopi, GV | 33 |
| Johnson, JA | 28 |
| Kuresh, R Sumar | 28 |
| Ramesh, K | 27 |
| Tripathy, B | 27 |
| Deepak, V | 24 |
| Lyngdoh, Salvador | 24 |
| Gupta, SK | 23 |
| Talukdar, GH | 22 |
| Chellam, R | 21 |
| Selvan, K. Muthamizh | 21 |

Table 2. WII authors who wrote more than 20 articles in the full data set.

The OA data set has a total of 894 authors and 1,530 author appearances, with average documents per author being 0.353. Again, there are several very productive authors, as listed in Table 3.

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| **AUTHOR** | **OA ARTICLES WRITTEN** |
| Jhala YV | 40 |
| Rawat GS | 30 |
| Qureshi Q | 28 |
| Goyal SP | 19 |
| Habib B | 19 |
| Sathyakumar S | 17 |
| Mathur VB | 16 |
| Nigam Parag | 14 |
| Talukdar GH | 13 |
| Choudhury BC | 12 |
| Hussain SA | 12 |
| Vasudevan Karthikeyan | 12 |
| Adhikari BS | 12 |
| Johnson JA | 11 |

Table 3. Authors who have written more than 10 open access articles.

* 1. **Scope of publication outlets for WII researchers**

In the full data set, publications were recorded in 395 different sources, including two each in *Nature* and *Science.* The top ten publication outlets were the *Journal of the Bombay Natural History Society* (with 118 articles), *Indian Forester* (96), *Current Science* (86), *ENVIS Bulletin Wildlife and Protected Areas* (42), *Journal of Threatened Taxa* (40), *Biological Conservation* (31), *Cat News* (27), *Mammalia* (27), *Oryx* (26), and *PLOS One* (25).

The top eight publications in the OA data set were *Current Science*, with 42 articles; *Journal of Threatened Taxa* (39), *PLOS One* (25), *Oryx* (18), *Mitochondrial DNA Part B-Resources* (11), *Scientific Reports* (9), *Mountain Research and Development* (7), and *Proceedings of the Royal Society B-Biological Sciences* (7). Another four journals had five articles each; three journals had four articles, and the remaining 83 publication outlets had three or fewer publications.

* 1. **Subject coverage of WII researchers’ articles**

WOS lists both author-provided and assigned keywords for results. The full data set shows 3,516 author-provided keywords and 1,703 assigned keywords for 1,495 articles, for an average of 2.35 author-provided and 1.14 assigned keywords per article. Table 4 shows the top-ranked author-provided and assigned keywords.

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| **Author-provided Keyword (Ranking)** | **Times Used** | **Assigned Keyword (Ranking)** | **Times Used** |
| India (1) | 92 | Conservation (1) | 115 |
| Conservation (2) | 47 | National Park (2) | 53 |
| Distribution (3) | 30 | Biodiversity (3) | 45 |
| Tiger (3) | 30 | Diversity (3) | 45 |
| Western Ghats (5) | 20 | Patterns (3) | 45 |
| Himalaya (6) | 17 | Ecology (6) | 44 |
| Camera Trap (7) | 16 | Forest (7) | 41 |
| Panthera tigris (7) | 16 | Management (8) | 39 |
| Biodiversity (9) | 15 | Population (9) | 37 |
| Protected areas (9) | 15 | Abundance (10) | 33 |
| Western Himalaya (9) | 15 | India (10) | 33 |

Table 4. Top ten ranked author-provided and assigned keywords for the full data set.

Plotted over time, we can see how publications’ subject matter has changed in emphasis over time. In Figure 2 below, the terms *India* and *Western Ghats* show a use peak in the early 2010s and a decline in use from 2014. By comparison, the terms *Himalaya* and *Western Himalaya* have seen increased use since 2011, with no evidence of decline.

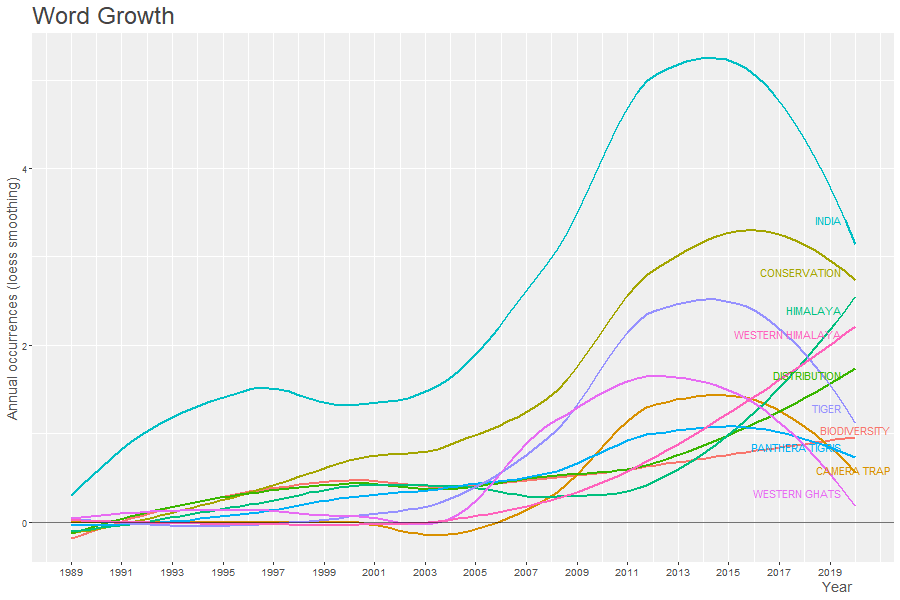


Figure 2. Word appearances in top 10 authors’ keywords over time. Words are India, Conservation, Himalaya, Western Himalaya, Distribution, Tiger, Biodiversity, Panthera tigris, Camera trap, and Western Ghats.

For the 301 OA articles, there were 894 author-provided and 791 assigned keywords, for an average of 2.9 author-provided and 2.6 assigned keywords per article. Table 5 indicates the top-ranked keywords for each.

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| **Author-provided Keyword (Ranking)** | **Times Used** | **Assigned Keyword (Ranking)** | **Times Used** |
| India (1) | 45 | Conservation (1) | 30 |
| Conservation (2) | 18 | Diversity (2) | 11 |
| Tiger (3) | 16 | Patterns (3) | 9 |
| mtDNA (4) | 15 | Ecology (4) | 6 |
| Panthera tigris (5) | 14 | Management (4) | 6 |
| Distribution (5) | 14 | Population (6) | 5 |
| Phylogeny (7) | 13 | National park (6) | 5 |
| Reintroduction (8) | 12 | Biodiversity (6) | 5 |
| Western Himalaya (8) | 12 | DNA (6) | 5 |
| Analysis (10) | 9 | Abundance (10) | 4 |
| Biodiversity (10) | 9 | Climate change (10) | 4 |
| Climate change (10) | 9 | Evolution (10) | 4 |
| Dhole (10) | 9 | Software (10) | 4 |
|  |  | Extinction (10) | 4 |
|  |  | Identification (10) | 4 |
|  |  | Mitochondrial DNA (10) | 4 |
|  |  | Phylogeny (10) | 4 |
|  |  | Birds (10) | 4 |
|  |  | Computer program (10) | 4 |

Table 5. Top ten ranked author-provided and assigned keywords for OA research output.

Figure 3 shows the trend over time in subject matter of OA articles since 1994. *India* is the only keyword with more than two uses per year, with other keywords showing steady and consistent use.

A close up of a device

Description automatically generated

Figure 3. Word appearances in authors’ keywords over time. Words are Conservation, Phylogeny, Western Himalaya, Distribution, mtDNA, Analysis, Panthera tigris, Reintroduction, and Tiger.

* 1. **Types of OA licenses used**

Table 6 shows the types of open access agreements used by WII researchers in publishing their articles. The majority of articles, 192 out of 301 (64%), were published in DOAJ Gold journals, with another 19 articles in other (non-DOAJ) gold journals. These gold OA articles are been made available in final form by the publisher, often with a license permitting reuse of the work. The author may or may not have paid a fee for open access in this model.

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| **OA Agreement** | **Number of Articles** | **Percent of OA Articles** |
| DOAJ Gold | 192 | 64% |
| Other Gold | 19 | 6% |
| Bronze | 82 | 27% |
| Green Accepted | 14 | 5% |
| Green Published | 86 | 29% |

Table 6. Open access agreements used by WII researchers. Total comes to more than 100% because articles may be published under several license types.

A total of 100 articles (33%) were under green OA licenses. “Green published” articles are available in final format in an institutional or subject repository, after any applicable embargo period, whereas “green accepted” articles are pre-prints that do not include publisher formatting. Authors typically do not pay fees for green open access. Finally, 82 articles (27%) were available as bronze OA; that is, they may be made available by the publisher for reading, but not for distribution or text mining, and those articles can be removed from open access at the publisher’s discretion.

1. **FINDINGS**

As indicated by publications in Web of Science databases, WII productivity has doubled from 1984 to 2000, and then doubled again from 2000 to 2019. OA document production has also increased significantly in recent years, making up over a third of total publications in 2019. The most productive WII authors are highly published in both OA and non-OA sources. Even so, OA documents tend to have more authors, indicating that larger research teams are working together to produce OA research.

WII researchers publish in a variety of journals and conference proceedings. OA publication venues tend to be less region- or country-specific, though, and possibly expose WII research to a more international audience. Most WII researchers publish in DOAJ Gold journals, meaning their research is available to the research community immediately. Even so, the researchers often have to pay to support OA journals through Article Publication Charges (APCs). This is often a bone of contention, as APCs reduce the amount of funding that can be dedicated to producing research.

1. **CONCLUSION**

In 2014, the Department of Biotechnology and Department of Science and Technology released the DBT and DST Open Access Policy,[[7]](#endnote-7) mandating deposit of research articles produced with public funds. WII’s commitment to open access publishing predates this policy, though, with significant increases in OA publishing happening as early as 2009.

Going further, DBT and DST released the Biological Data Storage, Access, and Sharing Policy of India in 2019[[8]](#endnote-8), to encourage rapid and responsible sharing of biological data gathered and produced with public funds. WII’s commitment to data sharing is yet to be analyzed, but data generation is a strength of WII and one of the areas in which they lead.

1. See, for instance, Nagarkar, S., Veer, C., & Kumbhar, R. (2015). Bibliometric analysis of papers published by faculty of life sciences departments of Savitribai Phule Pune University during 1999-2013.*DESIDOC, 35*(5), 368-375, or Bhui, T., & Sabu, N. B. (2018). Publications by faculty members of humanities and social science departments of IIT Kharagpur: A bibliometric study. *DESIDOC, 38*(6), 403-409. [↑](#endnote-ref-1)
2. See, for instance, Baskaran, C.. (2013). Research productivity of Alagappa University during 1999-2011: A bibliometric study. *DESIDOC, 33*(3), 236-242. [↑](#endnote-ref-2)
3. Web of Science Summary of Coverage. (2019, July 12). <https://clarivate.libguides.com/webofscienceplatform/coverage>. [↑](#endnote-ref-3)
4. Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics , 11(4), 959-975. [↑](#endnote-ref-4)
5. OpenRefine. <https://openrefine.org/>. [↑](#endnote-ref-5)
6. Aria, M., & Cuccurullo, C. (2020). A brief introduction to bibliometrix. <https://cran.r-project.org/web/packages/bibliometrix/vignettes/bibliometrix-vignette.html>. [↑](#endnote-ref-6)
7. Department of Biotechnology and Department of Science & Technology. (2014). DBT and DST Open Access Policy. <https://dst.gov.in/sites/default/files/APPROVED%20OPEN%20ACCESS%20POLICY-DBT%26DST%2812.12.2014%29_1.pdf> [↑](#endnote-ref-7)
8. Department of Biotechnology and Department of Science & Technology.(2019). Biological Data Storage, Access and Sharing Policy of India. <https://dst.gov.in/sites/default/files/Draft%201%20-%20Biological%20Data%20Policy.pdf> [↑](#endnote-ref-8)