Examining The Global Trends of Environmental Literacy: A Systematic Literature Review and Bibliometric Analysis

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ABSTRACT: This study conducts a systematic literature review (SLR) and bibliometric analysis to assess the trajectory of research on environmental literacy. By examining 661 articles from the Scopus database spanning from 1990 to 2025, the study reveals key developments and emerging trends in the field. Utilizing VOSviewer software for data visualization, the analysis identifies significant patterns in publications, collaboration networks, and influential contributors to the field. The findings highlight the predominant contribution of the United States, with major academic institutions such as the University of California and Harvard T.H. Chan School of Public Health at the forefront. The study reveals a notable increase in publications after 2010, particularly from 2020 onwards, reflecting the growing global recognition of environmental literacy. This research underscores the importance of addressing environmental challenges, including climate change and biodiversity loss, through effective education and policy integration. Despite the dominance of research from Western countries, the study calls for greater representation from regions such as Asia, Africa, and Latin America. The study's contributions are threefold: it advances the theoretical understanding of environmental literacy, introduces an integrative research methodology, and provides practical insights for educators, policymakers, and environmental organizations. These findings lay the foundation for future research and the development of strategies to foster environmental literacy and promote sustainability globally.

KEYWORDS: Bibliometric Analysis, Environmental Literacy, Global Trends, Systematic Literature Review

INTRODUCTION

Environmental literacy has emerged as a fundamental competency required to address the complex, multifaceted environmental challenges facing contemporary society (Bayer et al., 2021; Liang et al., 2018; Wilujeng et al., 2019). This competency, defined as the ability to understand, evaluate, and act upon environmental issues, incorporates cognitive, affective, and behavioral dimensions (Lee & Kang, 2023; Rodríguez-Pérez et al., 2024). Together, these elements empower individuals to make informed decisions and engage in sustainable practices, thereby contributing to the resolution of pressing global environmental crises (Lu et al., 2024; Ramulumo & Shabalala, 2025). As the world grapples with the effects of climate change, loss of biodiversity, and the depletion of natural resources, it is increasingly evident that environmental literacy is vital for fostering informed, proactive citizens capable of engaging with these challenges effectively(Curdt-Christiansen, 2020; García Gómez & Martínez Bernat, 2010; Wheaton et al., 2024). The academic discourse surrounding environmental literacy spans various domains, including environmental education, public policy, sustainability science, and environmental psychology, reflecting its interdisciplinary nature and pivotal role in shaping societal responses to environmental issues (Chao, 2024; Durmus & Kinaci, 2021; Saulais & Espougne, 2024). Over the past few decades, educational initiatives aimed at cultivating environmental literacy have become a central focus in global efforts to promote sustainability (Alqassim et al., 2024; Fošner, 2025; Ronen & Kerret, 2020). Research indicates that these initiatives not only enhance environmental awareness and attitudes but also contribute to the development of problem-solving skills essential for navigating the complexities of sustainability (Asyari et al., 2024; Sucilestari, Arizona, et al., 2025). Despite these advancements, significant gaps remain in the conceptualization and operationalization of environmental literacy. These inconsistencies, which vary across different cultural, geographical, and disciplinary contexts, present challenges in achieving a unified framework for environmental literacy (Akakpo et al., 2024; Grant, 2020; Sucilestari, Ramdani, et al., 2025a).

Moreover, the geographic distribution of research on environmental literacy reveals a significant concentration of studies in developed regions, particularly North America and Europe. This concentration presents limitations in the applicability and generalization of research findings, particularly in the context of global sustainability challenges that require diverse regional perspectives. The overrepresentation of Western-centric studies, coupled with the lack of studies from regions such as Asia, Africa, and Latin America, underscores the need for more inclusive, global research on environmental literacy (Acheampong et al., 2018; Catarino et al., 2023; McBride et al., 2013; Ndzimbomvu et al., 2021; Riveros-Davalos et al., 2024; Severin et al., 2023; Vandiver et al., 2022)

Furthermore, while there has been an expansion in environmental literacy research, few studies have employed integrative methodologies such as systematic literature review (SLR) and bibliometric analysis. These methods offer robust, replicable frameworks for synthesizing research findings, identifying trends, and mapping the intellectual evolution of the field. By providing a comprehensive overview of existing studies, SLR and bibliometric analysis allow researchers to identify both gaps in knowledge and emerging research areas that have yet to be fully explored (Arizona et al., 2025; Sucilestari, Ramdani, et al., 2025b).

In light of these limitations, this study aims to provide a comprehensive examination of global trends in environmental literacy research through the application of a systematic literature review and bibliometric analysis. By synthesizing existing studies, identifying publication patterns, and analyzing author collaboration networks, this research seeks to offer an in-depth understanding of the state of the field and provide insights for future research directions. The research questions guiding this study are: **[RQ1]**: Does environmental literacy remain a relevant and significant subject for scholarly inquiry in the future? **[RQ2]**: What is the distribution and publication trend of environmental literacy research within academic literature? **[RQ3]**: What theoretical contributions and practical implications can be derived from existing studies on environmental literacy, and how can these findings guide future research?

This study's contributions are threefold. Theoretically, it seeks to establish a more cohesive framework for understanding environmental literacy by unifying fragmented perspectives. Methodologically, it introduces an innovative approach that combines qualitative synthesis with bibliometric mapping to offer a comprehensive analysis of the field's development. Practically, the study provides actionable insights for educators, policymakers, and environmental organizations to design evidence-based interventions aimed at enhancing environmental literacy and promoting sustainable practices at local, national, and global levels. By advancing the discourse on environmental literacy, this research aims to contribute to the development of a more sustainable and resilient global society.

METHOD

A systematic literature review utilizing a bibliometric approach offers a quantitative evaluation of literature to identify trends, patterns, and key research entities within the field of environmental literacy. By using frameworks like PRISMA, this method ensures a thorough, replicable review process that provides a clear and transparent overview of the topic under investigation. The inclusion criteria for this review are: (1) articles published until September 10, 2025, (2) publications in English, and (3) a focus on the topic of environmental literacy. Bibliometric analysis was carried out using VOSviewer software to visualize bibliographic data, including citation networks, author collaborations, and keyword co-occurrence, revealing the intellectual structure and dynamics of the field.

The integration of systematic review and bibliometric analysis aids in synthesizing empirical findings and mapping the research landscape, helping to identify key contributors and emerging trends. This combined approach provides a comprehensive understanding of the field's evolution, its historical trajectory, and future research directions, offering valuable insights for interdisciplinary studies. Additionally, bibliometric analysis serves as a strategic tool in scientific publishing.

The study begins by selecting relevant keywords using a macro (top-down) methodology, which starts with broad search terms and narrows down to more specific studies. After evaluating gaps in prior research and the limited number of studies on environmental literacy, the focus is placed on the keyword "environmental literacy" in the titles, abstracts, and keywords of articles. The Scopus database is then employed for various investigative purposes, including conducting the literature review, identifying field experts, and monitoring research trends.

Figure 1 illustrates the process flow for article selection in the systematic literature review and bibliometric analysis related to environmental literacy. On September 10, 2025, the article search retrieved 6,369 documents from the Scopus database using the keywords "environmental AND literacy" in the title, abstract, and keywords. After applying specific keywords for screening, 1,893

articles were identified. Subsequently, 4,473 articles were excluded for not containing the specific keyword "environmental AND literacy," leaving 1,399 articles for further screening.

In the next phase, articles were excluded based on document type, removing conference papers, book chapters, reviews, books, and editorials, resulting in 1,354 eligible articles. Additional exclusions were made based on language, such as Spanish, Turkish, and Portuguese articles, bringing the total to 1,354 articles. Further refinement excluded articles based on access type, such as Gold, Green, Hybrid Gold, and Bronze, narrowing the final selection to 661 articles suitable for inclusion. The final inclusion stage filtered articles based on subject area, ensuring that the selected studies were relevant to environmental science, education, and sustainability. Ultimately, 661 articles were included in the systematic literature review.
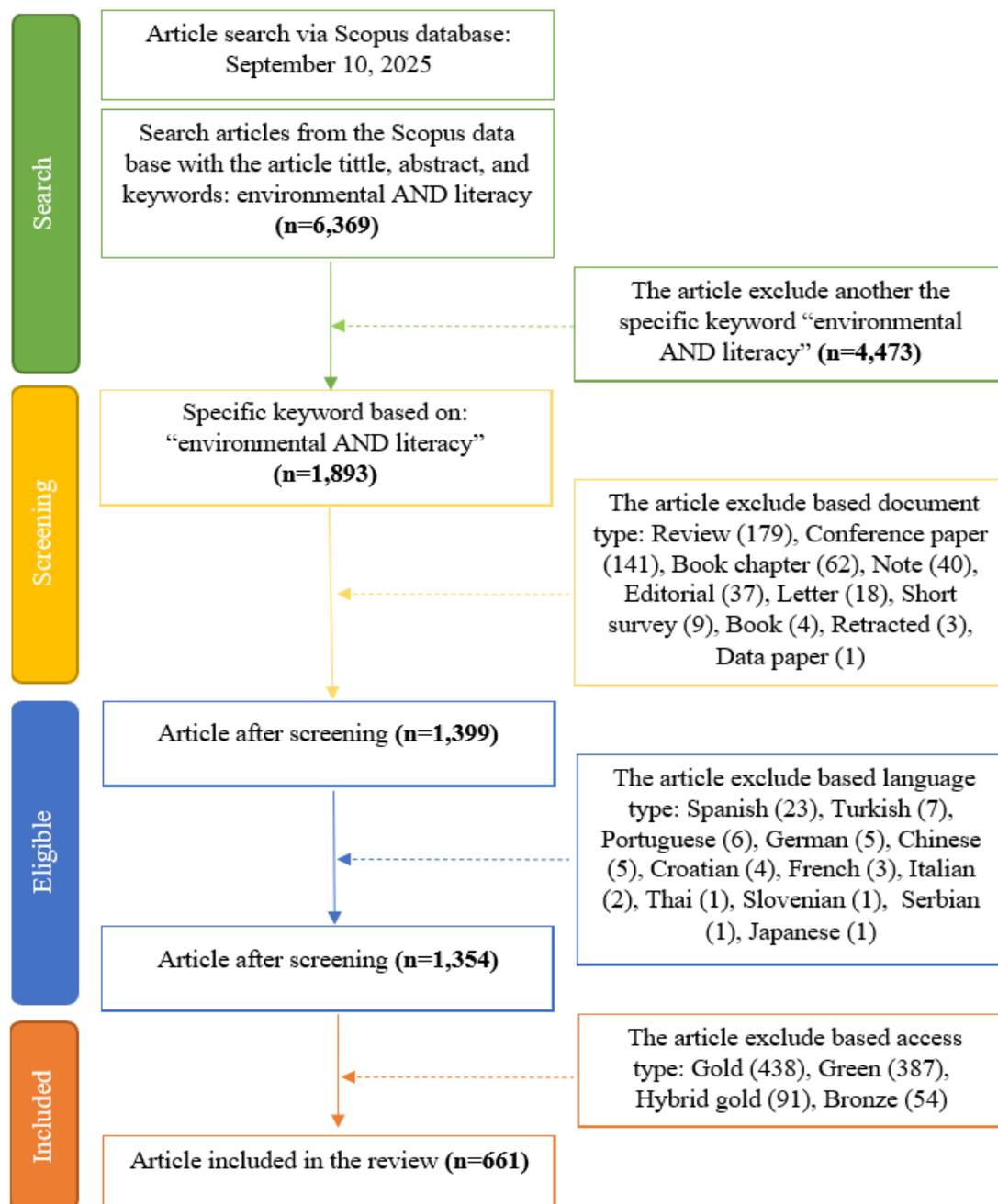

Figure 1. Systematic Literature Review process flow using PRISMA for Environmental Literacy

RESULTS AND DISCUSSION

The findings of this study focus on the results from 661 articles in the Scopus database regarding environmental literacy. This data was obtained by identifying the number of articles published, publication trends over the years, and the journals in which these articles were published. The study also highlights the most influential elements in environmental literacy, including the authors, institutional affiliations, and the countries contributing to this field.

A. RQ1: Does the exploration of environmental literacy remain a relevant and significant subject for scholarly inquiry in the future?

Based on the data obtained from the Scopus database, it is evident that scholarly work on environmental literacy has seen significant growth in recent years, as shown in Figure 2. The number of published articles remained relatively low until around 2016, with a gradual increase in research output. A sharp rise in publications can be observed from 2020 (53 documents) onward, peaking in 2024 (112 documents) before a slight dip in 2025 (53 documents).

This trend highlights the increasing attention given to environmental literacy, particularly from 2016 (16 documents) to the present. The exploration of environmental literacy has gained considerable momentum in recent years, with a growing focus on sustainability education (Alqassim et al., 2024; Chao, 2024; Durmus & Kinaci, 2021; Mylonas et al., 2025; Ronen & Kerret, 2020), policy integration (Fernández, 2016; Hughes et al., 2023; Selin et al., 2017), environmental behavior (Akakpo et al., 2024; Liang et al., 2018; McBride et al., 2013; Ronen & Kerret, 2020), and the role of media in promoting environmental awareness (ChamCham et al., 2024; Sucilestari, Ramdani, et al., 2025a). These developments indicate that environmental literacy is now recognized as an essential component in addressing global challenges such as climate change, biodiversity loss, and the need for sustainable practices (Liang et al., 2018; Wilujeng et al., 2019).
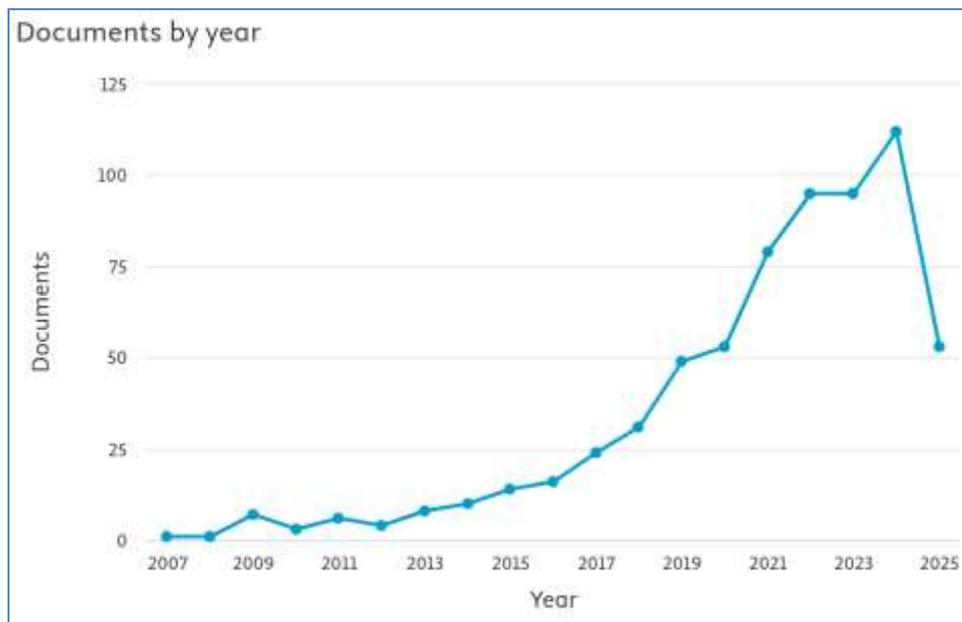
Figure 2. Distribution of Articles by Year (Top 10 Sources)
Source: Scopus Database (September 10, 2025)

Since the early 2000s, literature on environmental literacy has been relatively sparse, especially in high-impact journals. However, the sharp increase in publications since 2020 reflects a growing recognition of its importance. This presents an opportunity for future researchers to further expand this field. This study plays a critical role in advancing the understanding of environmental literacy, which will be pivotal in preparing individuals, particularly students, to address the increasingly complex environmental challenges of the modern world. By fostering environmental literacy, individuals will be better equipped to innovate and solve environmental issues with sustainable and informed solutions.

B.   RQ2: What is the distribution and current publication trend of research on environmental literacy within academic literature?

The analysis of the distribution of research on environmental literacy was conducted by categorizing the articles based on country, region, affiliation, source, and authors, with a focus on the top 10 countries contributing to the field. A deeper understanding of the allocation of studies on environmental literacy will be valuable for researchers and practitioners in formulating future research agendas, particularly in addressing global environmental challenges.

The allocation of scientific studies on environmental literacy based on country or region shows a dominant contribution from the United States, with the largest number of articles published. The United States (231 documents) is followed by the United Kingdom (60 documents), Australia (58 documents), and China (53 documents), all of which have made significant contributions to the field. Other countries such as Indonesia (40 documents), Italy (30 documents), Canada (27 documents), Germany (26 documents), Spain (23 documents), and Taiwan (23 documents) also show substantial engagement in environmental literacy research (See Figure 3).

This distribution highlights the global interest in environmental literacy, with a clear concentration of publications in English-speaking countries like the United States and the United Kingdom. However, the contribution from other regions such as Europe and Asia indicates the increasing international relevance of environmental literacy in addressing global sustainability challenges.

The findings from the analysis of global research trends on environmental literacy indicate that the topic has garnered significant attention not only in European and North American countries but also in regions across Asia, Australia, and other parts of the world. This global interest underscores the relevance of environmental literacy in addressing critical challenges such as climate change, sustainability, and environmental awareness.
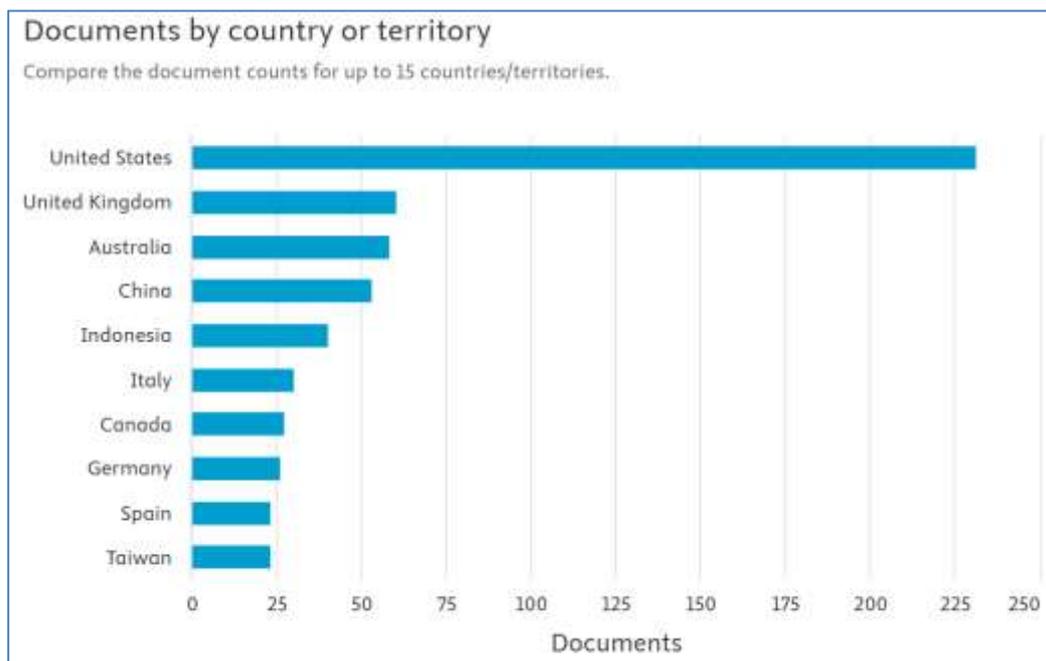
Figure 3. Distribution of Articles by Country (Top 10 Sources)
Source: Scopus Database (September 10, 2025)

The network analysis using VOSviewer highlights the strong connections between countries involved in environmental literacy research. The United States, the United Kingdom, and Australia are among the leading contributors to the field, as seen in the central positioning of these countries in the network. Other countries like China, Canada, Germany, and Indonesia also show notable engagement in the development of environmental literacy studies.
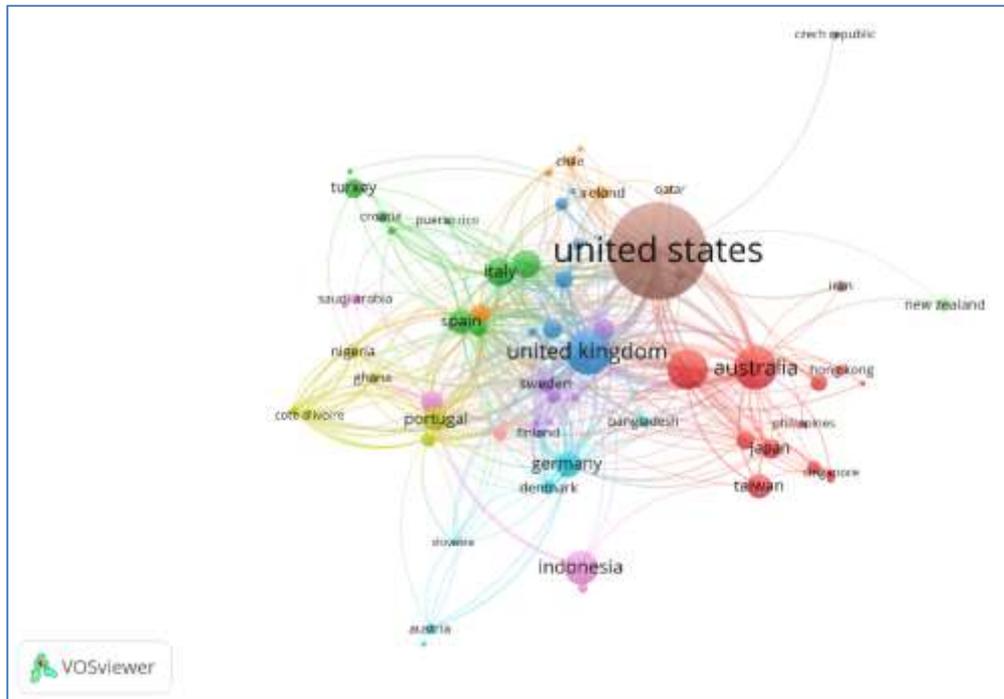
Figure 4 Network country visualization
Source: Scopus data base analysis with VOSviewer (September 10, 2025)

These findings highlight the rapid progress in environmental literacy research, with global contributions to frameworks, policies, and educational practices promoting environmental awareness. The growing interest in environmental literacy, not just in Western countries but also across diverse regions, underscores its broad applicability in addressing global environmental challenges through education, policy, and behavior change.
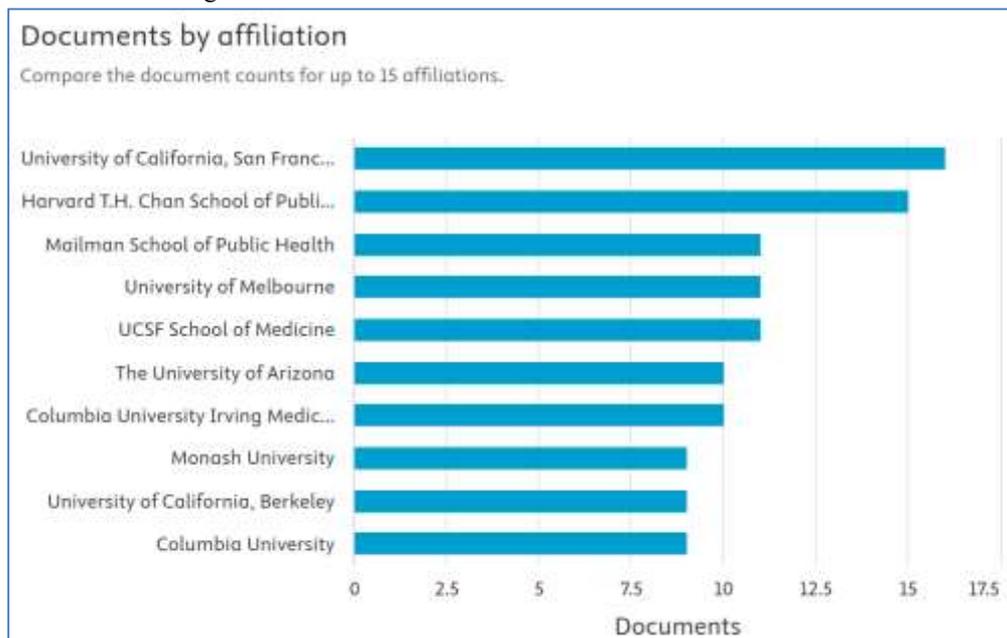

Figure 5. Distribution of Articles by Affiliation
Source: Scopus Database (September 10, 2025)

The allocation of scientific studies related to environmental literacy, based on institutional affiliation, is dominated by the University of California, San Francisco (16 articles), with the highest number of publications, followed by Harvard T.H. Chan School of Public Health (15 articles). Other leading institutions contributing to the research on environmental literacy include Mailman School of Public Health (11 articles), University of Melbourne (11 articles), and UCSF School of Medicine (11 articles), and The University of Arizona (10 articles), with several universities also making notable contributions, including Columbia University (10 articles), Monash University (9 articles), University of California, Berkeley (9 articles), and Columbia University (9 articles). This distribution demonstrates the global interest and academic engagement with the topic across prominent research institutions worldwide (see Figure 5).
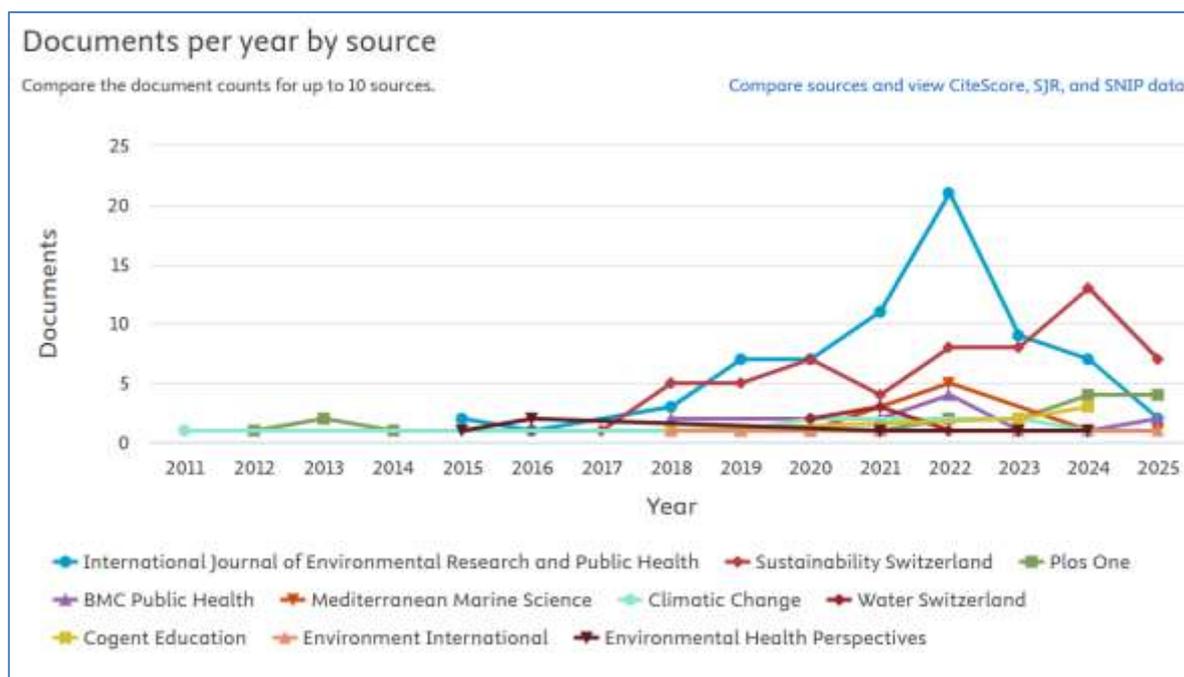

Figure 6. Number of Articles by Sources (Top 10 Sources)
Source: Scopus Database (September 10, 2025)

The distribution of studies on environmental literacy in the top 10 publications based on affiliation shows that scientific interest in this topic is not only limited to academic institutions in Western countries (such as the United States and Europe), but also attracts attention in educational institutions in Asia and Australia. Thirdly, the allocation of studies on environmental literacy based on publication sources is dominated by the journal International Journal of Environmental Research and Public Health with the highest number of articles, followed by Sustainability Switzerland and Plos One, with significant contributions also from journals like BMC Public Health, Mediterranean Marine Science, and others. Figure 6 displays the number of articles per publication source from 2011 to 2025, illustrating a notable rise in publications starting in 2020, especially for International Journal of Environmental Research and Public Health, reflecting the growing scientific attention to environmental literacy.

The distribution of research related to environmental literacy shows that there is no clear dominance among the authors. Of the top ten authors, Adamkiewicz, G. and Brody, J.G. stands out with the highest number of articles (6 documents), followed by Brown, P. and Tomsho, K.S., each contributing 5 documents. Other authors such as, Bonaccorsi, G., Boronow, K.E., Brugge, D., Fsng, W.T., Lorini, C., and Mokos,. M. each contributed to the research with a similar number of publications (4 documents), highlighting a broad involvement across various authors rather than dominance by a single contributor.
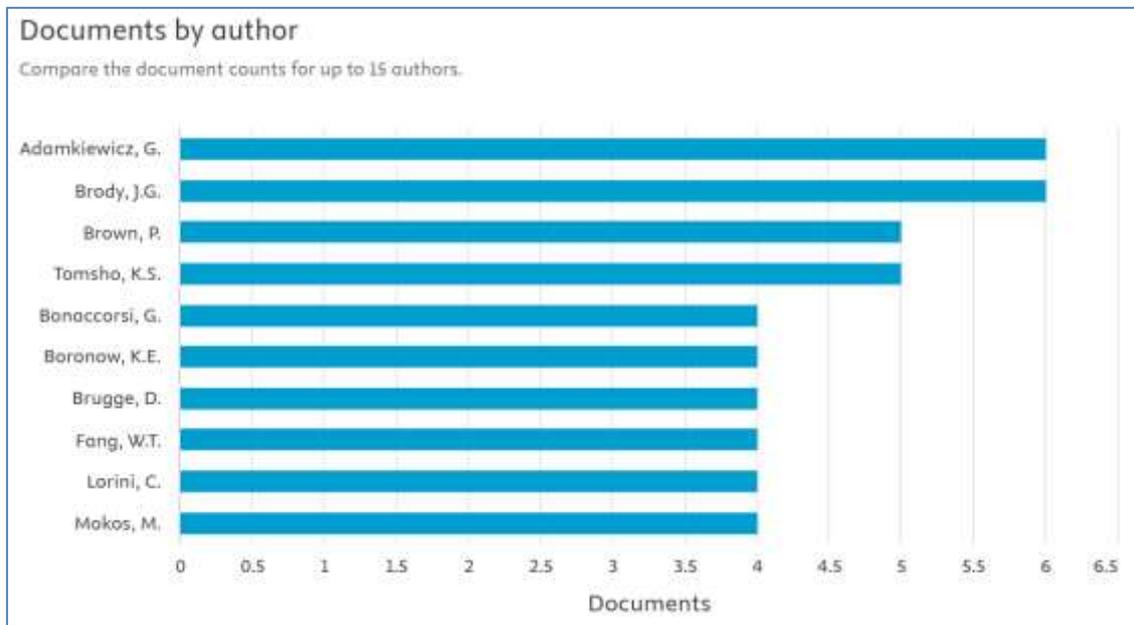
Figure 7 Number of Article by author (top 10 sources)
Source: Scopus data base (September 10, 2025)

C. RQ3: What are the theoretical contributions and practical implications derived from existing studies on environmental literacy, and how can these findings guide future research?

The examination was conducted on 661 manuscripts collected from the Scopus repository, with VOSviewer software used to analyze the metadata. The results suggest that environmental literacy and its related themes have both theoretical and practical implications for future research. The analysis using VOSviewer aids researchers and practitioners in understanding the connections between key concepts such as humans, literacy, environmental health, and knowledge, and how these variables relate to one another in the broader field of environmental studies.

The bibliometric analysis helps highlight which areas have been extensively studied by previous scholars, such as the connections between humans and literacy, as well as the role of environmental health and environmental exposure. At the same time, it also identifies areas that have been less explored, providing a clear foundation for future research. From a practitioner's perspective, the analysis underscores the importance of integrating environmental literacy into educational practices and policies globally. This understanding can guide the sustainable application of these concepts in real-world settings and ensure that they are effectively implemented in educational institutions worldwide.

Based on Figure 8 and Table 1, the emergence of topics related to environmental literacy, as seen through keyword analysis, shows a strong connection between these concepts. The frequency of keywords in the table indicates that the term humans appeared most frequently (255 occurrences), followed by literacy (237 occurrences), highlighting the central role of human involvement in environmental literacy. Additionally, terms such as environmental factor (117 occurrences) and environmental health (98 occurrences) are prominent, reflecting the significant focus on the relationship between humans and their environment.

Keywords like environmental exposure (64 occurrences) and education (72 occurrences) also appear frequently, emphasizing the importance of awareness and education in promoting environmental health. Other topics such as knowledge (65 occurrences), awareness (52 occurrences), and physical activity (29 occurrences) are relevant as well, indicating the diverse aspects of environmental literacy that are being explored in the literature.

While topics like humans, literacy, and environmental health are central to the discourse, less frequent keywords such as health knowledge, attitudes, and practice (34 occurrences) suggest the inclusion of human behavioral factors and their role in addressing environmental challenges. Overall, this data provides valuable insight into the importance of environmental literacy in various aspects of life, particularly in human health, education, and the development of sustainable practices.
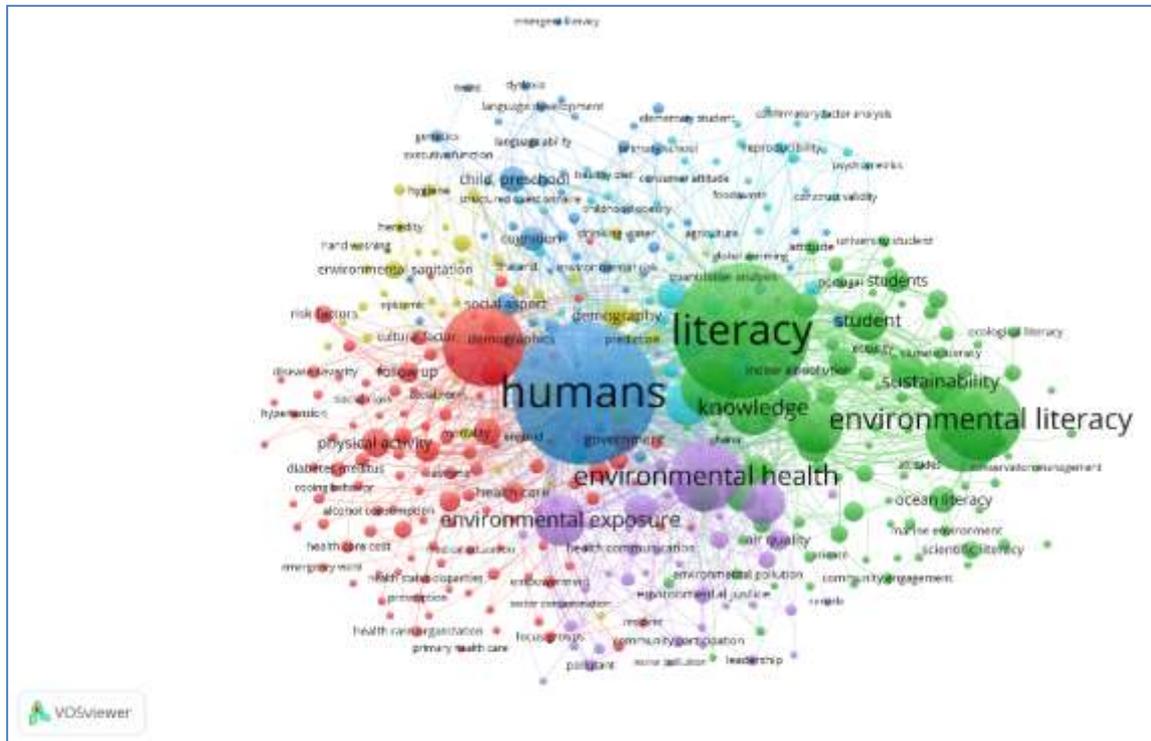
Figure 8 Keywords by author
Source: Research Data by VOSviewer (2025)

The keyword analysis indicates that environmental literacy is a central concept, with related terms such as sustainability, environmental education, and climate change also being prominent in the literature. This highlights the interdisciplinary nature of environmental literacy, connecting it with broader environmental and educational concerns. This study provides valuable insights into the global trends of environmental literacy, revealing key theoretical contributions and practical implications that will inform future research directions in the field. The findings emphasize the importance of integrating environmental literacy into education and policy to address contemporary environmental challenges and promote sustainable development globally.

Table 1 Keywords by authors

Rank	Keyword	Occurences	Total link strength
1	Humans	255	6217
2	Literacy	237	3832
3	Environmental factor	117	2723
4	Environmental health	98	2058
5	Environmental exposure	64	1546
6	Education	72	1380
7	Awareness	52	1250
8	Knowladge	65	1166
9	Health knowledge, attitudes, practice	34	957
10	Physical activity	29	939

Source: Research data (2025)

D. Discussion

The comprehensive examination of 661 articles sourced from the Scopus database highlights a notable evolution in the academic discourse surrounding environmental literacy. Through a combination of metadata analysis and bibliometric tools such as VOSviewer, the study reveals critical trends and insights that reflect both the growth of environmental literacy as an academic subject and its multifaceted applications in policy, education, and sustainability. The growing body of literature on environmental literacy highlights its increasing relevance and importance in contemporary academic discourse. As global challenges such as climate change, biodiversity loss, and sustainability become more pressing, the need for individuals equipped with environmental knowledge and the ability to engage in informed decision-making is more critical than ever. The exploration of environmental literacy has evolved significantly over the past few years, reflecting not only heightened academic interest but also a broadening of the scope of its application across disciplines, regions, and institutions worldwide.

First, the rising trend in environmental literacy research suggests that the topic remains not only relevant but also essential for future scholarly inquiry. With a surge in academic publications, particularly in recent years, it is evident that researchers increasingly recognize the importance of fostering environmental literacy to address global challenges. This growing interest underscores the urgency of incorporating environmental education into curricula (Chao, 2024; Fošner, 2025; Mokos et al., 2020), policymaking (Fernández, 2016; Selin et al., 2017), and community outreach efforts, ensuring that future generations are better equipped to navigate environmental issues with creativity, adaptability, and a strong sense of responsibility (Gustafsdottir et al., 2024; Kurniawan et al., 2024; Liu & Tobias, 2024; Ramírez et al., 2019).

Second, the distribution of research across countries and institutions reveals the widespread academic engagement with environmental literacy. The contributions from various countries across continents—including the United States, the United Kingdom, and Australia—indicate that environmental literacy is a global concern, reflecting its relevance in diverse cultural and geographical contexts. This international collaboration fosters a richer, more diverse understanding of environmental literacy, offering valuable insights that transcend regional boundaries. Furthermore, the prominent role of leading universities and research institutions highlights the academic community's commitment to advancing the field, strengthening the foundational knowledge and strategies for promoting environmental awareness worldwide (Bert et al., 2023; Durmus & Kinaci, 2021; Lee & Kang, 2023; Maryati et al., 2022; Okyay et al., 2022).

Lastly, the theoretical and practical implications derived from the existing body of work suggest both progress and areas for future research. While much has been studied regarding the connection between humans and environmental health, there remains a significant need to explore the interrelationships between environmental literacy and social, economic, and behavioral factors. Future research should aim to fill these gaps, examining how environmental literacy influences real-world decision-making, public policy, and the long-term sustainability of communities. Moreover, the study of environmental exposure and its impact on health outcomes can further inform educational and public health initiatives, driving global efforts to foster a healthier and more sustainable world. The findings from this study suggest that environmental literacy is gaining substantial traction as an interdisciplinary field, with an expanding body of research that will continue to shape academic, policy, and educational landscapes. The ongoing exploration of environmental literacy will be key in preparing individuals to meet the challenges of an increasingly complex and interconnected world, reinforcing its significance as a vital tool for global sustainability and informed action (Liang et al., 2018; Pfleger et al., 2024; Wilujeng et al., 2019).

The following discussion expands on these findings and addresses the key components of environmental literacy, as demonstrated in the SLR and bibliometric analysis, specifically focusing on the four main indicators of environmental literacy: 1) basic ecological knowledge (Ha et al., 2022; McBride et al., 2013; Okyay et al., 2022; Weng, 2022), 2) environmental affect (Lee & Kang, 2023; Rastegarimehr et al., 2024; Shi et al., 2025), 3) cognitive skills (Byrne et al., 2009; Husamah et al., 2022; Sholahuddin et al., 2021; Tohmiya et al., 2018), and 4) pro-environmental behavior (Hsu et al., 2019; Liang et al., 2018; McBride et al., 2013; Ronen & Kerret, 2020).

Figure 9 illustrates the key components of environmental literacy, which is central to addressing environmental challenges. It consists of four interconnected indicators: Basic Ecological Knowledge, which refers to understanding ecological processes and the natural environment; Environmental Affect, which involves emotional connections and motivation to protect the environment; Cognitive Skills, representing the ability to analyze and apply environmental information critically; and Pro-environmental Behavior, focusing

on actions like resource conservation and waste reduction. Together, these elements form a comprehensive framework that equips individuals to engage with environmental issues and contribute to sustainable practices

Figure 9 Environment Literacy Indicators

(Byrne et al., 2009; Ha et al., 2022; Hsu et al., 2019; Husamah et al., 2022; Lee & Kang, 2023; Liang et al., 2018; McBride et al., 2013; Okyay et al., 2022; Rastegarimehr et al., 2024; Ronen & Kerret, 2020; Shi et al., 2025; Sholahuddin et al., 2021; Tohmiya et al., 2018; Weng, 2022)

1. *Basic Ecological Knowledge*

One of the core themes emerging from the keyword analysis is the significance of basic ecological knowledge in shaping the understanding of environmental literacy. The term humans ranked highest in occurrences (255), indicating that the relationship between human activities and environmental factors is central to the discourse. Additionally, keywords such as environmental factor (117 occurrences) and environmental health (98 occurrences) reflect the essential role of ecological concepts in environmental literacy. This underscores the importance of equipping individuals with fundamental knowledge regarding the environment, ecosystems, and ecological processes.

This focus on basic ecological knowledge is crucial as it provides the foundational understanding necessary for individuals to appreciate the complexities of environmental issues, such as climate change, biodiversity loss, and sustainable resource management. As the results from both the metadata analysis and the network visualization (Figures 3 and 4) suggest, countries like the United States, the United Kingdom, and Australia have been at the forefront of research in this area, emphasizing the importance of integrating ecological concepts into formal education systems (Ha et al., 2022; McBride et al., 2013; Okyay et al., 2022; Weng, 2022).

2. *Environmental Affect*

The analysis of the top keywords and their associated frequencies reveals that environmental affect plays a significant role in shaping environmental literacy. Terms such as awareness (52 occurrences) and education (72 occurrences) point to the emotional and cognitive connection individuals have with environmental issues. The rising attention to sustainability and climate change across global publications reflects a shift towards fostering an emotional engagement with environmental topics, which is necessary to prompt meaningful action.

Environmental affect refers to the emotional response or connection individuals have towards environmental challenges, which has been recognized as a critical factor in motivating pro-environmental behaviors. The increasing number of publications focused on environmental health and environmental exposure reinforces the connection between individuals' emotional and cognitive responses

to environmental degradation. Studies suggest that fostering a positive emotional connection to the environment can significantly enhance individuals' commitment to sustainable practices, such as conservation efforts and reducing carbon footprints (Lee & Kang, 2023; Rastegarimehr et al., 2024; Shi et al., 2025).

3. Cognitive Skills

Environmental literacy encompasses more than just knowledge and affect; it also involves the development of cognitive skills that allow individuals to analyze, evaluate, and synthesize environmental information. Keywords such as knowledge (65 occurrences) and environmental exposure (64 occurrences) highlight the cognitive aspect of environmental literacy, focusing on how individuals process and apply environmental information to make informed decisions.

The keyword analysis, in conjunction with the VOSviewer network visualization, reveals a significant intersection between environmental literacy and cognitive development, particularly in the context of education. The role of cognitive skills in environmental literacy is underscored by the substantial emphasis on education and sustainability, suggesting that environmental literacy is not only about acquiring facts but also about developing the intellectual capacity to engage critically with environmental challenges. Furthermore, the rise of environmental literacy as a key educational objective since 2020, as shown in the publication trends (Figure 2), indicates a growing recognition of the need to integrate cognitive skills into environmental education at all levels (Byrne et al., 2009; Husamah et al., 2022; Sholahuddin et al., 2021; Tohmiya et al., 2018).

4. Pro-environmental Behavior

Ultimately, the goal of environmental literacy is to drive pro-environmental behavior, which includes actions such as reducing waste, conserving energy, and advocating for sustainable practices. This theme is supported by keywords like physical activity (29 occurrences) and health knowledge, attitudes, practice (34 occurrences), which suggest a connection between individuals' behaviors and their understanding of environmental issues.

The bibliometric analysis further supports the idea that the integration of environmental literacy into educational and policy frameworks can promote pro-environmental behavior. By developing both cognitive skills and emotional connections to environmental issues, individuals are more likely to adopt behaviors that align with sustainability goals. The increasing body of research on environmental literacy points to the critical role of education in facilitating this behavioral shift. The strong network connections among institutions such as the University of California, Harvard T.H. Chan School of Public Health, and the University of Melbourne (Figure 5) suggest a collaborative effort across institutions to promote both environmental knowledge and action (Hsu et al., 2019; Liang et al., 2018; McBride et al., 2013; Ronen & Kerret, 2020).

E. Implications for Future Research and Practice

The findings from this study contribute significantly to the theoretical and practical understanding of environmental literacy, providing a framework for future research in the field. The SLR and bibliometric analysis highlight that environmental literacy is a multidimensional construct, encompassing not only basic ecological knowledge but also emotional engagement, cognitive skills, and pro-environmental behavior. These four indicators must be integrated into future environmental education curricula to ensure the development of well-rounded individuals capable of addressing the global environmental challenges of the 21st century.

From a theoretical perspective, future research should further explore the relationships between these components, particularly how cognitive and emotional factors intersect to drive sustainable behaviors. Moreover, longitudinal studies examining the long-term impacts of environmental literacy programs on individual and societal behaviors would provide valuable insights into the effectiveness of educational interventions.

From a practical standpoint, the integration of environmental literacy into educational policies and practices is essential. As evidenced by the global trends in environmental literacy research (Figures 3 and 4), it is crucial to continue fostering international collaboration on this topic. By leveraging the findings from this study, educational institutions, governments, and NGOs can design programs that enhance environmental literacy (Devaney et al., 2020; Wilujeng et al., 2019), promote sustainable practices (ChamCham et al., 2024; Ronto et al., 2022), and prepare individuals to take on leadership roles in addressing pressing environmental issues (Laut et al., 2014; Lee & Kang, 2023; Rodríguez-Pérez et al., 2024).

CONCLUSION

This study comprehensively examines global trends in environmental literacy through systematic literature review (SLR) and bibliometric analysis. The findings confirm that environmental literacy is a rapidly growing and significant area of scholarly inquiry,

particularly in addressing global environmental challenges such as climate change, biodiversity loss, and resource depletion. Research on environmental literacy has increased significantly since 2020, yet geographic disparities remain, with the majority of studies concentrated in North America, Europe, and Australia. This highlights the need for greater research representation from regions such as Asia, Africa, and Latin America, to better reflect the global scope of environmental issues. Additionally, the study identifies four key indicators of environmental literacy—basic ecological knowledge, environmental affect, cognitive skills, and pro-environmental behavior—that are crucial for understanding and enhancing environmental literacy.

For future research, it is recommended that efforts focus on developing a standardized framework for measuring environmental literacy, particularly among university students. This framework should address the four indicators identified: basic ecological knowledge, emotional engagement with environmental issues (environmental affect), cognitive skills related to environmental decision-making, and the ability to engage in pro-environmental behaviors. Longitudinal studies are essential to assess the long-term impact of environmental literacy programs on students' attitudes, knowledge, and behaviors. Furthermore, research should explore the integration of environmental literacy into curricula and educational policies across diverse regions, particularly in underrepresented areas, to ensure a more inclusive and global approach. Additionally, interdisciplinary studies that combine environmental science, education, and behavioral psychology can provide deeper insights into how these dimensions of environmental literacy interact and influence student outcomes. Ultimately, future studies should aim to create evidence-based interventions that can be applied in both educational settings and public policy to foster a more sustainable and environmentally literate global society.

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