

Characteristics of highly cited papers in Environmental sciences: Trends and authors

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Abstract

The greatest challenge in scientific publishing is that incentives are focused on getting it published, not getting it right. The promotion and prestige of getting highly cited papers have become more prevalent in recent years. While having highly cited papers could imply a high impact, overly producing highly cited papers could raise doubts about the quantity, calibre, and real-world impact of such papers. There has not been any research on analyzing highly cited papers in environmental sciences. To fill this gap, this study surveyed 931,027 articles published in 2013-2022 in Environmental Sciences journals to identify highly cited papers and their authors. The top 1% citations of these articles were identified in 3 topics: (1) biochar, (2) pollution and environmental degradation, and (3) climate change, renewable energy and emissions. The findings also show that the top highly cited authors are dominated by a few extremely prolific individuals, publishing an average of 60–100 papers each year and having more than 20 highly cited papers. Moreover, most authors work independently except two clusters centred in Korea and China. The network analysis uncovers a network of scientists with a remarkable number of highly cited papers working as a team. Scientific publishing should be carried out honestly and ethically. The scientific community relies on the integrity of the research process and the accuracy of published research in order to advance knowledge and make important decisions. Publications should have honesty, openness, transparency, objectivity, and reproducibility principles.

Introduction

One of the most widely used scientific quality metrics is citation count. Citation is often used to measure scientific research's quality and impact. When a paper is cited by other researchers, it can be taken as an indicator that the paper has made a significant contribution to the field and that it is considered to be of high quality and importance. Therefore, a high number of citations can be seen as a sign of the quality and significance of a researcher's work [1,2].

In particular, recent years have witnessed an upsurge in the promotion of highly cited and scientific or scholarly papers that many other papers have cited [1,2]. This is often taken as an indicator of the impact and influence of the paper in the academic community. Highly cited papers are often seen as being of high quality and significance and may be considered to be important contributions to the field in which they were

published. There are various ways to identify highly cited papers, such as through databases that track and compile citation data, or through lists of papers that have been identified as highly cited by database institutions such as Clarivate Analytics or the Institute for Scientific Information or Scopus.

Researchers may be interested in highly cited papers because they are likely to contain important and influential ideas and findings in their field. Reading and referencing highly cited papers can help researchers stay current with the latest developments in their field and may provide them with ideas for their own research. Funding agencies and grant review committees may consider the number of citations a paper has received when evaluating the quality and significance of a research proposal. Universities and other institutions may use citations to evaluate the quality of a researcher's work and decide which researchers to hire or promote. Furthermore publishers of scientific journals may be interested in highly cited papers because they are likely to be of high quality and may attract a large number of readers. In general, highly cited papers are often seen as being important contributions to the field in which they were published and may be of interest to a wide range of people in the scientific and academic communities.

Clarivate Analytics is a company that provides information, analytics, and expertise to the scientific and intellectual property communities. One of the services they offer is the identification of Highly Cited Papers, which they do through their Web of Science database. To identify Highly Cited Papers, Clarivate Analytics looks at the number of citations a paper has received over a given time period and compares it to the number of citations received by other papers in the same field and published in the same year. Then, they use this information to create a list of papers that have received a high number of citations relative to other papers in their field. The selection process is based on its own citation data and is intended to identify papers that have significantly impacted their field and whose work has been widely recognized by their peers. The list of Highly Cited Papers is updated regularly to reflect the most recent data.

There are a few things that can help increase the chances of a paper becoming highly cited:

- Conduct high-quality research: It is important to produce research that is well-designed, well-conducted, and that makes an original contribution to the field.
- Publish in high-quality journals: Publishing in a well-respected and high-impact journal can increase the visibility of your paper and the chances that it will be cited by other researchers.
- Write a clear and well-written paper: A clear, well-written paper that is easy to understand and follow will be more likely to be read and cited by other researchers.
- Use appropriate citation practices: Citing relevant and influential papers in your own work can increase the chances that your paper will be cited by others.
- Promote the paper: Making sure that the paper is widely available and promoting it to the relevant research community can increase the chances that it will be read and cited.

It is worth noting that becoming a highly cited paper is not something that can be guaranteed, as it depends on a variety of factors such as the quality of the research, the relevance of the topic, and the extent to which it is of interest to the research community.

Papers in the field of environmental sciences can address a wide range of important and timely topics, and if the research is of high quality and makes a significant contribution to the field, it can become highly cited. Environmental sciences cover a wide range of subdisciplines and include interdisciplinary research. Some ongoing trends and developments in the field of environmental sciences include:

- Climate change: Understanding the causes and impacts of climate change, and developing strategies for mitigating and adapting to its effects, is a major focus of research in environmental science.
- Biodiversity and conservation: Protecting biodiversity and preserving natural habitats is a key concern in environmental science, and there is ongoing research on topics such as species extinction, habitat loss, and conservation strategies.

- Environmental pollution: Research on the causes and impacts of environmental pollution, as well as strategies for mitigating and remedying pollution, is a major focus in environmental science.
- Renewable energy: Developing and implementing renewable energy sources is an important area of research in environmental science, as it can help reduce the reliance on fossil fuels and mitigate their impact on the environment.
- Environmental policy and governance: There is ongoing research on the development and implementation of effective environmental policies and governance frameworks at the local, national, and global levels.

These are just a few trends and developments in the field of environmental science. The field constantly evolves as new research is conducted and new challenges and opportunities arise.

Scientists have considerable enticements to publish highly cited papers, and in fact, their professions depend on it. The obligation and pressure to publish to evaluate a scientist or institutional impact and scientific reputation have become a new facet of publishing over the years. However, it is important to note that citation is not the only measure of scientific quality and that it should not be the only factor considered when evaluating the impact and significance of a researcher's work. Other factors, such as the originality and importance of the research, the soundness of the research methods and conclusions, and the relevance of the research to the field, should also be taken into account.

It is generally accepted that a high number of citations is an indicator of the quality and significance of a researcher's work. However, it is possible for papers that contain fraudulent or unethical research to receive a high number of citations, either because the fraud is not detected before the paper is published or because the paper is cited by other researchers who are unaware of the fraud. In such cases, the high number of citations may not reflect the research's true quality and may result from the authors' fraudulent or unethical practices. The scientific community needs to be vigilant in detecting and addressing fraudulent or unethical research in order to ensure the integrity and reliability of the scientific literature.

Environmental sciences as a multidisciplinary field have not been studied in detail in terms of its highly cited papers. This paper aims to study its traits and authors. A number of studies have looked at various characteristics of highly cited papers and the researchers who wrote them. For example, some studies have analyzed the content and methods of highly cited papers in order to identify common themes or trends [1,2]. Other studies have examined the demographics and career histories of highly cited researchers in order to identify factors that may contribute to their success [3]. By studying the traits and authors of highly cited papers, it is possible to gain insights into the factors that contribute to the success and impact of scientific research. This information can be useful for researchers looking to improve the quality and impact of their own work, as well as for organizations that support research and development.

Methods

This study has the objective of studying highly cited papers in environmental sciences in 2013-2022. The Web of Science database was used, by searching all papers published under the category "Environmental Sciences" from January 2013 to December 2022. Web of Science is a database of scientific and scholarly literature, including journal articles, conference proceedings, and other types of publications. It is produced by Clarivate Analytics and is widely used in the scientific and academic communities as a tool for research and citation analysis. Web of Science includes a range of features and tools that allow users to search for and access scientific and scholarly literature, track the impact and influence of research, and identify trends and patterns in research. It includes a large number of journals and other publications from a wide range of disciplines, and it is frequently used by researchers, librarians, and others to find and access research in their field of study.

Search results of the research publication data were downloaded from the library's website and exported in MS Excel, and authors networks were analyzed and visualized using the VOS viewer 1.6.9. VOSviewer is a software tool that can visualize and analyze bibliometric data, such as citation and co-citation data. It was developed by Nees Jan van Eck and Ludo Waltman at Leiden University Centre for Science and Technology Studies (CWTS). VOSviewer can create various visualizations, such as co-citation maps, term maps, and network diagrams, that can help researchers understand the relationships between different research topics, authors, and institutions. It is often used in conjunction with bibliometric databases, such as Web of Science or Scopus, to analyze citation data and to identify patterns and trends in the scientific literature. VOSviewer is widely used in the scientific and academic communities and is available as a free download.

Results and Discussion

Highly cited papers in Environmental Sciences

Based on the publication database and publications from environmental science journals in Web of Science in the last decade (2013- 2022), this study conducted a comprehensive survey of 931,027 articles or equal to over 93,100 papers were published per year. Amongst these articles, Web of Science identified the top 1% or 10,153 papers that were considered highly cited papers. Highly cited papers are scientific papers that have received a large number of citations from other papers in the scientific literature or top 1% based on the number of citations received when compared to other papers published in the same field in the same year.

A text keyword network of these 10,153 highly cited papers was performed using VosViewer to examine topics that occurred in these papers. While environmental sciences is a large multidiscipline, the network produced by the software and uncovered in Figure 1, highly cited papers only study around 3 main topics:

- (1) Evaluating biochar performance and use as chemical adsorbents

Biochar is a type of porous, charcoal-like material that is produced by heating organic material, such as wood, in the absence of oxygen. It has a high surface area and a network of tiny pores, which make it highly effective at adsorbing a wide range of chemicals from solution. Biochar has been as a chemical adsorbent in a variety of applications, including: Removing heavy metals from water where biochar has been shown to be effective at removing heavy metals, such as lead, mercury, and cadmium, from contaminated water; Removing pesticides from soil as biochar can adsorb pesticides from soil, helping to reduce their levels and mitigate their harmful effects on the environment; Biochar can be used to filter out VOCs, which are harmful air pollutants that are emitted by a variety of sources, including paints, adhesives, and cleaning products; Removing oil spills by adsorbing the oil from the surface of water.

- (2) Global pollution and environmental degradation including microplastic accumulation in environment, plant and ocean, ocean acidification.

Microplastics are small pieces of plastic that are smaller than 5 mm in size. The accumulation of microplastics in plants and oceans is a cause for concern because of the potential negative impacts on both the environment and human health. In plants, microplastics can interfere with normal growth and development, as well as affect the plant's ability to absorb water and nutrients. Microplastics can also enter the food chain when plants are eaten by animals. In oceans, microplastics can accumulate in the water column and on the seafloor, where they can be ingested by marine life and enter the food chain. Microplastics have been found in a wide range of marine species, including fish, shellfish, and birds, and can cause physical harm and disrupt the normal functioning of their organs and systems. The accumulation of microplastics in the environment is also a concern because they can serve as a vector for the transport of harmful chemicals and pathogens, which can have negative impacts on both the environment and human health.

- (3) Climate change and reduction of emissions.

- (4) Noel, Nakita K., et al. “Lead-free organic–inorganic tin halide perovskites for photovoltaic applications.” *Energy & Environmental Science* 7.9 (2014): 3061-3068.
- (5) Ball, James M., et al. “Low-temperature processed meso-superstructured to thin-film perovskite solar cells.” *Energy & Environmental Science* 6.6 (2013): 1739-1743.
- (6) Kroeker, Kristy J., et al. “Impacts of ocean acidification on marine organisms: quantifying sensitivities and interaction with warming.” *Global change biology* 19.6 (2013): 1884-1896.
- (7) Eerkes-Medrano, Dafne, Richard C. Thompson, and David C. Aldridge. “Microplastics in freshwater systems: a review of the emerging threats, identification of knowledge gaps and prioritization of research needs.” *Water research* 75 (2015): 63-82.
- (8) Poloczanska, Elvira S., et al. “Global imprint of climate change on marine life.” *Nature Climate Change* 3.10 (2013): 919-925.
- (9) O’Neill, Brian C., et al. “A new scenario framework for climate change research: the concept of shared socioeconomic pathways.” *Climatic change* 122.3 (2014): 387-400.
- (10) Bolan, Nanthi, et al. “Remediation of heavy metal (loid) s contaminated soils–to mobilize or to immobilize?.” *Journal of hazardous materials* 266 (2014): 141-166.

The top cited papers are in new renewable energy reaserch and global environmental problems.

Highly cited authors in Environmental Sciences

This study subsequently analyzed top authors of the highly cited papers, and the results are showed in Table 1. Authors on the topic of new renewable energy and biochar dominate. The top producer of highly cited papers are mainly on pollution and biochar adsorbent, notably the top 4 are

- (1) Guang Zeng from Hunan University, China, who have 64 highly cited papers.
- (2) Yong Sik Ok from Korea University, South Korea, who have 59 highly cited papers.
- (3) Dan CW Tsang from Hongkong Polytechnic, China, , who have 57 highly cited papers.
- (4) Jorg Rinklebe from University Wuppertal, Germany, who have 40 highly cited papers.

Other authors all have more than 20 highly cited papers. It is important to note that there are no female authors in this top highly cited authors. As a result, 12 of these authors were awarded highly cited researcher (HCR) by Clarivate in multiple fields in 2022. A highly cited researcher is a scientist who has produced a large number of papers that have been highly cited by other researchers in the scientific literature. Highly cited researchers are identified by the number of high cited papers.

Table 1. Top authors of highly cited papers.

Authors name	no. HCP (2013-2022)	Topic	Affiliation
Zeng, Guang	64	Pollutant remediation	Hunan Univ
Ok, Yong Sik	59	biochar	Korea Unive
Tsang, Dan	57	biochar	Hongkong P
Rinklebe, Joerg	40	biochar	University V
Bolan, Nanthi Sirangie	27	biochar	University o

Cheng, Min	26	Pollution remediation	Hunan
Wang, Shaobin	25	nanomaterials	University o
Gao, Bin	24	water contaminant	University o
Nazeeruddin, Mohammad K (Graetzel, Michael)	24	solar cell	Swiss Fede
Guyatt, Gordon H.	23	clinical Epidemiology	McMaster U
Zhang, Qiang	22	batteries	Tsinghua U
Wang, Jianlong	22	pollutants	Tsinghua U
Rizwan, Muhammad	22	biochar	Government
Shaheen, Sabry M.	22	biochar	Kafrelsheikh

Furthermore this study conducts a co-authorship network analysis of authors of the highly cited papers. The result of VosViewer analysis presented in Fig. 2 shows that except for 2 clusters, most authors work independently as seen by no connecting lines between authors. This means that most authors of highly cited papers work are unconnected. However two highly clusters immediately stand out as within each cluster has lots of connecting lines revealing a close collaborative network.

Cluster one is the largest network of authors centred around Yong Sik Ok, accompanied by two of the hyper prolific authors Daniel CW Tsang, and Jorg Rinklebe [4]. A close up of this cluster (Fig. 3) disclosed coauthors from China: Bin Gao, Hou Deyi, Wang Lei, Chen Liang, Wang hailong; Egypt: Sabry Shaheen, Ali El-Naggar; Pakistan: Nabeel Khan Niazi, Muhammad Shahid, Muhammad Rizwan, Shafagat Ali; Australia: Nanthi Bolan, Binoy Sarkar; Sri Lanka: Menthika Vithanage. Authors in this cluster all have more than 10 highly cited papers.

Cluster two was smaller centered in Zeng guang and Cheng min from Hunan university of China. It is important to note that these two clusters operated independently.

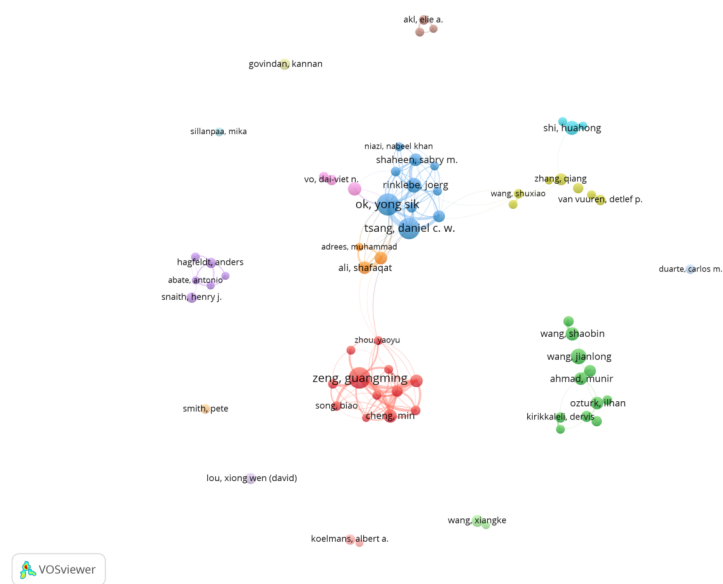


Figure 2: This is co-authorship network of highly cited papers in Environmental sciences. Top figure the network of authors, bottom figure the close up of the top two centre networks

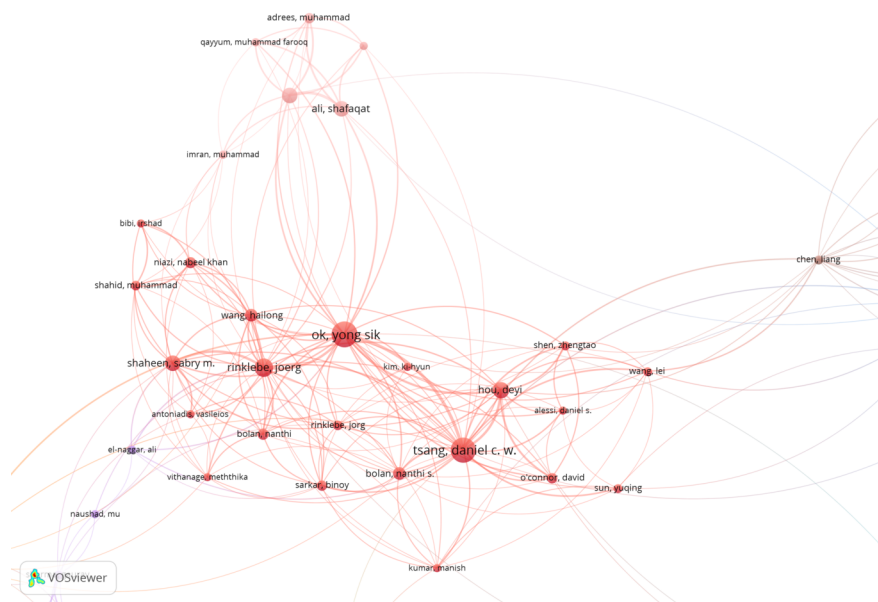


Figure 3: This is a the network of Yong Sik Ok in highly cited papers.

As discussed in previous findings, the top highly cited authors are extremely productive to the degree that it was called implausible. During 2017-2020, in these 4 years, Yong Sik Ok was found to publish 106 papers per year, Dan Tsang 90 papers per year and Jorg Rinlebe at 46 papers per year. The definition of hyper prolific authors is authors who publish more than one paper in 5 days or 73 papers per year [4]. In this case Yong Sik Ok and Dan Tsang fulfil and exceed this hyper prolific authors. Yong Sik Ok publishes a paper every 3.5 days, and Dan Tsang from China publishes a paper every 4 days.

It is generally not possible to publish a scientific paper in just 4 days. The process of publishing a scientific paper typically involves several steps, including conducting research, writing and revising the manuscript, submitting the manuscript to a journal, and going through the peer review process. Each of these steps can take a significant amount of time, and the entire process can take several months or even years from start to finish. That being said, it is possible to expedite some aspects of the publishing process if necessary. For example, suppose a paper is time-sensitive and needs to be published as soon as possible. In that case, the authors may be able to request an expedited review process, which could potentially reduce the review time. However, even with an expedited review process, it is unlikely that a paper could be published within 4 days.

In general, it is important to take the time necessary to thoroughly conduct research, write and revise the manuscript, and go through the peer review process in order to ensure that the paper is of high quality and meets the standards of the scientific community.

Another key cluster in the highly cited papers is led by Zeng Guang from Hunan university who published 70.5 papers per year. It is very interesting to note that from Table 1, cluster 1 led by Yong Sik Ok produce highly cited papers shared by many of his coauthors. As a result out of 14 top authors, only 5 didn't join any network and work indepently, while 7 belongs to Yong Sik Ok group and 2 belongs to Zeng Guang group. This result further cemented the idea that top authors of highly cited papers are dominated by few clusters. If one ones to have highly cited papers, the need to join a cluster. Fig. 3 shows the extension of such a cluster of authors.

It is also thought-provoking to note that, to paraphrase a famous statement by Dr. Drummond Rennie, editors have the decision to publish articles, and no one watches over their shoulders. The high amount of highly papers by these authors are linked with the amount of editorial positions held by these authors. It is a public knowledge that Yong Sik Ok, Daniel Tsang and Jorg Rinklebe maintain a network through editorial work on high impact factor journals such as Environmental Pollution, Journal of Hazardous Materials, Chemosphere, and several other high impact journals. According to Web of Science, Daniel CW Tsang has conducted 1054 verified peer reviews within a short period, with over 30 reviews completed per month in 2021. This statistics reveal that Daniel Tsang publishes 1 paper every 4 days and reviews 1 paper per day. As a result Daniel Tsang was awarded as Top Reviewers by many journals. Another paper investigating medical journals publication conclude a few authors, often members of the editorial board, were responsible for a disproportionate number of publications. One should raise a red flag to identify journals that are suspected of biased editorial decision-making—a term called “nepotistic journals.” To enhance trust in their practices, journals need to be transparent about their editorial and peer review practices [5].

It is noteworthy that a highly productive scientist offers a higher probability of citations because they generate more works that are encouraged for citation. Moreover using a collaborative research strategy can have a positive effect on publishing output, exposure, and citation. Furthermore the conditioning of the data and science to maximize publications has been mentioned as a strategy to increase publications. Journals are more likely to publish studies with conclusive, encouraging findings that were written by well-known, incredibly productive authors.

One can create many strategies to increase citation and create highly cited papers, such as self-citation, reciprocal citation, or the creation of a network of researchers. It is not appropriate or ethical to try to boost citations in order to artificially increase the perceived impact or significance of a researcher's work. The purpose of citations is to acknowledge and build upon the work of others, and any attempt to manipulate

citations in order to boost the impact of a researcher’s work is considered to be a form of academic misconduct. Such behavior undermines the integrity of the scientific enterprise and can damage the reputation of the researcher and the research community as a whole [6].

Rather than trying to boost citations, researchers should focus on producing high-quality research that is original and valuable to their field. This includes conducting their research in a rigorous and ethical manner, accurately and transparently reporting their findings, and ensuring that their work is made available to the wider scientific community through publication in appropriate venues. If a researcher’s work is truly impactful and valuable, it should be able to stand on its own merits and will naturally attract citations from other researchers [7].

Conclusions

This study conducted a survey of highly cited papers or top 1% cited articles published in 2013-2022 in Environmental Sciences journals. The results of 10153 papers disclose that the top cited papers are in 3 main topics: renewable energy, biochar and pollution, and global environmental issues. There is a tight network of scientists with a remarkable number of highly cited papers. This co-authorship strategy help increases citations and highly cited papers.

It is important to stress that there is not necessarily a link between a highly cited paper and research misconduct or citation manipulation. A paper may be highly cited for a variety of reasons, including the significance and novelty of the research, the quality of the writing, and the relevance of the topic to the scientific community. Citation manipulation can be motivated by various factors, such as the desire to increase the perceived impact and influence of one’s research, boost one’s research metrics or rankings, or secure funding or academic advancement. While it is possible for a highly cited paper to be the result of genuine interest and impact in the scientific community, in some cases, the high number of citations may be the result of citation boosting. It is important for the scientific community to be aware of this possibility and to take steps to prevent and address citation manipulation, in order to maintain the integrity and reliability of the scientific literature.

Overall, many factors can contribute to the citation of a scientific paper, and researchers can take a number of steps to increase the visibility and impact of their work. For example, publish in high-impact journals which tend to have a larger readership, promote the paper through social media and other channels, engage in active research such as participating in conferences, collaborating with other researchers, and staying up-to-date with the latest developments in the field. Moreover proper citation practices, such as citing relevant and recent literature and using a consistent citation style, can help to increase the visibility and credibility of a paper and make it more likely to be cited by others.

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