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Systematic Literature Review: Reframing Riverbank Erosion as a Contextual Learning Tool in Environmental Education

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Abstract:
Riverbank erosion is a significant environmental issue that affects ecological systems, socioeconomic conditions, public health, and community resilience. Despite its widespread impacts, its potential as a contextual learning resource in environmental education has received limited scholarly attention. This study aims to synthesize existing evidence on the impacts of riverbank erosion and examine how the phenomenon can be reframed as a contextual learning medium within environmental education. A Systematic Literature Review (SLR) adapted from the PRISMA guidelines was conducted using articles retrieved through Publish or Perish from the Scopus database. Using the keywords "riverbank erosion," "contextual learning," and "environmental education," the selection process resulted in 10 relevant articles, which were analyzed through qualitative descriptive techniques. The findings reveal that riverbank erosion contributes to environmental degradation, damage to land and settlements, population displacement, and increased socioeconomic vulnerability. More importantly, this review highlights the educational value of riverbank erosion as an authentic environmental context that supports contextual learning, place-based learning, and environment-based learning approaches. By synthesizing evidence across environmental and educational studies, this review provides a conceptual linkage between local environmental challenges and meaningful learning experiences. The findings suggest that integrating riverbank erosion issues into environmental education can foster environmental literacy, critical thinking, and students' awareness of sustainability challenges, while offering educators a framework for connecting real-world environmental problems with classroom learning.

INTRODUCTION

Environmental issues have become a global concern that is receiving increasing attention in various aspects of life, including education. Various forms of environmental degradation such as pollution, flooding, landslides, and erosion occur due to a combination of natural factors and uncontrolled human activities (Kurakova 2023; Q. Li 2023). One form of environmental damage that frequently occurs in aquatic areas is riverbank erosion. This phenomenon causes changes in the river's shape, damage to land surrounding the river, and a decline in environmental quality (Purwanto 2022). These conditions demonstrate that

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environmental problems not only impact ecological aspects but also affect the social and economic lives of communities.

Riverbank erosion has various impacts on the environment and people's lives (Rashid 2021). The process of soil erosion along riverbanks can lead to the loss of agricultural land, damage to settlements, changes in river flow, and an increased risk of disasters in the surrounding areas (Rahman 2021). Additionally, riverbank erosion also affects the socioeconomic conditions of communities, such as a decline in livelihoods and increased environmental vulnerability. In several studies, the phenomenon of river erosion has also been linked to environmental health issues resulting from the disruption of water quality and sanitation for communities near river basins (Islam 2023; Rahman 2021). Therefore, riverbank erosion can be viewed as a complex environmental phenomenon closely tied to people's daily lives.

The rise in various environmental issues highlights the importance of environmental education in fostering students' awareness and concern for their surroundings(Mallick 2021). Environmental education plays a role in helping students understand the relationship between humans and the environment, as well as encouraging the development of a caring attitude toward environmental sustainability (Hasan 2024). Environmental learning should not only focus on conveying theoretical concepts but also provide real and contextual learning experiences so that students can understand environmental issues more deeply (Hasan 2024; Spiteri 2022). Thus, learning that utilizes environmental phenomena in the students' surroundings is important to implement in the educational process.

One approach that can be used in environmental education is contextual learning. This approach emphasizes the connection between learning materials and real-life situations that students experience in their daily lives (Batri 2026; Koch 2024). Through contextual learning, students do not merely passively receive information but are also encouraged to observe, understand, and analyze real-world phenomena occurring in their surroundings (Mardhiah 2021). The natural environment can be utilized as a learning resource capable of providing students with direct experiences, thereby making the learning process more meaningful (Z. Li 2025; Zinchenko 2023). Therefore, various environmental phenomena have the potential to serve as contextual learning tools in environmental education.

The phenomenon of riverbank erosion has the potential to be utilized as a contextual learning tool because it is directly related to real-world environmental conditions that students can observe (Hardwick 2025). By utilizing the phenomenon of riverbank erosion, students can learn about various aspects such as the causes of environmental damage, the impacts on community life, and the importance of preserving the environment (Islam 2023; Kurakova 2023). Additionally, learning based on environmental phenomena can enhance students' critical thinking skills, environmental awareness, and understanding of environmental issues in their surroundings (Hachana 2025; Hasanuzzaman 2025). By utilizing the environment as a learning resource, the educational process is expected to become more relevant to students' real lives.

Although numerous environmental phenomena can be incorporated into contextual learning, riverbank erosion offers a particularly valuable educational context. Unlike many environmental issues that are often studied separately, riverbank erosion simultaneously reflects

ecological degradation, human-environment interactions, socioeconomic vulnerability, and disaster risk. As a locally observable phenomenon, it enables students to connect scientific concepts with real-world environmental challenges while fostering critical thinking, environmental literacy, and sustainability awareness. These characteristics make riverbank erosion a potentially powerful yet underexplored resource for environmental education.

Many previous studies have examined riverbank erosion from environmental, geomorphological, social, and economic perspectives. Likewise, contextual learning and environmental education have been widely investigated across different educational settings. However, these two bodies of literature largely remain disconnected. To date, there has been limited effort to synthesize how riverbank erosion can be systematically utilized as a contextual learning resource in environmental education. Consequently, the educational potential of riverbank erosion remains insufficiently conceptualized despite its relevance to students' everyday environmental experiences. Addressing this gap is important for developing learning approaches that connect local environmental problems with meaningful and authentic educational experiences.

Based on these issues, this study aims to analyze the potential of riverbank erosion as a contextual learning medium in environmental education through a systematic literature review (SLR) approach. This study focuses on identifying the environmental and social impacts of riverbank erosion that can be used as a learning resource, as well as analyzing the utilization of river erosion phenomena as a contextual learning medium in environmental education. The research questions in this study are: (1) what are the environmental and social impacts of riverbank erosion that can be used as learning resources and (2) how can the phenomenon of riverbank erosion be utilized as a contextual learning medium in environmental education.

METHODS

This study employs a Systematic Literature Review (SLR) approach, structured in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Hardianto et al. 2024; Ihsan et al. 2025). This approach is used to systematically examine various research findings related to riverbank erosion, contextual learning, and environmental education. Through the SLR approach, this study aims to identify, evaluate, and synthesize the findings of previous research to gain a comprehensive understanding of the potential of riverbank erosion as a medium for contextual learning in environmental education. The review process was conducted through structured stages, including article identification, screening based on inclusion and exclusion criteria, assessment of article eligibility, and synthesis of relevant research results. This approach is expected to produce an analysis that is objective, transparent, and replicable.

The primary data source for this study was the Scopus database, which was selected for its extensive coverage of scientific publications in the fields of the environment and education. The article search process was conducted using the Publish or Perish application to facilitate the identification and management of scientific articles relevant to the research topic. The article search strategy utilized several combinations of keywords related to the study's focus, namely "riverbank erosion" AND "place-based learning" AND "contextual learning" AND

"environmental education." These keywords were used separately or in combination using Boolean operators such as AND to obtain articles consistent with the research objectives. The search was conducted for the years 2021–2026 to ensure the recency of the information and the relevance of the research to current developments in environmental and educational issues.

The selection of these keywords was intentional and aligned with the objectives of the review, which sought to explore the intersection between riverbank erosion and environmental education. While broader environmental search terms could have yielded a larger number of studies, many of these studies focus exclusively on physical, hydrological, or engineering dimensions of riverbank erosion without educational relevance. Therefore, educational keywords such as contextual learning, place-based learning, and environmental education were included to ensure that the retrieved studies directly addressed the research questions of this review.

The article selection process involved establishing inclusion and exclusion criteria to ensure that the articles analyzed were highly relevant to the research focus. Inclusion criteria include: (1) articles discussing riverbank erosion, contextual learning, or environmental education; (2) articles published in scientific journals; (3) articles published between 2021 and 2026; (4) articles available in English; and (5) articles with full-text access.

Meanwhile, exclusion criteria include: (1) articles unrelated to educational or environmental contexts; (2) articles overly focused on technical engineering aspects, mathematical modeling, or civil engineering; (3) non-empirical publications such as editorials, opinion pieces, and short proceedings; (4) articles not available in English; and (5) articles without full-text access. The application of these criteria aims to ensure the consistency and quality of the articles used in the data synthesis process.

After the article selection process is complete, the next step is data extraction and analysis. Each article meeting the inclusion criteria was extracted based on several key aspects, including: (1) article title and author, (2) year of publication, (3) research location or context, (4) research objectives, (5) research methods, (6) main research findings, and (7) relevance to contextual learning and environmental education.

The extracted data was then analyzed using qualitative descriptive analysis techniques by grouping the findings based on the main themes of the research. These themes include the environmental and social impacts of riverbank erosion, the concept of contextual learning, and the use of the environment as a learning medium. The results of the synthesis were then used to answer the research questions and to gain an understanding of the potential of riverbank erosion as a medium for contextual learning in environmental education.

The article selection process in this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which consist of four main stages: identification, screening, eligibility, and inclusion. In the identification stage, an initial search was conducted using the Scopus database with the keyword combination "riverbank erosion," "place-based learning," "contextual learning," and "environmental education." The initial search yielded a total of 143 articles (n = 143).

The next stage was screening, which involved filtering based on the type of publication. At this stage, articles such as conference papers, book chapters, reviews, notes, editorials,

letters, and books were excluded from the selection process, resulting in the removal of 60 articles, leaving 83 original research articles (n = 83).

During the eligibility stage, screening was conducted based on the language of publication. Articles written in languages other than English such as Chinese, German, Korean, and Indonesian were excluded from the selection process, resulting in the removal of 24 articles. Following this process, 59 English-language articles remained (n = 59). The subsequent stage involved screening based on the article's access status. Only open-access articles were retained to facilitate the analysis process and ensure the accessibility of data sources. A total of 15 articles requiring paid access were excluded, leaving 44 open-access articles (n = 44).

The inclusion stage involved selecting articles based on content relevance through an evaluation of abstracts and full texts. At this stage, 34 articles were excluded because they lacked a direct connection to the research theme, particularly those that focused too heavily on technical engineering aspects or failed to address the context of environmental education and contextual learning. After all selection stages were completed, 10 final articles (n = 10).

Although the final number of included studies was relatively small (n = 10), this reflects the highly specific focus of the review. The study aimed to identify literature that not only addressed riverbank erosion but also demonstrated relevance to environmental education, contextual learning, or place-based learning. Many studies identified during the screening process focused primarily on engineering, hydrological, or geomorphological aspects of riverbank erosion without discussing educational implications. Therefore, the rigorous application of the inclusion and exclusion criteria resulted in a smaller but highly relevant set of articles for synthesis. The entire article selection process was transparently documented using a PRISMA flowchart to ensure the traceability, validity, and replicability of the research (Figure 1).

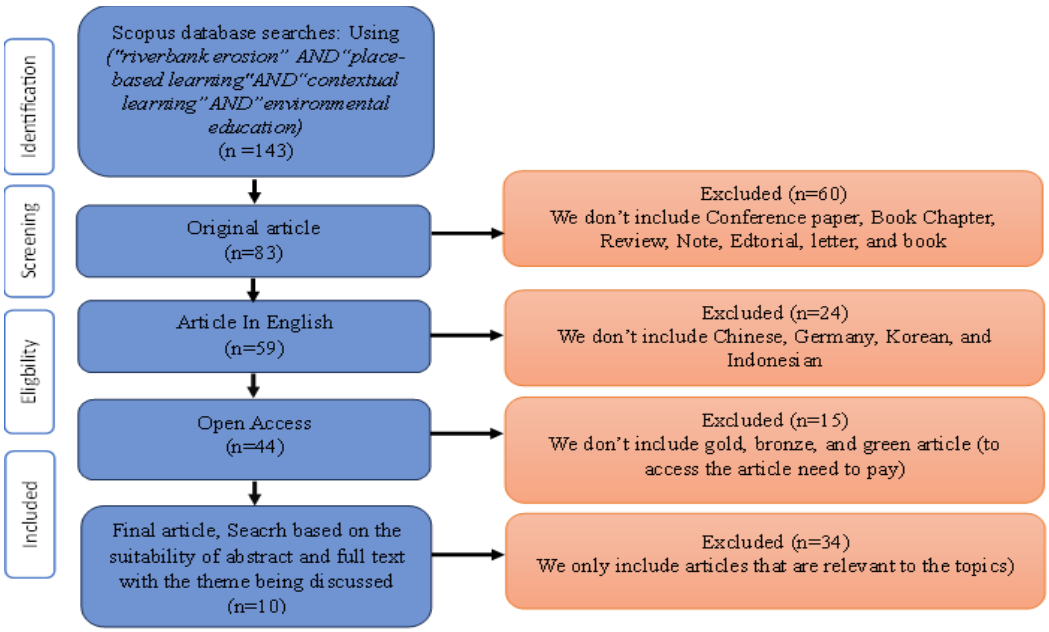


Figure 1. PRISMA Diagram

After the article selection process is complete, the next step is the systematic extraction and analysis of data to identify patterns in the findings, relationships between variables, and

research trends relevant to the focus of the study. Each article that passed the inclusion stage was extracted using a data synthesis sheet containing key information, including: (1) title and author's name, (2) year of publication, (3) country or research location, (4) research objectives and approach, (5) environmental and social impacts resulting from riverbank erosion, (6) forms of environmental utilization as a learning medium, (7) contextual learning approaches employed, and (8) key findings and implications for environmental education.

In addition, a quality appraisal procedure was incorporated during the eligibility and inclusion stages. Articles were evaluated based on publication in peer-reviewed journals, methodological clarity, relevance to the research objectives, availability of full-text access, and adequacy of reported findings. Studies that did not provide sufficient methodological information or showed limited relevance to environmental education were excluded from the final synthesis. This procedure was conducted to enhance the reliability and trustworthiness of the review findings.

The data extraction process was conducted manually to ensure the data aligned with the research focus. Data analysis was performed using a qualitative descriptive approach by identifying the main themes emerging from the analyzed articles. These themes include the environmental and social impacts of riverbank erosion, environment-based contextual learning, and the utilization of local environmental phenomena as learning resources in environmental education.

The research findings were synthesized to identify the relationship between the phenomenon of riverbank erosion and the approaches of contextual learning, place-based learning, and environment-based learning. The results of this synthesis were then presented in the form of analytical narratives and thematic tables to clarify the relationship between environmental phenomena, their social impacts on communities, and their use as a medium for contextual learning in environmental education

RESULTS AND DISCUSSION

RQ1: What are the environmental and social impacts of riverbank erosion that can be used as learning resources?

The synthesis of the analyzed articles indicates that riverbank erosion has various environmental, social, economic, and public health impacts. These impacts demonstrate that river erosion is not merely a physical environmental issue but is also closely linked to the social lives of communities and can be utilized as a contextual learning resource in environmental education. Table 1 presents the various categories of riverbank erosion impacts based on the synthesis of the analyzed articles.

Based on Table 1, environmental impacts are one of the key findings in the various studies analyzed. Riverbank erosion leads to changes in river morphology, land degradation, and ecosystem damage in areas surrounding the river. Erosion along the Mekong River has caused the loss of agricultural land and damage to riverbank areas (Tha 2022). Additionally, the changes in the river's edge caused by erosion result in continuous land loss and exacerbate environmental damage in the surrounding areas (Hasan 2026; Novak 2021).

Table 1. Environmental and Social Impacts of Riverbank Erosion as a Learning Resource

No.	Categories of Riverbank Erosion Impacts	Summary	Supporting Articles
1	Environmental Impact and Land Degradation	Riverbank erosion leads to changes in river morphology, land degradation, loss of agricultural land, and damage to river ecosystems and riparian areas.	(Bhuyan 2024; Hasan 2026; Tha 2022)
2	Damage to Residential Areas and Infrastructure	Erosion causes damage to homes, public facilities, roads, and community infrastructure along rivers, thereby increasing the risk of environmental disasters.	(Kaiser 2023; Tha 2022)
3	Population Migration and Social Vulnerability	River erosion forces communities to relocate, causes them to lose their assets, and increases social vulnerability and instability in their lives.	(Ahmad 2023; Bhuyan 2024; Kaiser 2023)
4	Economic Impact and Loss of Livelihood	The loss of productive land due to erosion has led to a decline in income, changes in livelihoods, and increased poverty among riverside communities.	(Ahmad 2023; Bhuyan 2024; Kaiser 2023)
5	Health and Environmental Sanitation Impacts	Riverbank erosion affects public health through poor sanitation, limited access to clean water, and increased psychological distress among affected communities.	(Ahmad 2023; Kaiser 2023)
6	The Impact of Human	Human activities such as sand mining, land-use changes, and development along rivers accelerate riverbank erosion.	(Islam 2023; Tha 2022)
7	The Impact of Climate Change and Floods	The climate is changing, leading to more frequent flooding and worsening river erosion, which increases the environmental and social vulnerability of communities	(Ahmad 2023; Bhuyan 2024)
8	The Potential of Erosion as a Source of Contextual Learning	The phenomenon of riverbank erosion can serve as a learning resource for understanding the relationship between humans and the environment, disaster mitigation, environmental conservation, and environmental education.	(Eaton 2021; Rodrigues 2025)

Beyond environmental impacts, various studies indicate that riverbank erosion also has significant social consequences. River erosion leads to damage to settlements, population displacement, and increased social vulnerability among communities. The communities displaced by river erosion face various social problems such as loss of housing, poor housing quality, and limited access to basic public services (Hossain 2021; Kaiser 2023). A communities in erosion-prone areas have high levels of social vulnerability due to limited access to education, healthcare, and infrastructure (Bhuyan 2024).

Economic impacts are also one of the primary consequences of riverbank erosion. The loss of agricultural land and community assets leads to a decline in income and changes in the livelihoods of riverside communities. The climate change and river erosion increase the economic vulnerability of communities in flood- and erosion-prone areas (Ahmad 2023; Malak

2021). These conditions result in communities having a low capacity to adapt to environmental changes and disasters.

Additionally, the study's findings indicate that riverbank erosion also impacts community health and environmental sanitation. The communities affected by river erosion face various health issues due to poor sanitation, limited access to clean water, and increased psychological stress resulting from the loss of homes and livelihoods (Kaiser 2023; van Kamp 2024). This indicates that the impacts of river erosion are not merely physical but also affect the overall well-being of communities.

Human activities and climate change were also identified as the primary causes of increased riverbank erosion (Rodrigues 2025). Activities such as sand mining, land use changes, development near rivers, and the increased frequency of floods due to climate change accelerate erosion and environmental damage. These conditions demonstrate a close relationship between human activities and environmental degradation in riverine areas(Shahriar 2021).

Overall, the findings of this study indicate that riverbank erosion has great potential to serve as a contextual learning resource in environmental education. This phenomenon can be used to help students understand the relationship between human activities, environmental changes, socioeconomic impacts, and the importance of maintaining environmental sustainability. Additionally, the phenomenon of riverbank erosion can also be used to enhance students' environmental awareness, critical thinking skills, and concern for environmental issues in their surroundings. A cross-study synthesis reveals several recurring patterns. First, environmental degradation consistently emerges as the starting point of a chain of interconnected impacts. Most studies indicate that riverbank erosion not only causes physical changes to river systems and land degradation but also triggers social displacement, economic losses, and health-related challenges. Second, social and economic vulnerabilities frequently appear together, suggesting that communities experiencing livelihood losses are also more likely to face displacement and reduced access to essential services. Third, recent studies increasingly emphasize the role of climate change and human activities as interacting drivers of erosion, reflecting a growing shift from viewing erosion as a purely natural process toward understanding it as a socio-environmental issue. These patterns demonstrate that riverbank erosion represents a complex environmental phenomenon that can support interdisciplinary learning about environmental sustainability, human-environment interactions, and disaster resilience.

RQ2: How can the phenomenon of riverbank erosion be used as a contextual learning tool in environmental education?

The results of this synthesis indicate that the phenomenon of riverbank erosion has great potential to be utilized as a contextual learning medium in environmental education. Contextual learning emphasizes the connection between learning materials and the real-world conditions experienced by students, thereby making the learning process more meaningful and practical. In this context, the phenomenon of riverbank erosion can be used as a learning resource to help students understand the relationship between human activities, environmental changes, and their impact on community life. Table 2 shows various ways of utilizing the phenomenon of

riverbank erosion as a contextual learning medium based on the results of the synthesis of the analyzed articles.

Table 2. Educational Applications of Riverbank Erosion in Environmental Education

No.	Educational Application Categories	Summary	Supporting Articles
1	Environment-Based Learning	The phenomenon of river erosion is used as a real-world learning resource to understand environmental degradation and conservation.	(Eaton 2021; Rodrigues 2025)
2	Contextual Learning	The lesson connects the material to the students' surrounding environment through the observation of river erosion phenomena.	(Eaton 2021)
3	Place-Based Learning	The local environment, such as rivers and riverbanks, is used as a learning tool to enhance students' understanding of environmental issues in their surroundings	(Rodrigues 2025)
4	Environmental Disaster Mitigation Education	This phenomenon of river erosion is used to study disaster risk, mitigation, and community adaptation to environmental change.	(Ahmad 2023; Tha 2022)
5	Environmental Problem-Based Learning	The issue of river erosion is used as a case study in the classroom to enhance students' critical thinking and problem-solving skills	(Bhuyan 2024; Eaton 2021)
6	Environmental Awareness and Concern Education	Learning based on the phenomenon of river erosion can increase students' ecological awareness and concern for the surrounding environment	(Eaton 2021; Rodrigues 2025; Tha 2022)
7	Observational and Investigative Field Learning	The students can directly observe the condition of the river, changes to the riverbanks, and the environmental impacts of erosion	(Hasan 2026; Tha 2022)
8	Integration of Environment Education	The phenomenon of river erosion can be incorporated into environmental education materials such as soil conservation, climate change, and the relationship between humans and the environment	(Ahmad 2023; Rodrigues 2025)

Table 2 shows that the results of the synthesis indicate that the phenomenon of riverbank erosion can be utilized as a resource for environment-based learning. The river environment and its banks can serve as a real-world learning medium to help students understand various environmental concepts such as environmental degradation, natural resource conservation, and the relationship between humans and the environment. The integration of the environment and the community into the learning process can enhance students' understanding of environmental issues and encourage behavioral changes that are more mindful of environmental sustainability(Eaton 2021; Pino-Perdomo 2026).

Additionally, contextual learning and place-based learning approaches also serve as ways to utilize the phenomenon of riverbank erosion in environmental education (Hunter 2022). Contextual learning allows students to connect learning materials with real-world conditions in their surrounding environment. In this context, rivers and their banks can function as natural

laboratories that provide students with hands-on learning experiences (Ahmad 2024; Carlsson 2024).

The phenomenon of riverbank erosion can also be utilized in teaching disaster mitigation and climate change. Research findings indicate that climate change, increased flooding, and human activities exacerbate river erosion and heighten the risk of environmental damage (Hasanuzzaman 2024). These conditions can serve as teaching materials to help students understand the importance of disaster mitigation, environmental adaptation, and sustainable natural resource management (Boroumand 2026).

In addition to enhancing understanding of environmental concepts, learning based on the phenomenon of riverbank erosion can also help improve students' critical thinking and problem-solving skills (Hajj-Hassan 2026). Real-world environmental issues such as riverbank erosion can be used as case studies in the classroom, enabling students to analyze the causes, impacts, and solutions to environmental problems occurring in their surroundings. Such learning can create a more active, participatory, and meaningful learning experience (Batri 2026).

The findings of the synthesis also indicate that incorporating the phenomenon of river erosion into learning can enhance students' environmental awareness and concern(Carlsson 2024; Pino-Perdomo 2026) . Through direct observation of river conditions and the impacts of erosion on communities, students can understand the importance of preserving the environment and reducing activities that may exacerbate environmental damage (Kim 2023). Learning based on the local environment can also help students develop a sense of responsibility toward their surrounding environment (Eaton 2021; Rakib 2024).

Overall, the synthesis results indicate that the phenomenon of riverbank erosion holds significant potential for use as a contextual learning medium in environmental education. Utilizing the local environment as a learning resource not only helps students understand environmental concepts theoretically but also provides real-world learning experiences relevant to their daily lives. The synthesis also reveals a clear pattern in the educational use of riverbank erosion. Across the reviewed studies, learning approaches consistently move from direct observation of local environmental phenomena toward the development of higher-order thinking skills and environmental responsibility. Environment-based learning, contextual learning, and place-based learning are not presented as separate approaches but rather as complementary strategies that connect students with authentic environmental issues. Furthermore, recent studies show an increasing emphasis on integrating environmental challenges with sustainability education, disaster mitigation, and community resilience. This trend suggests that riverbank erosion can function not only as a topic of environmental study but also as a platform for developing environmental literacy, critical thinking, and problem-solving skills within real-world contexts.

CONCLUSION

Riverbank erosion is an environmental problem that has far-reaching impacts on ecological conditions and people's lives. These impacts include land degradation, changes in river morphology, ecosystem damage, the loss of agricultural land and settlements, and

increased social, economic, and health vulnerabilities among communities. In addition to being influenced by natural factors, riverbank erosion is also exacerbated by human activities such as land-use changes, development around rivers, and climate change, which increases the risk of flooding and environmental damage. These conditions indicate that riverbank erosion is a complex environmental phenomenon directly linked to people's daily lives.

The phenomenon of riverbank erosion also holds great potential to be utilized as a medium for contextual learning in environmental education. The river environment can serve as a real-world learning resource through approaches such as contextual learning, place-based learning, and environment-based learning, which connect learning materials to the environmental conditions surrounding students. The use of environmental phenomena in learning can help students understand the relationship between humans and the environment, improve critical thinking skills, and foster awareness and concern for environmental sustainability.

This review contributes to the field of environmental education by reframing riverbank erosion from being viewed solely as an environmental hazard into a meaningful contextual learning resource. The findings demonstrate that riverbank erosion can function not only as a subject of environmental study but also as an authentic learning context that integrates environmental literacy, sustainability education, disaster mitigation, and human–environment interactions. These findings suggest that local environmental phenomena can be systematically incorporated into environmental education to make learning more meaningful, relevant, and responsive to students' lived experiences.

Furthermore, the results provide important implications for curriculum design and educational practice. Integrating riverbank erosion into environmental education can support the development of place-based and contextually relevant learning experiences that strengthen students' environmental awareness, critical thinking, and problem-solving skills. This study also offers a conceptual foundation for educators and curriculum developers seeking to connect local environmental challenges with broader educational goals related to sustainability and environmental responsibility.

This study still has several limitations, including the fact that the sources of the analyzed articles were limited to the Scopus database, and the number of articles meeting the inclusion criteria remained relatively limited given the study's focus. Furthermore, this study focused primarily on conceptual analysis and literature synthesis regarding the use of riverbank erosion as a medium for contextual learning in environmental education; thus, it did not examine the direct implementation of such learning in the field. Future research is therefore needed to investigate the effectiveness of riverbank erosion-based learning in different educational contexts and to examine its impact on environmental literacy, sustainability awareness, critical thinking, and student engagement. Such studies would strengthen the empirical foundation for integrating local environmental phenomena into environmental education and contribute to the further development of contextual and sustainability-oriented learning approaches.

AUTHOR STATEMENTS

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This research received no external funding and was conducted independently by the authors.

Author Contributions

The first author conceptualized the study, developed the review protocol, conducted the literature search, screened and selected the articles, performed data extraction and thematic analysis, interpreted the findings, and prepared the original manuscript draft. The second author contributed to the research design, supervised the methodological process, assisted in data interpretation, and critically reviewed the manuscript. The third author provided academic supervision, contributed to the development of the theoretical framework, and critically revised the manuscript for important intellectual content. The fourth author contributed to the validation of the review process, assisted in the interpretation of findings, reviewed the manuscript, and provided substantive revisions. All authors read, approved, and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no conflict of interest regarding the publication of this article.

Data Availability Statement

The data supporting the findings of this study are derived from published articles indexed in the Scopus database and are available from the corresponding author upon reasonable request.

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