

## **Trends and Approaches In Environmental Journalism Research Post-2000: A Bibliometric Analysis**

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### **Abstract:**

Research in Environmental journalism is changing with its wider application of communicating environmental and climate change issues in the last two decades. The approaches that provide more context and depth need to be considered, and emerging trends need to be identified to sustain the innovativeness and development of the field. The study is a bibliometric analysis using data from the Web of Science database reviewing articles on environment journalism published between 2003-2023 based on keywords environmental journalism, news, and media coverage. Further, bibliometric attributes of keywords, bibliographic coupling, and co-citation analysis were analyzed and added with VoS Viewer visualization. Bibliometric analysis is increasingly used in different disciplines to find emerging trends with the advancement of scientific databases, bibliometric software, and cross-disciplinary approaches. This method is essential in drafting an objective and subjective interpretation of the cumulative intellectual structure. The study provided an overview of the research, identifying the core areas of inquiry, thereby uncovering the trends and approaches in the field and possible knowledge gaps for further investigation.

**Keywords** - Environmental Journalism, Environmental Communication, Bibliometric Analysis, Bibliographic Coupling, and Co-citation Analysis

## **Introduction**

Research in environmental journalism and communication has changed rapidly post-2000 with the rise of the internet and information technology. Challenges and pursuits of environmental journalism have evolved and diversified since its early days in 1960, from fighting limited access, censorship, technical jargon, and lack of training (**Freidman, 1991; Frome, 1998**) to the environmental crisis we are fighting today. The changes in ownership patterns and the media landscape with the forays of social media and multimedia have shifted the coverage of issues in environmental journalism (**Freidman, 2015**). Journalists have raised environmental issues, bringing indispensable information to communicate complex environmental science to common people (**Sachsman & Valenti, 2020**).

In time, the stories of the environment and natural habitat and the impact of humans on it or vice versa have varying degrees of public interest and political discourse. Media coverage of environmental issues has mostly caught punctuated short-term public attention. However, there is a need to have more longitudinal studies to give us more context, role, and better in-depth journalism (**Hansen, 2015**). Environmental journalism has strongly been influenced by complex social, political, and economic processes, with international organizations, state agencies, and corporate houses directing conflicting information. Studies have shown that these agencies shape the media agenda as 'information subsidies' (**Gandy, 1982**), influencing news framing (**Priest, 2015**). Environmental journalists continuously play a vital role in these complex interactions of stakeholders and the resulting public and policy agenda.

Frome (1998) and Friedman (2004) have been tracing the evolution of environmental reports since 1970 and criticize them for their 'event-specific approach' to environmental disasters such as the Bhopal Chemical accident to Exxon Valdez oil spill. Scholars such as **Giannoulis (2010) and Friedman (2015)**, with the establishment of academic journals and publications, have examined 'priorities and beliefs' set in the field and criticized varied issues in the following decades. Journalists have been fighting for shrinking spaces in environmental issues to compete for equal footing with other beats, changing in complexity and range of issues (**Friedman, 2004**). The complexity of reporting climate change, pollutants, technology, and wide-ranging sustainability and energy efficiency issues are the changing beats of environmental journalism (**Kovarik, 2020**).

The complexities grew, leading to negotiations and conflicts in reporting environmental issues with journalism's established norms and practices. The dichotomies of 'temporal,' 'spatial,' 'objective,' 'balanced' with 'advocacy,' 'campaigns,' and 'translations/interpretations of scientific knowledge' are issues that came to the fore in environmental journalism (**Neuzil & Kovarik, 1996; Bodker & Neverla, 2012**). These dichotomies gave rise to a broader inquiry of "environmental communication" with scopes of more comprehensive interactions of diverse disciplines and actors. Environmental journalism precedes the phenomenon of "environmental communication," which summarizes the relationship between "ecological environment issues" and communication (**Wu et al., 2021, p. 1**).

According to Cox (2010), Environmental communication is the pragmatic vehicle for our understanding of the environment as well as our relationships to the natural world; it is the symbolic medium that we use in constructing environmental problems and negotiating society's different responses to them (**Cox, 2010**). It plays a vital role in solving environmental problems by informing, alerting, educating, and persuading people, and it also shapes people's understanding of environmental issues. The communicating environment provides various platforms and approaches to citizens, government officials, and opinion leaders such as NGOs and journalists to raise their concerns and discuss the issues that affect our planet (**Cox, 2010, p.11**).

Environmental journalism comes under environmental communication, defined as "researching, verifying, writing, producing and broadcasting of the news related to the environment to the public

sphere by trained professionals” (Pezzullo, 2018, p. 92). It is an obscured and compound journalism that covers a broad range of socio-political, technical, and natural phenomena. It is also divided into advocacy debate, which concerns the perception and communication of “risk and crisis” (Mocatta, 2015, p.13). Over the years, there have been vast transformations in environmental journalism. The researchers opted for the bibliometric analysis technique to analyze the changes and examine the new trends in environmental journalism.

Environmental journalists, with more professional organizations coming in place and the rise of academicians and scholars over these years, have been working to improve the quality of reporting, mitigate the broadly conceived boundaries, and maintain the journalistic practice of environmental issues. Technological development over two decades has affected the pattern and method of environmental journalism. Because of the continued evolution in the research area, investigating its trends and approaches becomes essential. With these in mind, the study focused on the research articles of journalistic practices in environmental journalism rather than communication practices, giving an overview of the issues and agendas propagated and highlighted by scholars tracking reports on environmental journalism post-2000. For the study, we formulated the following research questions:

RQ1: What is the intellectual structure of the research in environmental journalism?

RQ2: What are the research trends in environmental journalism post-2000?

RQ3: What are the Bibliometric attributes of the highly cited papers and co-cited authors in the field?

## **Literature Review**

Bibliometric analysis has been extensively and more prominently done in various fields like management studies and Business Research (Rosetto et al., 2017; Donthu et al., 2020; 2021), Information technology (Donthu et al., 2021), Economic research (Wang et al., 2020), Library and Information Science (Bichteler & Eaton, 1908; A°stro°m, 2007; Chang et al., 2015; Zhao & Strotmann, 2014), and many more. The bibliometric analysis method uses visualization,

graphics, and metrology to represent the data results and is associated with developing scientific knowledge (Niu et al., 2014).

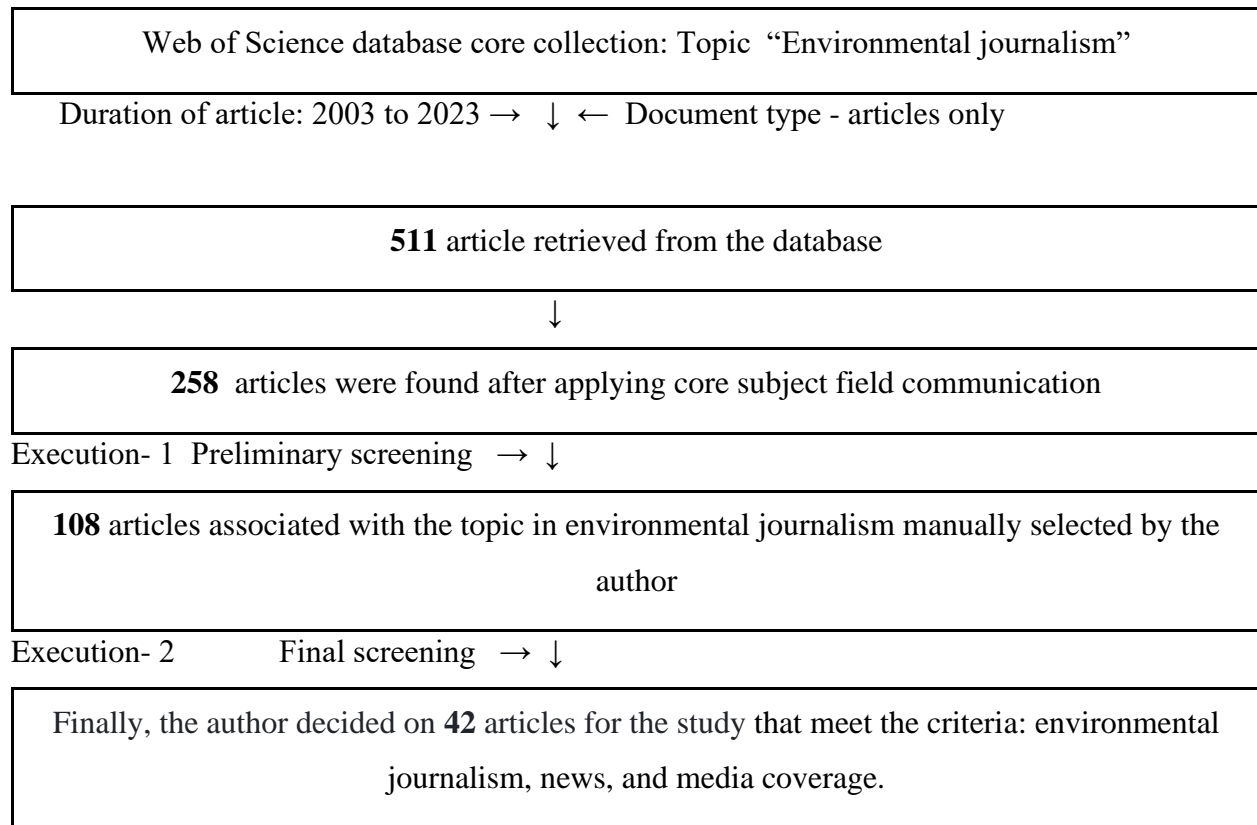
These bibliometric analyses use prominent citation index databases like Web of Science (Chang et al., 2015; Kollé et al., 2019; Rosetto et al., 2021; Wu et al., 2021) and Scopus (Donthu et al., 2021; Akerlof et al., 2022; Pandey & Ghosh, 2023; Showkat, 2023). However, some research has used mixed methods such as bibliometric analysis and SLR (systematic literature review) (Rosetto et al., 2021). Other studies have explored the analysis of authors in co-authorship analysis (Donthu et al., 2021); the co-authorship analysis is a formal interaction among scholars in research fields, which is an intellectual collaboration between scholars (Acedo et al., 2006; Cisneros et al., 2018). The co-citation analysis was introduced in 1970 and is used to investigate the co-citation network (Chang et al., 2015) of cited publications and to state the co-occurrence of cited articles in the journal (Donthu et al., 2021) added with bibliographic coupling (Chang et al., 2015; Donth et al., 2021).

Very few works use bibliometric analyses to analyze the research in environmental communication (Wu et al., 2021) and ‘the boundaries of environmental communication’ (Pleasant et al., 2002; Comfort & Park, 2018), co-citation analysis, and network analysis (Akerlof et al., 2022). Wu et al. (2021) argued that a knowledge mapping analysis is necessary to understand the current scenario and new trends in environmental communication, exploring basic characteristics, research hotspot analysis, and confines in environmental communication research. As Akerlof et al. (2022) mentioned, there is a need for more comprehensive and contextualized research on mass media in environmental communication. The works of Comfort & Park (2018), Wu et al. (2021), and Akerlof et al. (2022) are broadly done, transversing different disciplines and hence losing the specificity and contextualization of a journalistic perspective in environmental journalism. By highlighting this gap, the researchers conducted a bibliometric analysis of the research work in environmental journalism.

## **Methodology**

This study adopted the bibliometric analysis method to investigate the literature and methodology of the subject, selecting the 'Web of Science' core collection database to cover extensive data of cited references with all authors worldwide, which removed biases in the selection criteria. The retrieved articles from the database are fed to Vos Viewer for analysis and visualization. For this study, we considered the articles from 2000 to 2023 to examine environmental journalism trends and approaches. By applying the title "environmental journalism" and the keywords environmental journalism and environmental communication, we retrieved 511 articles as primary results on 20 October 2023. We selected 'only articles' as the document type, removing others such as 'editorial material,' 'early access,' and 'review articles.' Other document types like 'book' and 'book chapters' are unavailable in the Web of Science database for this topic. The database has only included book citation details since 2011 (Testa, 2012). Further, the document type- books or book chapters suffer from vulnerable integrants for assessment in bibliometrics (Calver et al., 2013) as they do not have authors' keywords, which are considered vital in the manuscript (Pesta et al., 2018). In addition to this, we selected English as a language for articles by excluding other mentioned languages.

The data retrieved belong to different subjects, but most belong to Communication with 258 articles; Environmental Studies with 213 articles, Environmental Science with 109 articles, and Green Sustainable Technology with 50 articles. By concentrating the research on Communication, we deselected the articles that did not belong to the communication subject field. After deselecting the article from other subject areas, we took 258 articles related to communication. Focusing on the core subject area of research, i.e., Environmental Journalism and Environmental Communication, we further screened manually and retrieved 108 articles. On closely reading the articles' Title, Author Keywords, and Keywords Plus of each paper from the database, the study manually filtered articles that primarily focus on 'environmental journalism' and journalism practice to increase the specificity and finalized the number of articles for the study to 42 articles. These articles meet the criteria with the keywords environmental journalism, news, reporting, and media coverage for this investigation. We studied these articles for the intellectual structure using keywords, bibliographic coupling, and authors' co-citation analysis, identifying the research trends and climate change-related issues in environmental journalism post-2000.



**Fig. 1:** Schematic for searching environmental journalism articles using keywords

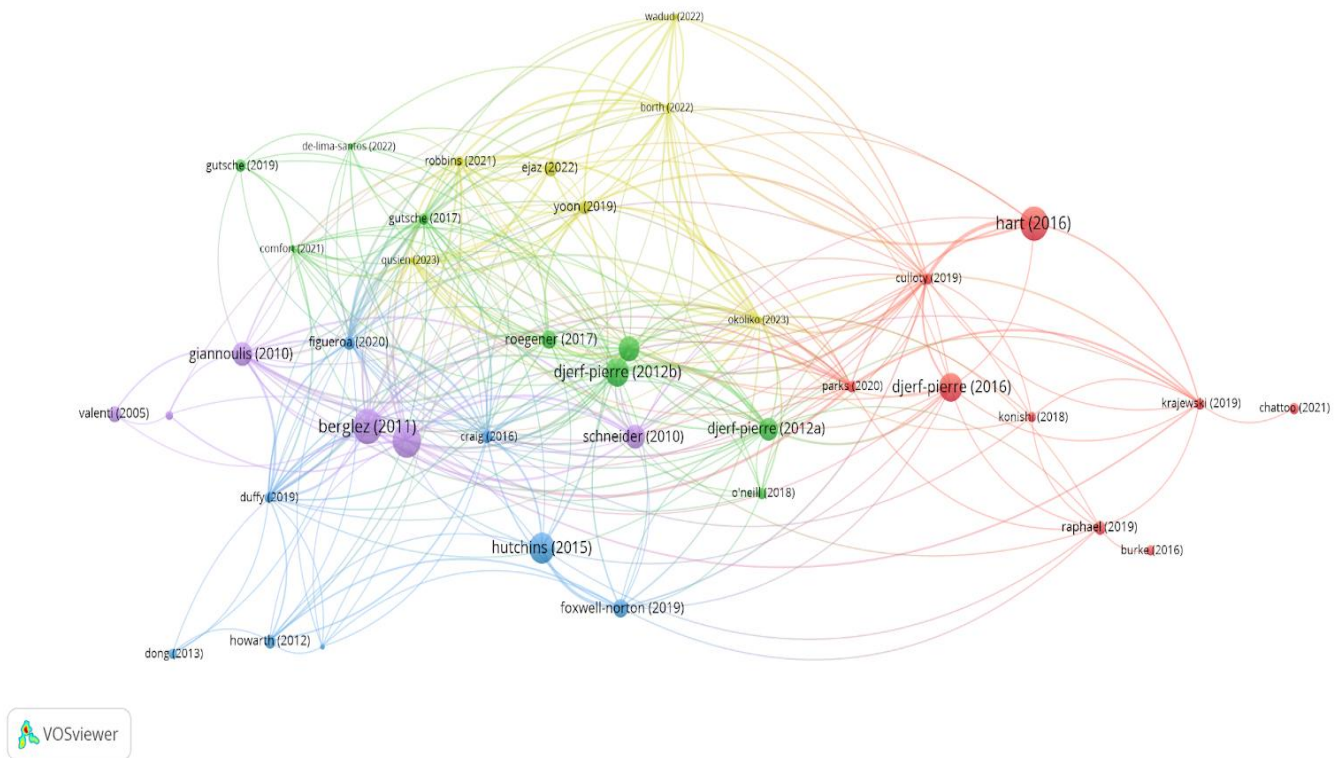
## Findings and Discussions -

To answer the first research question, RQ1, we classified the data into a theme-based intellectual structure based on bibliometric coupling. According to Zhao & Strotmann (2014), Bibliometric coupling is an effective way “to analyze the methods of the field and predict the possible direction for future research” (Zhao & Strotmann, 2014, p. 996). Using the bibliometric coupling technique, we developed four themes of the discipline. Themes were generated using the cluster based on documents, i.e., articles and authors graphically displayed in the network and density map. A cluster compiles items (i.e., Authors, Articles) that endure similar research characteristics. Cluster clubs the items together and forms subgroups based on their common topics, keywords, and themes. The procedure of analyzing the cluster is conducted by reviewing the articles of each cluster to find out the central themes of the particular cluster. This kind of same approach has been

delivered in several past studies (**Baker et al., 2019; 2020a; Burton et al., 2020; Kumar et al., 2020; Donthu et al., 2021**).

We chose the bibliographic coupling analysis of articles having at least 1 citation. Among 42 articles, 39 satisfied the citation requirement, and these articles are considered for analysis with an in-depth reading of every paper.





**Fig. 2:** Cluster of bibliographic coupling of articles.

### Theme 1

**Framing for public engagement - descriptive text, representative imagery, visualization, creative strategies, public engagement, behavior change (Based on clusters 1,2,3)**

The environmental journalism stories of climate change in textual or imagery tend to influence public opinion (**Hart, 2013; Schuldt et al., 2011**). Visual representation of climate change media text can influence people's perceptions and motivation (**Culltoy, 2019**). For conceptualizing

climate change, there must be a particular visual framing (O'Neill, 2013). It increases the perception of efficacy, changes individual behavior through efficacy, helps the public develop a sense of efficacy, and promotes public engagement (Hart & Feldman, 2016). The efficacy is 'essential to the positive reception' (Witte & Allen, 2000) of "risk messaging" (Krajewski et al., 2019, p. 272). Comprehensively visualizing the environment makes the environmental issues more meaningful for an audience. Through creative strategies like stand-up comedy, the audience learned factual information, which increased audience understanding and induced the potential engagement of people who ascertain fact-based information and acquire new knowledge (Chatto, 2018). Furthermore, awareness of the water crisis has been initiated through awareness campaigns like Public Service Announcements (PSAs) through new media platforms like YouTube, which raise awareness and persuade people to change their behavior (Krajewski et al., 2019).

The new media strategy with negotiation as an entanglement of people's persuasion is more effective in conveying the message of environmental issues and climate change. It helps to construct the "relationship between global NGOs and media, which ameliorates environmental communication" (Konishi, 2018, p. 1). "News media, media frames, and news media actors" (Djerf-Pierre, 2016, p. 634) play crucial roles in framing people's mindsets. With its robust, developed, and classic media strategy, the print media still holds strong to communicate and engage people at the grassroots level. Like other media strategies, "newspaper stories or columns may also mediate between government officials and ordinary people, increasing the communication and co-production of environmental knowledge between ecological scientists, social science researchers, and the communities they work with" (Burke et al., 2016, p. 169). The environmental communication praxis provides accessible pathways to engage the public so scientists can connect with what may be minimalist and vital for their research (Burke et al., 2016). Public engagement is interlocking with the media strategy for conflict management, where the media, economic, and political power network connects with people (Hutchins, 2015).

We could draw from these studies that different communication and media strategies such as textual and imagery presentations, stand-up comedy, awareness campaigns like Public Service Announcements (PSAs), media actors, and print media platforms help reach the public. These strategies are used comprehensively to enhance social interactions, awareness, public participation, and

engagement and also to change the cognitive behavior of individuals and society on environmental issues. These media platforms studied by the authors are fruitfully associated with society to work on and negotiate environmental-related issues such as climate change, renewable energy issues, water crises, and environmental justice.

## **Theme 2**

### **Local and global: Democratizing policies and practice - Agenda setting, interactive journalism, involvement of local, examination, policy reforms (Based on clusters 2,3,1**

Environmental news is not considered significant news that would be replaced by economic news or other crisis-related news. Media uses the ‘crowding effect’ in the selection of news and internally changes and sets the agenda according to the preference of time and news (**Djerf-Pierre, 2012, p. 513**). The ‘outpouring for one category of environmental issues’ engenders ‘attention to other environmental issues’ and shows the “relatedness” among all environmental news (**Djerf-Pierre, 2012, p. 302**).

Environmental journalism is arduous and precariously necessary—news media worldwide cover environmental issues. The authors discussed news covered by local journalists in environmental stories like the ‘Chipko Movement’ in India, the ‘Great East Japan Earthquake,’ ‘The Australian Bushfire,’ and ‘The Amazon rainforest’ to highlight the local, national, and global significance. According to Gutsche and Shumow (**2017**), environmental news is where the two journalistic communities cover a single issue. However, local journalists are experts in local issues and can report local issues more promptly than national journalists. It swiftly draws a borderline between local journalists and national journalists and “crowd out” (**Djerf-Pierre, 2012, p. 291**) them from local issues, which makes the national journalists “outsider” it calls the “boundary intersection” (**Gutsche & Shumow, 2017, p.8**) of local press coverage.

Many authors have highlighted the significant role of the national media in protecting the environment. In the case of Australia, Foxwell-Norton and Konkes (2018) found that their news

media played a crucial role in the major environmental issue of ‘The Great Barrier Reef.’ They reported the news and critically communicated the Reef’s protection with ‘modern environmental policy’ and “news media practice” (Foxwell-Norton & Konkes, 2018, p.1). In other cases, the local media made a boundary intersection with global journalists. The international media still highlighted and covered international environmental issues, like how the Chinese Central Media represents Africa through environmental news, which shows the “development of environmental discourses” (Boughen, 2021, p. 67). As a local issue, the global environmental issue is also kept in light by national media. The U.S. media covering global climate change shows that climate change is accepted as a crisis in news media (Parks, 2020).

As environmental issues become vital in global warming and climate change, NGOs become ‘purveyors of journalistic information’ (Powers, 2016) as they do journalism publications significantly. “The journalists who write for these NGOs promptly follow the ‘norms and practices of traditional commercial journalism’ to write environmental news” (Comfort & Blankenship, 2021, p. 1). Along with reporting and engagement of NGOs in environmental news coverage, the news media also focuses on public involvement. The environmental crisis has prompted “the news media to create editorial brands that explicitly cover these topics with the help of ‘data journalism’ and ‘collaborative journalism’.” (de-Lima-Santos, 2022, p.540). It emphasizes “the audience’s deeper participation and involvement and helps transform “their traditional role as passive recipient into active participant” (de-Lima-Santos, 2022, p.540). They also actively participate in government policy reform of national environmental issues (O’Neill et al., 2018). Public participation is essential in studying and democratizing the ‘environmental justice’ policy and practice. Public engagement in “environmental policy and decision-making can be more inclusive of the knowledge, interests, and voices of disempowered communities” (Raphel, 2019, p.1102).

### **Theme 3**

#### **Journalistic Challenges - complexity, norms, media coverage, shifting roles ( Based on clusters 4,3**

Being a crucial part of the news industry, the environmental journalist faces the complexity of technical and interpretive information and has to tackle disinformation, negativity, and political pressure (**Robbins & Wheatley, 2021**). Concentrating on the research on the challenges faced by environmental journalists (**Qusien & David, 2023; Mushfique, 2022**), we studied and discussed their work. There is polarization in the coverage of environmental problems between “conservative mainstream media and left-leaning mainstream and alternative media outlets” (**Yoon & Wilson, 2018, p. 1**). In the post-modern society, journalism practices must evolve by developing new boundaries and relocating their framework approach. It plays the role of watchdog, provides quality information, and initiates debates (**Haworth, 2012**)

Focusing not only on hard news areas like pollution, environmental damages, and climate change, authors like **Craig (2015)** discuss new domains of environmental journalism, ‘green lifestyle journalism,’ concentrating journalism around sustainable living (**Craig, 2015**). However, theme concerts about how the public and government influence the media coverage and impact on the practice of journalism make it more challenging. Overcoming the complexity and challenges in environmental journalism, environmental journalists engage through campaigns and news coverage to influence the people on environmental issues. By guiding journalists, news managers, researchers, and practitioners, they create and measure an impact with the highest-impacted climate solutions (**Fahy & Nisbet, 2011; Gibson et al., 2016; Post, 2017**).

### **Theme 4**

#### **Setting Standards and Ethics - Objectivity, Setting Standards, Priorities and Beliefs, Objectivity vs Advocacy, Ethical framework ( Based on clusters 5,2,3)**

Environmental issues are transmitted to the public primarily through environmental journalism. Understanding complex and scientific environmental issues and disseminating them to the general

public in simple language is an art (**Valenti & Tavana, 2015**); it requires guidance and assistance from experts like nature scientists; with them, the journalists engage in proper training and understand the problem (**Valenti & Tavana, 2015**). By minimizing the error in reporting, journalists approach the issue objectively, reduce subjective opinion, and reveal their biases (**Schneider, 2010**). Hiles and Hinnant (2014) discussed the evolving standards of journalism, redefining the term objectivity by emphasizing the ‘weight-of-evidence’ (**Hiles & Hinnant, 2014, p. 33**) by altering it with ‘balance’ (**Hiles, 2010, p.12**).

With a lack of objectivity and a decline in the quality of reporting, people restrict themselves to consuming from specific news sources (**Enda & Mitchell, 2013**). Having no quality theory for journalism, the term ‘quality environment journalism’ becomes vague. With the development of socio-eco-political factors, approaches toward the environment have also changed. **Giannoulis et al. (2010)** argue that the priorities and belief system of reporters influence the angle of news reporting and classify the reporters based on their roles in reporting news in the four categories ‘Disseminator, Interpreter/investigator, Populist mobilizer, Adversary.’ “Journalists discuss environmental issues by relying on personal values and social systems” (**Giannoulis et al., 2010, p. 425**).

“Environmental journalists sometimes see themselves as advocates of the environment” (**Figueroa, 2017, p.5**), which breaches the journalistic norms of objectivity. There is a fragile line between advocacy and objectivity, and because of that, maintaining the norms becomes more precarious for the environmental journalist (**Figueroa, 2017**). Decreasing the vagueness of this argument regarding the legitimation of journalistic authority and environmental reporters, **Dong (2013)** examines the creation and maintenance of moral and pragmatic legitimacies, cognitive and social legitimation, and symbolic legitimation of the market media ideology and found a positive influence of news values and objectivity routines on environmental journalism (**Dong, 2013, p. 397**). Even though personal values and cues influence the judgment of the news reporter, it should not break the ethics of journalism, which are crucial. Despite all the qualities, standards, objectivity, and fairness, journalists need to convey their message to the public. Maintaining the above factors, journalists can encompass new ideas, logic, and creativity in news reporting (**Jones,**

2012); without deviating from the media logic, journalists should critically utilize creative thinking and implementation in action (Berglez, 2011).

### Citation Analysis

We used Citation analysis to answer the second research question, RQ 2, to list and analyze the top 10 highly cited articles from a total of 42 articles of environmental journalism. Peter Berglez (2011) sits on top with the highest citation number of 60, discussing the creativity in journalism, specifically the reporting about climate-related issues. However, Feldman’s (2016) article has the highest average citations per year, i.e., 6.88, and is the second most highly cited, with 55 citations. The comparison of both articles shows Berglez's article, achieved the first rank after 13 years with an average of 4.62 per year, whereas Hart; Feldman’s article gained the second spot within seven years (see Table no. 1). The difference between the total citations of both articles is 5, While the average number of citations is 2.26. If the same pattern continues, the second-ranked paper can become the highest-cited article in the next 2 to 3 years.

#### Top ten highly cited ‘environmental journalism’ articles from 2003 to 2023

S.no.	Article	Author	YO P	Total citation	Average citation per year
1	Inside, Outside, and Beyond Media Logic: Journalistic Creativity in Climate Reporting	Peter Berglez	2011	60	4.62
2	The Impact of Climate Change-Related Imagery and Text on Public Opinion and Behavior Change	P. Sol Hart, Lauren Feldman	2016	55	6.88
3	Climate Change in the Newsroom: Journalists' Evolving Standards of Objectivity When Covering Global Warming	Sara Shipley Hiles, Amanda Hinnant	2014	55	5.5
4	Theorizing the Enactment of Mediatized Environmental Conflict	Brett Hutchins, Libby Lester	2015	44	4.89

5	Framing Renewable Energy: A Comparative Study of Newspapers in Australia and Sweden	Monika Djerf-Pierre, John Cokley, and Louise J. Kuchel	2016	40	5
6	The Crowding-Out Effect Issue Dynamics and Attention to Environmental Issues in Television News Reporting over 30 years	Monika Djerf-Pierre	2012	40	3.33
7	Media Representations of Climate Change in the Argentinean Press	Maria Teresa Mercado	2012	29	2.42
8	Newspaper Reporters' Priorities and Beliefs About Environmental Journalism: An Application of Q-Methodology	Christos Giannoulis, Iosif Botetzagias, and Constantina Skanavis	2010	27	1.93
9	Making Space for the Nuances of Truth: Communication and Uncertainty at an Environmental Journalists' Workshop	Jen Schneider	2010	27	1.93
10	When Attention Drives Attention: Issue Dynamics in Environmental News Reporting over Five Decades	Monika Djerf-Pierre	2012	25	2.08

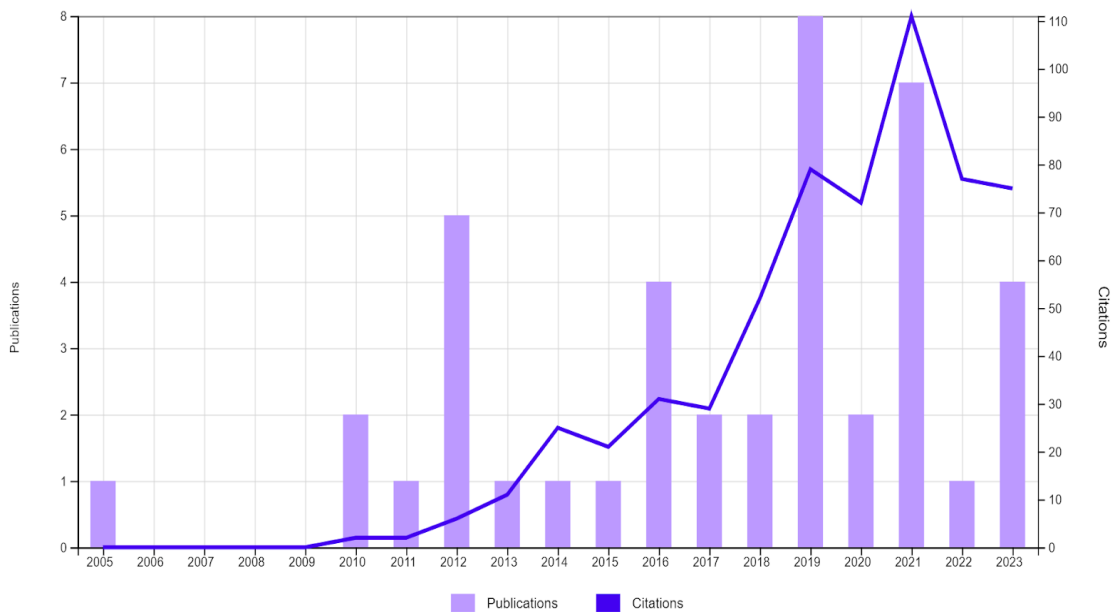
**Table no. 1**

Understanding the similarities between these top two articles, the authors found that both relate to climate change-related issues. The first two pieces and the third article of Hiles and Hinnant (2014) discussed climate change. This delineates the articles related to the area of climate change in the field of environmental journalism and obtains more citations than any other topic. In the top ten cited reports, four articles dealt with climate change; it can be understood that 25% of highly cited articles come from the climate change domain. Articles related to climate change have 199 citations from a combined total of 402 citations in the top 10 papers listed above, forming 49.50% of total citations. It demonstrates that almost half of the total citations received by the top ten articles of environmental journalism come from articles associated with climate change issues.



Every article obtains approximately 40 citations per article. Of 402 citations, 170 are received by the top three papers, with an average citation per article of 56.66, more significant than the average citation of the top ten articles by 16.66. These articles were published in 2012, 2010, and 2016 with two articles each. In the list of top ten highly cited papers, no article was published before 2010, while the latest one was published in 2016. No highly cited article has appeared in the last seven years, i.e., since 2016., Hart and Feldman (2016); Djerf-Pierre, Cokley, and Kuchel's (2016) articles have 60 and 40 citations with an average of 6.88 and 5 per year. Renewable energy can be considered one by examining the emerging areas of environmental communication. Djerf-Pierre, Cokley, and Kuchel's (2016) article, which discussed renewable energy, received high citations in a short period compared to the other areas of the field.

Publication of articles in this research area has gradually increased. The publication of articles needed to be more consistent. However, it shows there needs to be more consistency in publishing articles, as only Valenti and Gaugau's article was published in 2005. No articles were published for four years till 2010. Finding the pattern in the publication of articles is challenging as there is no consistent growth or even decline in the publication of articles (**See Fig No. 3**). In 2021, there were only 7 publications but received the highest number of citations of 111 followed by 2019, with 79 citations. This argument supports the conclusion.



**Fig. 3:** Trends in publication and citation of articles from 2005 to 2023 in environmental communication.

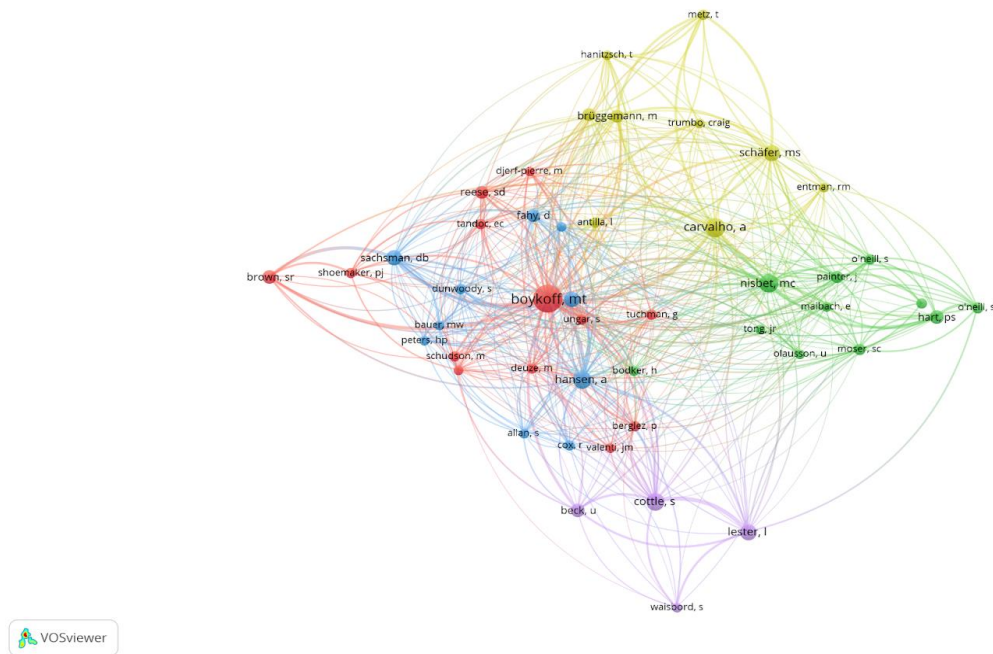
**Source: Web of Science Citation Report**

that there is no relationship between the number of citations and article publication. There are drastic ups and downs in the article's publication and constant growth in the article's citations.

In environmental journalism research, the articles have received consistent citations per year since 2010. However, in the last three years, there has been a slight decline in the citations. The total number of citations received by 42 articles is 593 in 19 years from 2005 to 2023, with an average citation per year of 42.36. The average number of articles published during this period is 2.21 per year. The year 2012 was the year of quality research in environmental journalism. This year, five articles were published, of which three are in the list of top 10 articles. These articles focused on how environmental reporting has gradually changed over time. The main two articles, which focused on advancing environmental reporting in different media forms, were authored by Djerf-Pierre in the same year. She is the only author with two papers in the list of top 10 highly cited articles in environmental journalism.

### **Co-citation analysis**

We used the authors' co-citation analysis to answer the third research question, RQ 3. We analyzed the most influential authors and the network of authors in environmental journalism, which helped us to analyze the evolution and dynamics in this area. Authors cited together usually disclose the common study area (**Hjorland, 2013**) and exhibit the advantage of developing the intellectual structure of the field. It measures and discloses the two authors cited together, creating the networking mapping of authors (**Donthu et al., 2021**). As eligibility criteria for the analysis, the scholars considered a minimum of 5 citations of a particular author. Rossetto et al. (**2017**) argued that "co-citation analysis is the strongest interrelationships between researchers and their subjects of interest in later periods" (**Rossetto et al., 2017, p.1346**). It shows how the network was created and developed between authors and suggests the significant connectivity increase.



**Fig. 4 - Cluster of co-citation analysis**

We analyzed 1664 authors; out of them, 47 items satisfied the minimum criteria. We monitored and presented an intellectual structure of the co-cited authors and the network between them and used VOSviewer software (Fig no.3). A total of 47 items were represented in five different group clusters with their unique colors. The first cluster is represented by a red color consisting of 13 authors. At the same time, the second is represented by green, the third by blue, the fourth by yellow, and the fifth by violet, consisting of 11, 10, 9, and 4 authors in each cluster, respectively.

The co-citation network comprises a total of 47 items comprising 5 clusters. The total link strength of the cluster is 2219, with 569 links between 46 authors and 5 clusters. Among these 5 clusters, the first cluster is considerably the biggest, consisting of 13 items represented by red color. The violet color represents the fifth cluster, the smallest cluster, with only four items; in contrast, the second, third, and fourth clusters have 11,10,9 items, respectively, and are portrayed with green, blue, and yellow, respectively.

The author of the first cluster, Boykoff, has shown solid connections. Out of 46 authors, he is linked with 43, suggesting the most substantial relationship between researchers and influential

work. The cluster size indicates the domain area's importance, and the highly linked author possessed the highest concentration, indicating the topical orientation of the cluster. By having the highest link strength, i.e., 469, and linked with 43 authors out of 47 authors, Boykoof has played a central role in representing the topical orientation of cluster 1. The dominant authors of the first cluster with Boykoff, Brown, Reese, and Berglez. They explored 'media coverage on global climate change' (**Boykoff & Boykoff, 2004, p. 134**) with respective global transformations, suggesting creative reporting and updating the journalism approach. The authors of the first cluster followed the Q-methodology (**Brown, 1980; 1996**) and frame mapping techniques (**Reese, 2001**).

Compared to the first cluster, the second cluster has 11 items consisting of 10 authors, one author named O'Neil, who published an article with two different names, S. O'Neil, and S.J. O'Neil. The second cluster is smaller than the first cluster. Among all ten authors, Nisbet has the most robust link connection, with 34 items corresponding to 172 link strengths. The central point of cluster 2 from all 11 items concludes at Nisbet, which depicts the proximity in their networks. The prominent representatives of the second cluster are Nisbet, Hart, O'Neill, and Painter. The interrelationship between these authors advances towards topics like 'science communication' discussing "climate skepticism" (**Painter & Ashe, 2012, p. 1**), polarized frames with diverse "pro-environmental behavior" (**Whitemarsh & O'Neill, 2010, p. 305**) insisting on effective mitigation and "public engagement" (**O'Neill & Nicholson-Cole, 2009, p.1**), applying methodologies like framing theory (**Nisbet, 2009**), public engagement strategies, and boomerang effect (**Hart & Nisbet, 2011**).

The third cluster of the network also consists of 10 authors. Decoding the thematic compatibility of the third cluster, the authors of this cluster discussed the news coverage of environmental risk, source diversity, public relations on shifting roles, and emerging practices. The research areas that emerged from this cluster are "science publics" (**Fahy & Nisbet, 2011, p. 783**) and evolving science media ecosystems (**Hansen, 1991; 1998; Sachman, 1976; Anderson, 2009; Fahy & Nisbet, 2011**).

The fourth cluster is relatively smaller, consisting of 9 authors, compared to the first three. Among these nine authors, Carvalho has the highest number of links, i.e., 43 connecting with almost 43

items with 239 link strengths, creating solid connections. The second highest-linked author is Schafer with 32 links and 171 link strengths. Following this, the third and fourth highly connected authors are Bruggemann and Metz with 31 links and 136 link strength, ten links, and 102 link strength. It is reasonable to assume that the topic structure of this cluster considerably built by these authors, which revolves around “comparative studies” (**Carvalho, 2007, p. 207; Schmidt et al., 2013, p. 1233; Bruggemann 2014, p. 76**) more or less all the authors have applied comparative studies with their specialized approach as re-reading and analyzing news on climate change, comparative analysis of media’s attention to climate change and in public spheres, comparative communication research of media system and comparative philosophy and media ethics.

Compared to all previous clusters, the fifth cluster is the smallest network cluster constructed by only four authors. Despite being the smallest cluster, the authors of this cluster have a strong connection in the network, which is effectively reflected by their links and total link strength. Among these four authors, three authors, i.e., Beck, Cottle and Lester have strong link strength in and outside of the cluster, i.e., 94, 171, and 135, respectively. The authors of this cluster developed the intellectual structure stressing the topic “environmental conflict” (**Cottle, 1998, p. 8**) and “risks” (**Beck & Kropp, 2007, p. 2**), and they incorporated it in their work, like environmental risk.

## **Conclusion**

This study explored the answers to the three questions proposed to discover trends and intellectual structure of environmental journalism. With the application of tools like bibliographic coupling and co-citation analysis, the paper classified the intellectual structure derived from the VOSviewer software into four significant themes of the discipline for smooth understanding. The first theme discussed framing for public engagement, stressing topics like textual, imagery, and visual framing for conceptualizing environmental issues (**O’Neill, 2013**) and developing a sense of efficacy in public (**Hart & Feldman, 2016**), using various media platforms and media strategies to convey messages on environmental issues and climate change more effectively. The second theme proposed around the concepts of ‘local and global.’ Emphasizing democratic practices in policy making. This theme focuses on “agenda-setting” (**Djerf-Pierre, 2012, p. 513**), “interactive

journalism with the involvement of locals” (Gutsche & Shumow, 2017, p.8), and their active participation in government policy reforms in environmental issues (O’Neill et al., 2018).

Further, the third theme concentrates on topics like ‘journalistic challenges’ - compiling problems like disinformation, negativity, and political pressure with the complexity of technical knowledge (Robbins & Wheatley, 2021) journalists face. Journalism practices should evolve and relocate the frames by focusing on emerging domains like ‘green lifestyle journalism’ (Craig, 2015). The fourth theme exclusively dealt with ‘setting standards and ethics’ in environmental journalism. It discusses objectivity, balance, priorities, and beliefs of reporters breaching journalistic norms. With norms and ethics, this theme also focuses on new ideas, logic, and creativity in news reporting to convey the message successfully to the general public. (Jones, 2012).

The second question deals with the research trends in environmental journalism post-2000.

We found a gradual increment in the publication of articles in this research area over time. Of the 42 articles, we analyzed to get an insight into highly influential topics of the domain. We detected that ‘climate change’ is the most significant topic. This topic has dominated environmental journalism for the past 20 years and has obtained more citations than any other topic. The paper on ‘renewable energy’ showed exponential growth in a short duration in the past few years. This topic has emerged as an influential topic in the past few years. With renewable energy, we also predicted that ‘green lifestyle journalism’ (Van Raan, 2004; Craig, 2015) can potentially attract upcoming researchers' attention in the domain.

We applied author co-citation analysis to analyze the most influential author of the discipline. We monitored the intellectual structure of the co-cited authors and their networks and presented them into 5 different clusters. The highly linked author possessed the highest concentration, orienting towards a cluster topic. The topical orientation of the first cluster revolved around Boykoff as he linked with 43 items of the cluster. Cluster one explores ‘media coverage on global climate change.’ In contrast, the dominant topic of the second cluster is ‘science communication’ discussing ‘climate skepticism’ influenced by the author M.C. Nisbet, who linked with every author of the cluster with a total of 34 Links.

The prominent authors of the third cluster are Fahy, Hansen, Sachman, and Anderson. The interrelation between this author develops topics like evolving science media ecosystems, news coverage of environmental risk, source diversity, public relations on shifting roles, and emerging practices. With emerging phenomena like “science publics (Fahy & Nisbet, 2011, p. 783).” The fourth cluster consists of 9 authors. The topic structure of this cluster revolves around “comparative studies” (Carvalho, 2007, p. 207; Schmidt et al., 2013, p. 1233; Bruggemann 2014, p. 76). Beck, Cottle, and Lester. are the representatives of the fifth culture; the topics derived from their work dealt with “environmental conflict (Cottle, 1998, p. 8),” “risks” (Beck & Kropp, 2007, p. 2), and cooperating with risk society.

This study demonstrated the intellectual structure of the research in environmental journalism. We analyzed the highly cited paper and the most influential author of the discipline. Bibliographic and co-citation analyses helped understand discipline trends from the last two decades. This study contributes to the field by developing central themes of the field. The study also analyzed the evolution of topics in the field. With the most influential topic of the domain, the study also reveals the emerging topics of the field. It can be helpful for the upcoming scholars to compare the past, current, and future topics to take the research forward with new findings. It will also assist future researchers pursuing their studies in this broad subject area.

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