

ARTICLE

The State of Environmental Communication Research: An Analysis of Published Studies in the Communication Disciplines

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Abstract: The purpose of this investigation was to systematically evaluate environmental communication studies across the communication-related disciplines. This study achieved the goal by examining published articles in 28 journals from the time period spanning 1973-2014. A total of 142 articles were evaluated based on an analysis of authorial, topical, theoretical, and methodological information. The findings demonstrate exponential growth in the number of environmental communication studies in recent years. A wide range of scholars and institutions has contributed to this area of research. A majority of the articles focused on environmental issues. The outcome of this study could provide a comprehensive picture of communication-based environmental research and guide the directions of future research in this area.

Keywords: Environmental communication; Sustainability; Systematic literature review

1. Introduction

In the twenty-first century, environmental issues are of utmost importance and have garnered great attention across a variety of social areas; however, environmental communication has not been a research realm in the spotlight. For example, more than 90% of respondents to a *Newsweek* survey indicated that environmental issues are their primary concern ^[1]. Recently, environmental issues have been discussed in light of sustainable development. Sustainable development is the process of stimulating

economic development while maintaining environmental sustainability and solving societal problems ^[2]. There is a critical need for environmental sustainability because a degraded environment could result in economic and/or social problems. For instance, climate change accelerates desertification, which leads to water shortage, which negatively influences health, education, and working hours.

Environmental communication is defined as “the link between communication practices and environmental affairs” ^[3]. As the role of media in environmental communication is

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to disseminate information regarding the importance of individuals' participation in environmental development and to impact the social discourse surrounding environmental issue ^[4] communication disciplines[Ⓞ] should be at the forefront of environmental communication research.

In the communication field, scholarly works around environmental issues have begun to emerge in recent decades. For instance, the major communication associations, such as the Association for Education in Journalism and Mass Communication (AEJMC), National Communication Association (NCA), and International Communication Association (ICA), have their own environmental divisions named Environmental Communication, Environmental Communication, and Communicating Science, Health, Environment & Risk respectively. In addition, the International Environmental Communication Association was launched in 2011. Monographs have also been published, such as Cox ^[5] *Environmental Communication and the Public Sphere*, in which articles on science communication, policy-making processes, advocacy campaigns, environmental journalism, environmental movements, and environmental rhetoric across scholarly and profession fields are presented ^[6]. In addition, Godemann and Michelsen ^[4] edited a book titled of *Sustainability Communication: Interdisciplinary Perspectives and Theoretical Foundations* that features cross-disciplinary perspectives to emphasize the values and roles of sustainability communication.

More notably, Pleasant et al. ^[3] investigated the state of knowledge regarding the topic of "environmental communication" from 1954-2001 using related keyword searches in the social science journal literature. The primary analysis included publication information, author, keywords, and topics. They noted the continuous growth of environmental communication research, a dispersed literature across journals, and the frequent appearance of scholars that possessed an expertise in risk. Although Pleasant et al.'s study is a meaningful resource of bibliographies about environmental communication studies, it is limited in scope. Their analysis encompassed only journals, authors, and topics. To fill this gap, this study will expand the scope of examination to assess the current body of knowledge on environmental communication in the multiple communication disciplines, including advertising, communication, and public relations by (1) identifying the journals that have published articles on environmental communication, (2) organizing the articles by theories and methods employed, (3) providing details on sample size

and unit of analysis, (4) discussing the conceptual contributions of the literature, and (5) offering an agenda for future research on environmental communications. This paper will provide a synthesis and review of literature that integrates the three interrelated disciplines about the topic of environmental communication based on the following research question.

RQ 1: What is the state of research addressing the topic of environmental communication among mass communication disciplines in terms of journals, authors, topics, theories, and methods?

The findings of this study will help to guide the future direction of environmental communication research for communications fields.

2. Materials and Methods

To investigate academic research on the topic of environmental communication among the communication disciplines, this study content analyzed full-length published articles in peer-reviewed journals. To extract relevant articles for examination, the researchers reviewed titles, abstracts, and full text from journals in the two categories: (1) journals published by major communication associations and (2) leading communication journals not published by the major communication associations. The time period explored to extract samples ranged from 1915, when the first issue of *Quarterly Journal of Speech* was published and the time period of analyzed samples ranges from 1973, when Althoff et al. ^[7] published the first article addressing environmental communication in *Journalism Quarterly*, through 2014.

2.1 Article Extraction

2.1.1 Category 1

In the field of communications, there are three major professional associations: the Association for Education in Journalism and Mass Communication (AEJMC), the International Communication Association (ICA), and the National Communication Association (NCA) ^[8]. It should be noted that the selected communication associations are based in the United States (i.e., their headquarters are located in the US and their annual meetings are held primarily in the US). Each of these associations publishes numerous peer-reviewed journals, with 35 in total from the three associations (19 AEJMC, 5 ICA, and 11 NCA journals).

2.1.2 Category 2

A few journals are not affiliated with the three major

Ⓞ Although the field of communications encompasses multiple disciplines, including advertising, public relations, and journalism, the authors use the inclusive term "communication" to refer to the discipline having to do with using a communication channel such as media.

associations but have been regarded by communication scholars^[8,9] as leading journals in one of the disciplines in the mass communication field, so they were selected for inclusion: *Communication Research* (CR), *Journal of Broadcasting & Electronic Media* (JOBEM), *Public Relations Review* (PRR), *Journal of Advertising* (JA), *Journal of Current Issues and Research in Advertising* (JCIRA), and *Journal of Advertising Research* (JAR). In total, the two phases of journal selection yielded 41 journals for analysis.

2.2 Articles

This study examined only full-length, peer-reviewed, published research articles. Editorials, book reviews, and other nonconforming materials were excluded. The researchers sorted the final studies in two phases: First, the researchers accessed an online database of each journal and searched relevant articles using the following keywords: corporate social responsibility, sustainability, environment, green, ecology, nature, climate change, recycling, energy, global warming, conservation, pollution. Second, the researchers reviewed the titles, abstracts, and full text of the selected articles. This second phase aimed to exclude articles not focusing on natural environment (e.g., economic environment). Of the 41 journals initially reviewed, only 28 included articles on environmental issues. A total of 142 individual articles were extracted from those journals. Table 1 shows the number of environmental communication articles included in the study and the share of these articles published by each journal examined.

2.3 Coding Scheme

This study coded seven main categories: (1) basic article information, (2) author, (3) research topic, (4) defining environmental communication, (5) theory and hypothesis, (6) media channel, and (7) methods.

2.3.1 Basic Article Information

Four items were coded in this category: journal name, publication year, the number of citations, and names of funders. Examining journal names enabled the researchers to understand which journals have placed importance on the study of environmental communication. The year of publication is useful information for tracking trends in environmental communication research over time. To count the number of citations for individual articles, this study used the Social Science Citation Index (SSCI) and Google Scholar Citation Index. Scholars have utilized SSCI^[8] and Google Scholar Citation Index^[10] to determine the influence of a study. The presence of a research grant and its sources were recorded

to get a sense of which organizations financially supported environmental communication research.

2.3.2 Author Information

This category includes author name and affiliation, which is useful information for identifying prominent scholars and institutions in the area of environmental communication. Author affiliations at the time of publication were recorded.

2.3.3 Research Topic

Examining the topical area of articles illustrates prevalent and underrepresented topics. This study established eleven major topical areas in environmental communication. The researchers adopted research topic categories from Khang et al.^[9] and enlarged upon them during the pilot coding process, generating 11 research topics: (1) environmental communication research, (2) research development, (3) environmental communication strategy, (4) environmental issue, (5) environmental management, (6) regulation/ethics, (7) message effect, (8) media use, (9) international/cultural communication, (10) education in environmental communication, and (11) societal issue (See Table 2 for more detailed explanation). Multiple research topics could be coded in a single article.

2.3.4 Definitions of Environmental Communication

To understand the status of environmental communication, this study examined the definitions of environmental communication and its relevant terms used in the articles.

2.3.5 Research Questions and Hypotheses

Research questions and hypotheses can be a guideline to understand the type of the study and include exploratory, descriptive, and so on. This study investigated whether each article explicitly presented research questions and hypotheses in an independent sentence.

2.3.6 Theory and Theoretical Framework/Model

The presence of a theory and a theoretical framework/model was examined. Kim et al.^[11] defined a theory as “a set of constructs linked together by relational statements that are internally consistent with one another” (p. 302), while a theoretical framework/model is “a framework for thinking about a problem which may yet evolve into a statement of the relationship among theoretical propositions” (p. 302). By applying their definitions, this study coded name of a theory, theoretical frameworks, and models for each article examined.

Table 1. Numbers of Environmental Communication (EC) Articles Published in Each Journal from the First Issue to the 2014 Last Issue.

Journal	First Issue	<i>n</i>	EC Articles / Total Published Articles (%)
<i>Journal of Advertising</i>	1972	23	1.42
<i>Public Relations Review</i>	1975	20	1.28
<i>Journalism & Mass Communication Quarterly</i>	1955	17	0.64
<i>Journal of Communication</i>	1984	10	1.43
<i>Communication and Critical/Cultural Studies</i>	2004	9	2.81
<i>Mass Communication and Society</i>	1998	7	1.28
<i>Newspaper Research Journal</i>	1979	7	0.85
<i>Journal of Applied Communication Research</i>	1973	6	0.85
<i>Communication Research</i>	1974	5	0.76
<i>Journal of Public Relations Research</i>	1989	5	1.23
<i>Quarterly Journal of Speech</i>	1915	5	0.05
<i>Journal of Broadcasting & Electronic Media</i>	1956	3	0.20
<i>Communication, Culture, & Critique</i>	2008	2	0.78
<i>Communication Education</i>	1952	2	0.10
<i>Critical Studies in Media Communication</i>	1984	2	0.29
<i>Human Communication Research</i>	2007	2	0.20
<i>Journal of Advertising Research</i>	1965	2	0.08
<i>Journal of Communication Inquiry</i>	1974	2	0.40
<i>Journal of Current Issue and Research in Advertising</i>	1978	2	0.43
<i>Journal of International and Intercultural Communication</i>	2008	2	1.54
<i>Text and Performance Quarterly</i>	1980	2	0.32
<i>Communication Monographs</i>	1934	1	0.11
<i>Communication Theory</i>	2011	1	0.23
<i>Electronic News</i>	2007	1	1.11
<i>First Amendment Studies (formerly Free Speech Yearbook)</i>	2004	1	1.25
<i>Journal of Computer-Mediated Communication</i>	2013	1	0.25
<i>Journalism & Mass Communication Educator</i>	1967	1	0.05
<i>Journal of Magazine and New Media Research</i>	1999	1	1.59
Total		142	0.41

2.3.7 Media Channel

The specific media channel was coded for each article focusing on a channel. The coding items were adopted from Kim et al. ^[11], and social media was added. An article could be coded for multiple media.

2.3.8 Method

This study coded the macro-level (qualitative, quan-

titative, critical, and mixed) and the micro-level specific research method (e.g., content analysis, experiment, survey, interview, etc.) for each article to analyze prevalent methods.

2.3.9 Guidelines for Future Studies

Suggestions for future research from each article were coded to examine any pattern of the recommended guidelines.

Table 2. Research Topic Categories.

· Environmental communication research	: The study examines environmental communication research itself (e.g., reviewing environmental communication and historical/philosophical research on environmental communication).
· Research development	: The study aims to develop a measurement scale and/or a theory in the communication communication context.
· Environmental communication strategy	: The study focuses on effective environmental communication strategies (e.g., maintaining good green reputation and conducting an advertising green campaign).
· Environmental issue	: The study investigates particular environment-related concerns (e.g., climate change, air pollution, and recycling).
· Environmental management	: The study focuses on organizational environmental actions (e.g., pro-environmental manufacturing process and green product development).
· Regulation/ethics	: The study discusses regulations executed by governments or markets or (un)ethical issues of environmental communication or practice (e.g., self-regulation, Environmental Protection Agency, and greenwashing).
· Message effect	: The study addresses the effects of environmental messages on individuals, organizations, or society.
· Media use	: Media use involves studies examining the effects of a particular media or comparing the effects of two or more media channels.
· International/cultural communication	: The study looks into a culture or examines two or more cultures in environmental communication
· Education in environmental communication	: The study investigates education and pedagogy related to environmental communication.
· Societal issue	: The study deals with concerns related to environmental communication in society (e.g., green movement and environmental activists).

2.4 Inter-coder Reliability

Two graduate students were selected to act as coders and codertraining sessions were conducted. A random sample of 18.3% ($n = 26$) of the total articles was used to test the reliability of their coding. Because all the variables were coded at the nominal level, Cohen’s Kappa test was used to determine the extent of agreement among the coders^[12]. Overall, the Kappa value was .84.

3. Results

3.1 Environmental Communication Articles and Authorship

3.1.1 Journals Publishing Articles on Environmental Communication

A total of 142 articles were derived from the 28 journals examined. *Journal of Advertising*, first issued in 1972, published the largest portion of the articles ($n = 23$, 13.3%), followed by *Public Relations Review* ($n = 20$, 11.6%). The number of environmental communication articles has increased over the years, as indicated in Figure 1. An increase in the number of environmental communication articles was observed for the time period with the exception of the years 1980-1989 and 2000-2004. The growth of environmental communication articles in the late 2000s to the early 2010s was particularly notable, with an increase of 38 articles. About 63.4% of the papers

selected for analysis were published in the latter half of this time period.

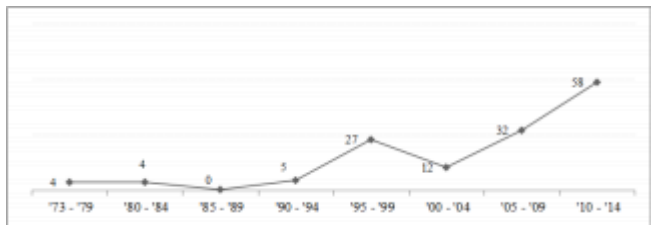


Figure 1. Trend of Environmental Communication Articles Published from 1973 to 2014.

3.1.2 Authorship and Institution

To assess scholarly productivity, the researchers counted the number of articles each author published and calculated the authors’ article credit based on the concept of cumulative article credits^[13]. Phaedra Pezzullo and Ann Marie Major received the most credits, and Daniel Riffe and James James Shanahan published the largest number of articles. Authors affiliated with George Mason University were the most productive, followed by Pennsylvania State University, Indiana University, University of Minnesota, and University of North Carolina at Chapel Hill. (See Table 3 for more information).

3.1.3 Citation and Grant

The citation number was examined using SSCI and Google Scholar citation. The article written by McCo-

mas and Shanahan ^[14] in *Communication Research* was the most cited, followed by Shrum et al. ^[15] and Carlson et al. ^[16] in *Journal of Advertising* according to SSCI. Table 4 shows the top 10 most cited articles in SSCI and the Google Scholar index.

Table 3. Most Productive Authors and Institutions in Environmental Communication.

Author	Articles	Total Credits	Institution	Total Credits
Pezzullo, Phaedra C.	3	3.00	George Mason Univ.	5.08
Major, Ann Marie	3	2.50	Penn. State Univ.	5.00
Zhao, Xiaoquan	3	2.25	Indiana Univ.	4.00
Cantrill, James G.	2	2.00	Univ. of Minnesota	4.00
McCluskey, Micheal R.	2	2.00	Univ. of North Carolina at Chapel Hill	4.00
Ross, Andrew	2	2.00	Univ. of Utah	4.00
Bortree, Denise Sevick	3	1.75	Ohio State Univ.	3.67
Riffe, Daniel	4	1.67	Univ. of Waikato, New Zealand	3.50
Shanahan, James	4	1.67	Washington State University	3.42

Note: Total credits = sum of credits from individual articles. Credits in an article = 1 / (the number of authors).

Table 4. Top 10 Most Cited Articles.

Article / Journal	SSCI n (rank)	Google Citation n (rank)
McComas and Shanahan ^[14] / CR	104 (1)	305 (3)
Shrum et al. ^[15] / JA	91 (2)	462 (1)
Carlson et al. ^[16] / JA	69 (3)	336 (2)
Ader ^[17] / JMCQ	68 (4)	271 (4)
Banerjee et al. ^[18] / JA	53 (5)	262 (5)
Cantrill ^[19] / JACR	46 (6)	126 (15)
Schuhwerk and Lefkoff-Hagius ^[20] / JA	46 (6)	211 (7)
Bortree and Seltzer ^[21] / PRR	43 (8)	205 (8)
Bennett and Lawrence ^[22] / JC	39 (9)	104 (16)
Obermiller ^[23] / JA	39 (9)	140 (13)

Notes: CR = Communication Research, JA = Journal of Advertising, JMCE = Journalism & Mass Communication Educator, JACR = Journal of Applied Communication Research, PRR = Public Relations Review, JC = Journal of Communication. Citation numbers were collected on March, 2015.

Sixteen (11.2%) out of the 142 articles examined indicated a funding source for the research. Nine studies (6.3%) received university-based funds while seven (4.9%) benefited from non-university-based funds. Table 5 displays the funding agencies referenced in the articles.

Table 5. Source of Funding in Sustainability Communication 1973-2014.

Funding		'73 - '84		'85 - '94		'95 - '04		'05 - '14		Total	
		n	%	n	%	n	%	n	%	n	%
Funded	Not university based	2	25.0	0	0.0	0	0.0	5	5.6	7	4.9
	University based	0	0.0	0	0.0	2	5.1	7	7.8	9	6.3
Total		8	100.0	5	100.0	39	100.0	90	100.0	142	100.0

Notes: The institutions or agencies of the funders are as follows, in alphabetical order: Department of Science and Technology, New Delhi; Foundation for Public Relations Research and Education; Iowa State University; Ohio University; Old Dominion University; Royal Society of New Zealand; Rutgers University; Seattle University; Spanish Ministry of Science and Innovation; Texas Cooperative Extension; University of Cincinnati; University of Massachusetts-Boston; University of Michigan-Dearborn; University of Waikato, New Zealand; United States Environmental Protection Agency; United States Fish and Wildlife Service; United States Forest Service; United States National Science Foundation.

3.2 Research Topics and Theoretical Frameworks

3.2.1 Research Topics

To track changes in topic prominence, this study divided the entire time period into four periods often years each. Overall, the most frequently examined topic was environmental issue ($n = 93$, 27.5%) followed by message effect ($n = 49$, 14.5%), regulation/ethics ($n = 47$, 13.9%), and environmental communication strategy ($n = 29$, 8.6%). These topics have maintained prevalent since the 1970's

due to the increased public's interest in sustainability, climate change, and environmental issues. (See Table 6)

3.2.2 Theory Adoption, Research Question, and Hypothesis

Among the 142 articles examined, 41 (28.9%) presented one or more theories or theoretical frameworks as shown in Figure 2. Among those studies, the most frequently used theory was framing theory ($n = 4$, 9.7%), followed by cultivation theory ($n = 3$, 7.3%) and situation theory ($n = 3$, 7.3%).

Table 6. Topics in Environmental Communication (EC) Articles from 1973 to 2014.

Research Method	'73 - '84		'85 - '94		'95 - '04		'05 - '14		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Environmental issue	7	33.3	3	20.0	25	28.1	58	27.2	93	27.5
Message effect	3	14.3	3	20.0	13	14.6	30	14.1	49	14.5
Regulation/ethics	3	14.3	3	20.0	8	9.0	33	15.5	47	13.9
EC strategy	0	0.0	1	6.7	10	11.2	18	8.5	29	8.6
Media use	1	4.8	1	6.7	10	11.2	14	6.6	26	7.7
Societal issue	1	4.8	2	13.3	7	7.9	14	6.6	24	7.1
Environmental management	2	9.5	0	0.0	4	4.5	18	8.5	24	7.1
International/cultural comm.	0	0.0	0	0.0	3	3.4	14	6.6	17	5.0
EC research	1	4.8	1	6.7	6	6.7	6	2.8	14	4.1
Research development	1	4.8	1	6.7	2	2.2	3	1.4	7	2.1
Education in EC	1	4.8	0	0.0	0	0.0	3	1.4	4	1.2
Other	1	4.8	0	0.0	1	1.1	2	0.9	4	1.2
Total	21	100.0	15	100.0	89	100.0	213	100.0	338	100.0

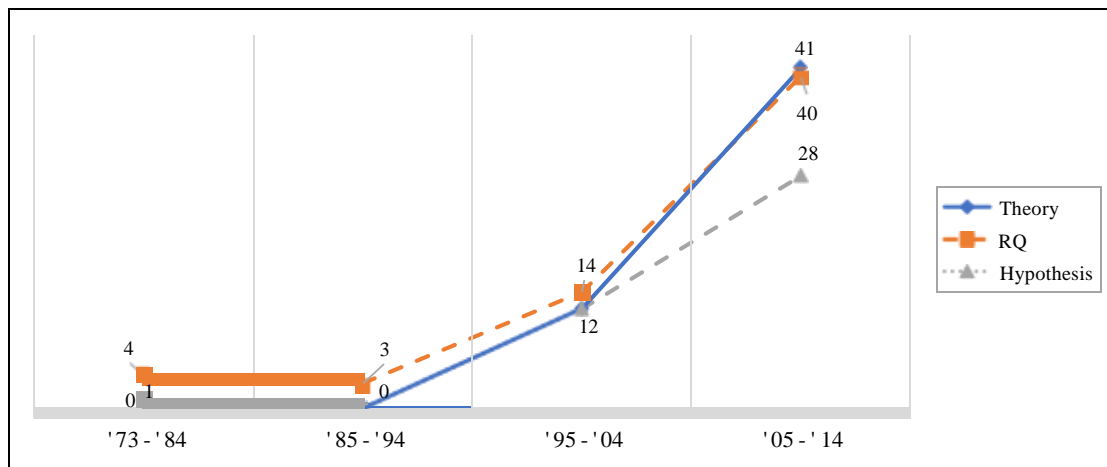


Figure 2. Presence of Theory/Theoretical Framework, Research Question, and Hypothesis in Environmental Communication from 1973 to 2014.

Ninety (63.4%) articles presented research questions and/or hypotheses. Sixty-one (43.0%) articles had one or more research questions, while fifty-three (37.3%) contained hypotheses. The use of hypotheses emerged from the period 1995-2004 and continued into the current period (See Figure 3).

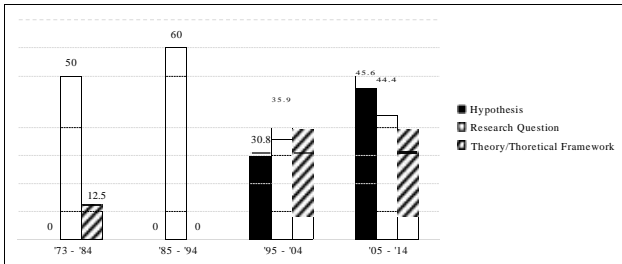


Figure 3. Proportions (%) of Articles adopting Theory/Theoretical Framework, Research Question, and Hypothesis among All Analyzed Environmental Communication Articles from 1973 to 2014.

3.3 Definitions of Environmental Communication and Its Related Terms

This study reviewed the definitions of environmental communication or similar terms featured in the articles examined. These definitions varied across academic disciplines. Public relations approached environmental issues with societal and economic issues under the umbrella concept of *sustainability*. Mass communication emphasized individuals’ or organizations’ belief about the environment using the terms *ecological worldviews* and *environmentalism*. Advertising focused on environmental messages in advertising mostly using the term *green*. Table 7 displays each of the definitions identified.

Table 7. Definition of Environmental Communication and Similar Terms.

Authors (year) / Journal	Used Term	Definition
Signitzer and Prexl ^[24] / JPRR	Corporate sustainability communication	“CSC (Corporate sustainability communication) is defined as an evolving concept that refers to corporate communications about sustainability issues ^[24, p.2] .”
Signitzer and Prexl ^[24] / JPRR	Corporate sustainability	“(Corporate sustainability) is defined as a relative concept that describes the planned and strategic management processes of working towards a balance of economic, social, and environmental goals and values ^[24, p.3] .”
Fung et al. ^[25] / MCS	Ecological worldviews	“... Ecological worldviews, for instance, are core beliefs regarding the relationship between human beings and nature ^[26,27, p.556] .”

Authors (year) / Journal	Used Term	Definition
Good ^[28] / MCS	Environmentalism	“Environmentalism is built upon a belief or understanding that the earth’s resources are ultimately finite and that the ecosystems that compose the earth also have value outside of what they are able to provide humans ^[29, p.370] .”
Minton et al. ^[30] / JA	Sustainability	“(The United Nations) described sustainability as ‘development that meets the needs of the present without compromising the ability of future generation to meet their own needs ^[31, p.70] ’.
Shrum et al. ^[15] / JA	Green	“We use the term ‘green’ simply to indicate concern with the physical environment (air, water, land) ^[15, p.72] .”
Kilbourne ^[32] / JA	Green	“An advertising perspective considers green to be a unidimensional concept encapsulating environmental, ecological, Green, and environmentally oriented behaviors such as recycling. The ecological literature suggests that this approach is too simplistic since ecology is a multi-dimensional concept containing at least two dimensions: political and positional ^[32, p.17] .”

Notes: JPRR = Journal of Public Relations Research, MCS = Mass Communication and Society, JA = Journal of Advertising.

3.4 Media Channel

Almost half of the articles in this study ($n = 69, 48.6\%$) examined specific media. Twelve articles investigated two or more media channels (8.5%). The most frequently examined medium was newspaper ($n = 32, 36.8\%$), followed by television ($n = 19, 21.8\%$), magazine ($n = 11, 12.6\%$), Internet ($n = 9, 10.3\%$), and social media ($n = 5, 5.7\%$). The first studies that examined the Internet and social media were published in 2001 and 2009, respectively.

3.5 Research Method

3.5.1 Empirical/Non-empirical Study

Among all the articles analyzed, 81.7% ($n = 116$) were empirical studies. A chi-square test did not show a significant difference of the portion of the empirical study across the four time periods.

3.5.2 Quantitative/Qualitative Study

A quantitative approach was most often adopted ($n = 90, 63.4\%$), followed by a critical approach ($n = 27, 19.0\%$), a qualitative approach ($n = 20, 14.1\%$), and mixed ($n = 5, 3.5\%$).

3.5.3 Methods

The most popular method was content analysis ($n = 38, 26.8\%$), followed by experiment ($n = 27, 19.0\%$), survey ($n = 27, 19.0\%$), and critique/essay ($n = 27, 19.0\%$). (See Table 8). Ten of the studies adopted two or more methods.

3.5.4 Statistical Analysis

More than half of the articles reported statistical results ($n = 83, 58.5\%$). The most frequently used statistical test

was frequency ($n = 42, 29.6\%$), followed by mean ($n = 31, 21.8\%$), regression ($n = 27, 19.0\%$), correlation ($n = 23, 16.2\%$), and ANOVA ($n = 20, 14.1\%$) (see Table 9).

3.6 Guidelines for Future Studies

Given that communication outlets vary, the most frequently mentioned suggestion for future research was to consider the roles of the Internet and new media in environmental messages. For instance, scholars suggested that future researchers should test whether the Internet could be a primary source of environmental news^[33]. Another suggestion involves cultural settings. Specifically, some studies recommended examining how advertising strategies differ based on the cultures in which they are employed^[34].

Table 8. Research Methods in Environmental Communication from 1973 to 2014.

Research Method	'73 - '84		'85 - '94		'95 - '04		'05 - '14		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<i>Macro-level</i>										
Quantitative	5	62.5	2	40.0	24	61.5	59	65.6	90	63.4
Qualitative	0	0.0	2	40.0	3	7.7	15	16.7	20	14.1
Critical	3	37.5	0	0.0	9	23.1	15	16.7	27	19.0
Mixed	0	0.0	1	20.0	3	7.7	1	1.1	5	3.5
Total	8	100.0	5	100.0	39	100.0	90	100.0	142	100.0
<i>Micro-level</i>										
Survey	8	57.1	5	55.6	39	50.6	90	54.2	142	53.4
Content	2	14.3	1	11.1	16	20.8	19	11.4	38	14.3
Critique	3	21.4	0	0.0	9	11.7	15	9.0	27	10.2
Experiment	1	7.1	0	0.0	5	6.5	21	12.7	27	10.2
Case Study	0	0.0	0	0.0	0	0.0	8	4.8	8	3.0
Interview	0	0.0	2	22.2	3	3.9	3	1.8	8	3.0
Ethnography	0	0.0	0	0.0	1	1.3	3	1.8	4	1.5
Observation	0	0.0	0	0.0	0	0.0	4	2.4	4	1.5
Policy	0	0.0	1	11.1	2	2.6	1	0.6	4	1.5
Secondary	0	0.0	0	0.0	2	2.6	1	0.6	3	1.1
Group	0	0.0	0	0.0	0	0.0	1	0.6	1	0.4
Total	14	100.0	9	100.0	77	100.0	166	100.0	266	100.0

Table 9. Applied Statistic Tests in Environmental Communication from 1973 to 2014.

Research Method	'73 - '84		'85 - '94		'95 - '04		'05 - '14		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
No statistics	3	37.5	2	40.0	16	41.0	38	42.2	59	41.5
Use statistics	5	62.5	3	60.0	23	59.0	52	57.8	83	58.5
Total	8	100.0	5	100.0	39	100.0	121	100.0	142	100.0
<i>Specific tests</i>										
Frequency	3	37.5	2	33.3	17	25.8	20	16.1	42	20.6
Mean	1	12.5	0	0.0	10	15.2	20	16.1	31	15.2

Research Method	'73 - '84		'85 - '94		'95 - '04		'05 - '14		Total	
Regression	2	25.0	0	0.0	4	6.1	21	16.9	27	13.2
Correlation	1	12.5	2	33.3	9	13.6	11	8.9	23	11.3
ANOVA	1	12.5	0	0.0	9	13.6	10	8.1	20	9.8
Chi-square	0	0.0	1	16.7	7	10.6	9	7.3	17	8.3
T-test	0	0.0	0	0.0	5	7.6	9	7.3	14	6.9
SEM	0	0.0	0	0.0	0	0.0	9	7.3	9	4.4
Factor Analysis	0	0.0	1	16.7	2	3.0	5	4.0	8	3.9
MANOVA	0	0.0	0	0.0	2	3.0	5	4.0	7	3.4
ANCOVA	0	0.0	0	0.0	0	0.0	4	3.2	4	2.0
Logistic Regression	0	0.0	0	0.0	0	0.0	1	0.8	1	0.5
Discriminant analysis	0	0.0	0	0.0	1	1.5	0	0.0	1	0.5
Total	8	100.0	6	100.0	66	100.0	124	100.0	204	100.0

4. Discussion and Conclusions

Keeping in mind the importance of communication in promoting and aiding environmental sustainability, the purpose of this investigation was to systematically evaluate environmental communication studies across the communication-related disciplines. This study achieved the goal by examining published articles in 28 journals from the time period spanning 1973-2014. A total of 142 articles were evaluated based on an analysis of authorial, topical, theoretical, and methodological information. As such, the outcome of this study could provide a comprehensive picture of communication-based environmental research and guide the directions of future research in this area.

In a nutshell, the findings demonstrate exponential growth in the number of environmental communication studies in the communication disciplines in recent years. A wide range of scholars and institutions has contributed to this area of research. Among the topical areas examined, a majority of the articles focused on environmental issues. While the articles exhibit diverse definitions of environmental communications based on each journal's subfield of communication and there is a lack of theoretical foundations for environmental communications, the methodological and statistical rigor employed in environmental communication research have grown increasingly sophisticated.

The journals publishing the greatest number of environmental communication studies included *Journal of Advertising*, *Public Relations Review*, and *Journalism & Mass Communication Quarterly*. It is noteworthy that more than half of the articles analyzed were published between these four journals, out of 28 total journals reviewed. In particular, *Journal of Advertising* published the highest percentage (16.2%) of environmental communication studies

among all of the journals reviewed.

The number of articles addressing environmental communication has continuously increased, and the quantity of such articles rose exponentially in the late 2000s. Notably, about 25% of the articles have been published between 2012 and 2014. Considering that this study analyzed articles over nearly a 40-year timeframe, this recent increase represents quite a significant change. This finding might imply that scholars in the mass communication disciplines have started to pay greater attention to the importance of environmental communication. One possible explanation for the significant increase in articles published in recent years could be attributed to the two special issues on green advertising in the *Journal of Advertising* in 1995 and 2012^[35].

In terms of the topical areas of research, environmental issue was the dominant research topic that appeared in articles reviewed in this study, followed by message effect, regulation/ethics, and media use. Several articles reviewed in this study investigated media coverage related to environmental communication^[36]. This is not surprising, as the field of communication is an academic discipline that primarily examines the effects of media in the coverage of contemporary topics at the individual, organizational, and social levels. Scholars least frequently researched the research development topic in environmental communication research. The lack of research into this topic reflects the state of the environmental communication realm. While systematic review of an academic topic related to its "nuts and bolts", environmental communication as an academic topic has already reached a consensus in terms of theory, method, perspectives, and so forth.

The outcome of this study indicates that about a quarter of the articles examined applied either a theory or theoretical framework. Among its many important roles, theory can act as the principal mover with respect to research. However, the analysis indicates a lack of theoretical rig-

or in environmental communication research. It should be noted that none of the studies reviewed attempted to develop a specific theory for environmental communication. Instead, studies applied the popular communication theories framing theory and cultivation theory to environmental communication. Similarly, framing theory and cultivation theory were also identified as the most frequently applied theories in mass communication in the twentieth century^[37], suggesting that these popular theoretical trends have carried over to environmental communication research. While only a small portion of the studies utilized a theory or theoretical perspective, it is encouraging that a majority of the studies examined (almost 80%) were empirical in nature.

Quantitative approaches, including content analysis, survey and experiment, were the method of choice in the majority of the articles in the sample for this study, with content analysis being the most popular approach. This finding may infer that scholars in environmental communication have investigated media contents to understand the nature of environmental communication.

In terms of statistical analysis, basic analyses, including frequency and mean, were most frequently reported. While using more advanced statistical analysis is not indicative of the quality of the article, such basic analyses cannot test interrelationships among the variables examined in a particular study. Although environmental communication is in the early stage of development, scholars would be advised to consider using more advanced statistical approaches to test and prove more complex interrelationships among the numerous variables applicable to environmental communications. Doing this will speed up the process of developing environmental communication as a theory-driven academic domain.

Limitations and Future Research Agendas

This study has a shortcoming in that non-peer reviewed works were excluded from the analysis. Books and industry-specific articles are also influential in advancing the scholarship. Therefore, scholars need to consider including other influential works in future examinations of environmental communication. In addition, this study primarily analyzed journals published by major professional associations, so articles on environmental communication which are not affiliated with the associations may be not included in this study. Future researchers should use a different sampleselection approach (e.g., journal impact factors) and include journals positioned beyond the communication discipline (e.g., *Sustainable Development*). In addition, this study focused solely on full-length peer-reviewed articles, but future scholars can analyze other types of publications such as book chapters.

Regardless of this shortcoming, the importance of this study should not be overlooked. By conducting a longitudinal content analysis of published studies addressing the topic of environmental communication, this study has shaped a better understanding of the nature and direction of this research realm. Hopefully, this study will encourage other scholars to pay greater attention to the important topic of environmental communication.

Conflict of Interest

There is no conflict of interest.

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