Jambura Geo Education Journal
Volume 7 Number 2, September 2026, 206-218
DOI: https://doi.org/10.37905/jgej.v7i2.37794

Spatial-Ecological Change in Conservation Areas as Presented in Environmental Geography Textbooks: A Content Analysis

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ARTICLE INFO

Article History
Received: 2026-03-12
Accepted: 2026-07-19
Published: 2026-09-30

Keywords
Content analysis;
Conservation areas;
Environmental geography textbooks;
Spatial ecology

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DOI: 10.37905/jgej.v7i2.37794

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ABSTRACT

Geography education depends on the quality of its instructional materials. This mixed-methods content analysis examined how three ISBN-registered environmental geography textbooks published in Indonesia represent spatial-ecological change in conservation areas and the knowledge and skills needed to study it. The books were examined quantitatively by calculating the frequencies and proportions of topics and visual elements and qualitatively through an interpretive synthesis of concepts, examples, and representations. The findings show that the textbooks cover environmental, conservation, and sustainability topics but provide limited empirical data, maps, and contextual case studies. None offers an explicit framework for applying geographic skills to analyze spatial-ecological change. Photographs dominate the visual material, whereas maps are absent. These limitations reduce opportunities for students to interpret spatial patterns, compare changes across scales and periods, and connect conservation concepts with evidence. Future environmental geography textbooks should integrate spatial data, maps, case studies, and explicit geographic-skill frameworks oriented toward conservation and sustainable ecosystem restoration.

How to cite: Ikhsan, F. A., Heldayani, E, & Sejati, A. E. (2026). Spatial-ecological change in conservation areas as presented in environmental geography textbooks: A content analysis. *Jambura Geo Education Journal*, *7*(2), 206–218. https://doi.org/10.37905/jgej.v7i2.37794

1. Introduction

Comparing the content of environmental geography textbooks can strengthen scientific knowledge and academic rigor among geographers and geography educators. GeoCapabilities supports development across geographical subdisciplines, including environmental geography (Bladh, 2020). Environmental geography integrates knowledge from several fields and emphasizes human-environment relationships, an orientation also reflected in higher education geography curricula (Maude, 2020). Examining the causes and consequences of environmental change is a distinctive form of geographical inquiry. Understanding spatial-ecological systems through contextual data can improve interpretations of human-environment interactions and their economic, social, and cultural implications. Basic geographical knowledge therefore remains essential to instruction and learning-material development in higher education (Esteves, 2019; Sumarmi et al., 2022).

Learning resources help students develop knowledge and skills. Textbooks remain important learning resources worldwide (Lee et al., 2021), and differences in their coverage can broaden students' understanding of environmental geography. Comparing textbook content can also develop methodological skills and knowledge of spatial-ecological change in conservation areas. The selection of core and enrichment material shapes a textbook's pedagogical contribution to the depth and breadth of geography learning (Lee et al., 2021). Engaging content can strengthen students' motivation and interest in reading, whereas resources with weak didactic frameworks may impede learning (Lee & Catling, 2017).

Within the Indonesian context, this study reviews environmental geography textbooks to determine how they address spatial-ecological change in conservation areas and to identify characteristics of high-quality higher-education textbooks. The analysis focuses on content concerning humans and the environment. Despite the importance of textbooks, limited attention has been paid to how environmental and ecological content is connected with place, policy, human activity, society, the economy, and conservation. Geography education research is shaped by the topics and content selected for instruction (Keenan & Fontaine, 2012). Accordingly, the conceptual knowledge embedded in textbooks influences learning design and classroom activities and should be communicated through disciplinary forms of geographical information.

This study examines how Indonesian environmental geography textbooks represent geographically situated phenomena. Presenting text together with illustrations of places and themes can develop students' GeoCapabilities and their understanding of human-ecosystem relationships. Human activities alter landscapes and the climate, while models of human-environment interaction help students interpret these changes. Visual representations also shape how students understand geographical phenomena as core disciplinary content. The concepts and skills selected for a textbook determine its accuracy, information quality, design, and relevance to students' needs. The findings are therefore intended to inform the development of more relevant environmental geography textbooks for Indonesian higher education.

Reviews of environmental geography textbooks should examine how they represent spatial-ecological change in conservation areas. Education and the use of natural resources influence students' understanding of landscapes (Meek, 2019). Ecological networks are integral to landscape approaches in biogeography and ecosystem conservation and support context-sensitive conservation planning (Jiang et al., 2022). Conservation strategies should also align land use with spatial priorities (Chen et al., 2023). Textbooks can make these relationships accessible through examples, data, images, and applications. Accurate, up-to-date geographical data enable students to identify environmental change across spatial and temporal scales (Kaplan, 2021). Within landscape ecology, local knowledge and people's connections to landscapes further inform conservation practice (Pearson & Gorman, 2023; Sejati et al., 2023; Sumarmi et al., 2022).

Research on representations of spatial-ecological change in environmental geography textbooks has attracted increasing attention. Geographic knowledge is central to curricula and to geography as an academic subject (Roberts, 2014). Textbooks should therefore model both geographic knowledge and skills, consistent with the GeoCapabilities approach (Boehm et al., 2018). Relevant content includes spatial-ecological phenomena, changes in conservation areas, human-environment dynamics, and environmental management. Evaluating reference books makes their knowledge structures and geographical concepts explicit (Maude & Caldis, 2019), while geographical knowledge should be grounded in research (Solem, 2023). Representations of diverse landscapes can support higher-order analysis and synthesis (Trahorsch et al., 2022). However, existing syntheses do not adequately explain how textbooks represent place identities, interaction patterns, and changes generated by human or natural processes.

Guided by curriculum theory, this study treats environmental geography reference books as instructional resources in higher education. This perspective supports an assessment of whether the theories, concepts, and scientific processes presented in the books align with the intended curriculum. It also positions problem solving as a means of developing young people's GeoCapabilities through university geography education (Lambert et al., 2015).

Content analysis of environmental geography textbooks examines both key and abstract concepts. Key concepts express the discipline's organizing ideas, whereas abstract concepts provide terms for explaining specific phenomena. Fögele (2016) emphasizes the role of key concepts, ideas, theories, and structured models in geographical reasoning. Theory likewise supports rigorous inquiry into geographical phenomena and human-environment dynamics. Abstract and general concepts should be organized according to the hierarchy of geographical study (Maude, 2020), because curriculum knowledge has philosophical and psychological as well as disciplinary dimensions (Young, 2015). Analyses of published reference books can thus inform curriculum development and help align the interpretation and illustration of geographical knowledge with the goals of geography education (Maude, 2016).

The organization and presentation of textbook content determine how effectively authors communicate their intended messages. Reviewing concepts and their relationships can reveal how a textbook translates geography education research into instructional content (Solem & Boehm, 2018). Conceptual mapping, in particular, makes the structure of the knowledge presented in a book explicit and shows how that structure may support students' spatial thinking (Mitchell, 2022; Ridha et al., 2019). Accordingly, this study maps the concepts, scope, and geographical skills presented in the selected textbooks. This approach clarifies the strength of each book as a learning resource and the extent to which it supports students' scientific identity and geographical reasoning.

Concept analysis can develop systematic thinking and help students recognize the strengths and weaknesses of a curriculum. Systems thinking is particularly important in geography (Cox et al., 2019); consequently, curriculum development requires textbooks that provide both essential conceptual knowledge and a structure for investigating geographical phenomena. Previous textbook research has examined content hierarchy (20%), concept integration (19%), and non-textual explanations (18%) (Vojíř & Rusek, 2019). These dimensions can help instructors evaluate environmental geography textbooks and reduce potential misconceptions. Textbook analysis can also assess content and the skills needed for comparative and argumentative reasoning (Simon et al., 2020).

The present content analysis focuses on students' need to develop accurate geographical concepts. Inaccurate text or graphical representations may produce misconceptions, whereas well-designed instructional resources can support students' interpretations of geosphere phenomena. This study therefore examines the extent to which environmental geography reference books used in higher education represent contemporary issues, cases, and evidence concerning geographical phenomena.

2. Method

This study analyzed the content of environmental geography textbooks (Kaplan, 2021; Okeeffe, 2013). The sample comprised three print textbooks registered with the National Library of the Republic of Indonesia. The books were published by different publishers and selected on the basis of the authors' expertise. The analysis focused on spatial-ecological change in conservation areas and was guided by the geography curriculum, the Indonesian Geography Association (IGI), and Indonesia's national geography competency standards. Table 1 presents the bibliographic characteristics of the selected books.

The review examined the structure and quality of the knowledge presented in each textbook. Content analysis identified geographical terms and their visual representations in each chapter, while conceptual mapping assessed the relevance of the topics and their relationship to the authors' expertise (Lee & Catling, 2017). The unit of analysis was the chapter or subchapter dealing with the spatial ecology of landscapes. Three dimensions were examined: chapter content, visual representation, and presentation design. The analysis proceeded in three stages. First, all chapters were reviewed to identify their geographical knowledge, skills, and textual structure. Second, key terms were coded as conceptual content in relation to each chapter's learning objectives. Third, the coded results were classified and compared across chapters and textbooks.

Table 1. Books on Environmental Geography under Analysis

Titles	Publishers	Year	Author(s)	Number of	
				Chapters	Pages
Book 1 - Environmental Geography An Introduction	Raja Grafindo Persada	2013	I Gusti Bagus Arjana	5	156
Book 2 – Environmental Geography Based Constructivist	Deepublish	2017	Agus Herianto and Ibrahim	9	115

Titles	Publishers	Year	Author(s)	Number of	
				Chapters	Pages
Book 3 – Environmental Geography Based on Local Wisdom	Aditya Media Publishing	2014	Sumarmi and Achmad Amirudin	9	170

Conceptual analysis combined quantitative and qualitative procedures to compare textbook content from a geography education perspective (Simon & Budke, 2020). The quantitative analysis used a Likert-type scoring scheme to assess the extent to which each phenomenon was covered and calculated the frequencies and proportions of visual elements. The qualitative analysis interpreted the concepts, representations, and examples related to spatial-ecological influences on conservation areas. This combined approach documented the information and representations in the core books (Lawhon & Le Roux, 2019), generated a comparative overview of their complexity, and identified strengths and limitations in their content.

3. Results and Discussion

Spatial-ecological change arising from human-environment interaction varies with regional and global environmental dynamics. Environmental geography textbooks must therefore present cultural ecology, political ecology, natural hazards, environmental history, and environmental justice clearly and accurately (Moseley et al., 2014). Understanding human-environment connections also requires content that integrates general concepts with specific geographical examples.

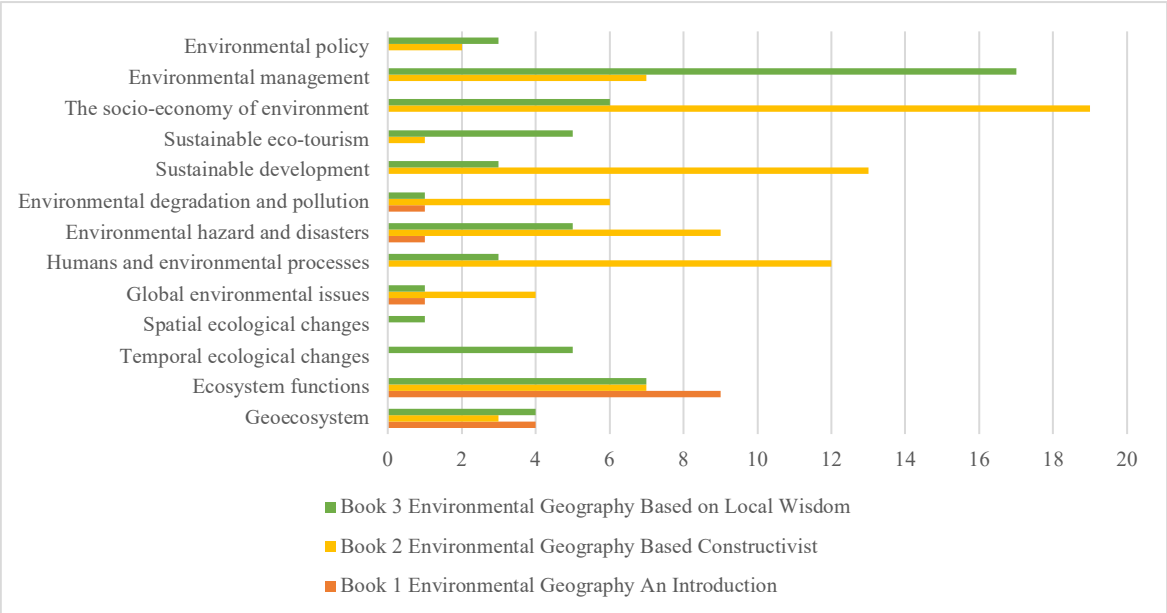


Figure 1. Content Themes Identified in the Three Textbooks

Figure 1 presents the themes related to the spatial ecology of conservation areas identified in the three textbooks. Together, these themes support knowledge construction about human activities on the Earth's surface. Accurate explanations of ecosystem distribution, spatial variation, and the effects of human-environment interaction can strengthen GeoCapabilities and help students understand their role in maintaining ecosystems across spatial and temporal scales.

Textbook coverage of spatial ecology should be supported by data, illustrations, photographs, graphs, and maps that substantiate concepts and factual claims. Both theoretical and empirical information should be presented explicitly and accurately. Textbook quality can be assessed by comparing concepts, theories, and facts with primary or secondary evidence from research

reports and by evaluating how effectively visual material communicates geographical information. Because geographical information is multimodal, photographs can provide contextual evidence, while maps help students interpret spatial patterns and develop geographical skills. Figure 2 summarizes the visual components identified in the books and shows that photographs predominate.

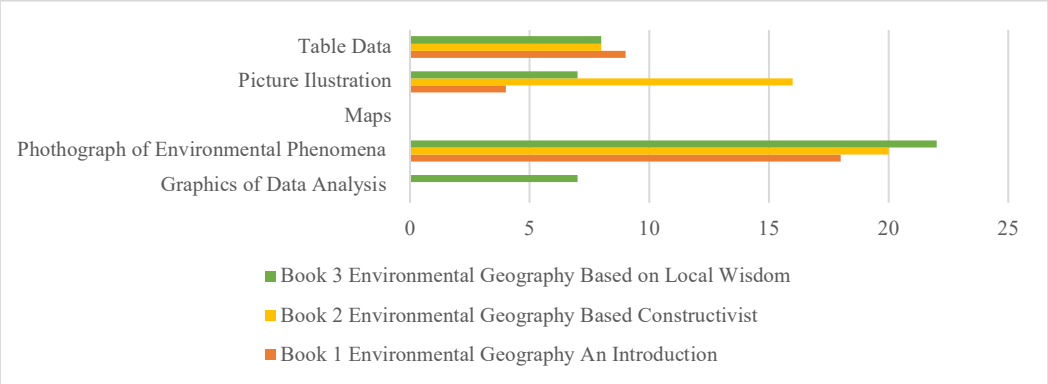


Figure 2. Visual Content Identified in the Three Textbooks

Empirical data were underrepresented, and none of the books included maps for identifying spatial-ecological change. Although the descriptions were generally concrete and explicit, robust geographical knowledge requires the integration of theory, illustrations, data, and maps. The qualitative analysis complemented the quantitative results by comparing conceptual content with geography education standards. The findings indicate that both visual content and presentation design may influence students' preferences as readers.

The content analysis identified substantial differences in the visual structure of the three textbooks. The comparison shows how content on environmental geography and human-environment interaction can help students interpret both concrete and abstract concepts. Maps are essential for interpreting and analyzing geographical information, yet none of the reviewed textbooks included them (Table 2). The books also made limited use of primary or secondary research data. Their content was generally aligned with university curricula, learning-material standards, and global environmental dynamics, and they drew on multiple sources and theories to present strategies for addressing ecological problems. Nevertheless, each book displayed different strengths and limitations, and future textbook development should align core content more explicitly with Indonesia's national geography standards.

The principal strength of the textbooks is their explicit coverage of the environment, conservation, and sustainability. Several sections also address ecological change over time, helping students interpret geographical phenomena across temporal scales.

Table 2. Comparison of Material and Visual Content in the Environmental Geography Textbooks

Analysis Criteria	Human-Environment Categories in Environmental Geography	Textbook 1: Environmental Geography: An Introduction (%)	Textbook 2: Constructivist-Based Environmental Geography (%)	Textbook 3: Environmental Geography Based on Local Wisdom (%)
Coverage of topics and materials	Ecosystems and agroecosystems	8.5	7.8	9.2
	Physical Geography	14.8	19.4	16.5
	Environmental Economics	1	2.8	8.4
	Population and environmental dynamics	8.6	9.4	12.8
	Regional and global geography	1.2	1.8	0.8
	Ecology	1	1.8	6.7
	Place and environment	1.8	5.2	18.4
	Biogeographic distribution	0.8	0.4	1.4
	Climate change and natural disasters	12.8	26.6	18.2

	Changes in the natural landscape	2.2	9.4	4.4
	Changes in the cultural landscape	0.8	4.2	6.8
	Spatiotemporal dimensions of the environment	1.2	2.6	4.4
	Multiscale deforestation and reforestation	2.4	8.2	22.9
	Sustainable conservation	12.6	15	35.7
	Agriculture, food and the environment	20.4	32.4	22.8
	Sustainable ecotourism	0.3	0.8	4.6
	Environmental management	1.6	4.4	8.5
	Environmental policy and politics	4.3	2.9	1.8
Visual details	Visual proportions of the contents of reference textbooks	47.7	45.7	49.7
	Minimum page proportions for each textbook	96.7	92.3	98.9
	Average number of visuals per page	4.3	3.1	5.3
	Data table	4.8	4.8	5.4
	Illustrative image	5.4	11.6	3.6
	Map	0	0	0
	Photo	67.7	69.3	78.6
	Chart	0	0	5.9
	Color visuals	96.1	97.4	99.2
	Monochromatic visuals	0.8	2.4	3.9

The qualitative analysis of Book 3 highlighted the following statement:

> "The relationship between humans and the environment by knowing, observing, controlling, and utilizing it to fulfill the basic needs for conservation" (p. 41).

Book 3 also states:

> "Human and environmental relations must be maintained and preserved through cooperation based on local wisdom, a key to the agroforestry system of Tengger people on Mount Bromo" (p. 47).

As presented in the textbooks, community-based environmental conservation is central to maintaining spatial-ecological systems. Environmental geography draws on sustainable management approaches, including exploration, conservation, and ecosystem restoration (Moseley et al., 2014). Textbook content should therefore reflect Indonesia's ecological dynamics. Book 2 addresses methodological approaches to the sustainable management and conservation of environmental resources:

> "Quantitative methodology based on the flow of positivism and the qualitative paradigm of the key phenomenological flow of research on sustainable management of environmental resource conservation" (p. 18).

Natural hazards and human activities affect environmental quality through processes such as biodiversity loss, environmental degradation, and mass movements. Understanding these processes and responding to their effects requires attention to the spatial and temporal dimensions of the atmosphere, biosphere, relief, pedosphere, and hydrosphere. Human actions are major drivers of environmental change, while sustainable conservation can support ecosystem restoration. Book 1 describes the combined influence of natural and human factors as follows:

> "Changes in the quality of the earth's surface result from various configurations of natural disasters and human activities" (p. 98).

Human-environment interaction gives places economic and cultural characteristics that can affect the spatial ecology of forest conservation areas. Such interactions also have economic consequences for ecosystems (He et al., 2022), and changes in land use emerge from the relationships between people and geoecosystems. Harden (2012) identifies environmental determinism, human ecology, natural hazards, human impacts, and sustainability as major dimensions of environmental geography. These dimensions support geographical investigations of geosphere phenomena (Moseley et al., 2014).

The findings indicate that the books provide limited explicit guidance on geographic knowledge and skills. Textbook review can identify these gaps and inform the development of improved learning resources. Geographic knowledge shapes students' understanding and interest in further study (Leydon et al., 2017), while geography education supports academic inquiry and cognitive development (Brookfield, 2022). Although the reviewed books help students identify the spatial ecology of places and regions, their coverage of social-ecological change at regional and global scales requires substantial improvement. This limitation is important because geographical information shapes both learning content and reflective discourse (Morawski & Budke, 2017).

Spatial-ecological change in conservation areas is a foundational topic in environmental geography. Four components are particularly important: (1) analyzing the spatial distribution of biodiversity and ecosystems; (2) mitigating environmental change caused by human activities and natural hazards; (3) distinguishing settlement areas from conservation areas; and (4) providing strategies and models for sustainable conservation. These components support an understanding of the distribution of biodiversity and human activity across the Earth's surface. Biogeography further reveals similarities and differences among spatial phenomena and their relationships with human activity. Conservation attention to the Earth's surface must also account for climatic zones (Dawson et al., 2017).

Human-environment interactions alter landforms and ecosystems. Conservation priorities are therefore essential for managing human activity in protected areas and limiting harmful spatial-ecological change. Biodiversity loss is closely related to climate change and inappropriate land use (Carroll et al., 2017). Spatial planning can help maintain environmental carrying capacity by directing biodiversity conservation and ecosystem management. Textbooks should consequently engage students in understanding, predicting, mapping, and responding to environmental change and ecosystem restoration through civic action.

The study of spatial-ecological change should reflect disciplinary contexts and students' changing needs. Human-environment inquiry also requires interdisciplinary innovation (Hedberg et al., 2017). Local, regional, and global data can strengthen students' geographical literacy, while spatial analysis, human-environment interaction, and place-based or regional analysis facilitate communication across disciplines (Baerwald, 2010). Geography thus informs problem solving, and human-environment interaction remains central to the conservation of geoecological systems (Mutia et al., 2019).

Table 3. Relationship between Environmental Geography and Spatial Conservation Ecology

No.	Human-Environment Framework in Environmental Geography	Domain Content	Spatial Conservation-Ecology Domain
1.	Human-environment content framework (Harden, 2012)	1. Environmental determinism. 2. Human/cultural/political ecology. 3. Natural hazards. 4. Human impact. 5. Sustainability.	
2.	Thematic content areas in	1. Environmental hazards: risk, vulnerability, and resilience.	

	environmental geography (Zimmerer, 2017)	2. Land use and land cover change science. 3. Social-ecological and coupled human-environment systems. 4. Political ecology and environmental governance. 5. Livelihoods and agricultural landscapes. 6. Resource political economy, management, and politics. 7. Food, health, and bodies in relation to the environment. 8. Environmental landscape history and ideas. 9. Knowledge concepts in environmental management and policy	Spatial conservation ecology
3.	Key Human-Environment Relationships in Higher-Education Geography Curricula (Larsen et al., 2022)	1. Systems thinking and human-environment concepts. 2. Systems and spatial scale variations with time dimensions. 3. Characteristics of places according to physical and cultural variations. 4. Sustainability policies and decisions according to local conditions. 5. Community roles. 6. Spatial scales for sustainable conservation. 7. Systemic physical environmental boundaries. 8. Consideration of the sustainability impacts of human-environment interactions. 9. The concept of sustainability emphasizes human values.	

Environmental geography textbooks provide access to current issues. Clear language and appropriate disciplinary style can strengthen students' understanding of theory, while carefully selected problems and cases can broaden their geographical perspectives. High-quality content should meet students' interests and needs and provide access to accurate, up-to-date information. These features can support critical thinking and scientific ethics (Silviariza et al., 2021).

The pedagogical value of textbook content also depends on how problems and cases are organized. Contextual cases can connect theoretical ideas with geographical evidence, and problem-solving tasks can encourage students to evaluate alternative explanations and responses. The inclusion of such cases is therefore an important means of developing students' critical thinking (Silviariza et al., 2021).

Environmental geography textbooks can integrate planning, management, and sustainability into coherent knowledge structures. Reviews of their content and visual components should therefore inform the development of higher-education reference books. Geography educators should emphasize sustainability thinking (Harrington, 2016), and content on human-environment relationships can help readers develop pro-environmental attitudes. Geographic and conservation skills should be illustrated with concrete examples so that students understand how to analyze and respond to human-environment problems.

The quality of geographical information influences students' ability to interpret human-environment interactions through a spatial-ecological approach. Aligning environmental geography content with learning goals can also support critical thinking. Table 3 summarizes the relationship between environmental geography and spatial conservation ecology.

Reviewing the chapter structure of environmental geography textbooks clarifies the knowledge and skills available to students. In the reviewed books, content on the spatial ecology of conservation areas was not sufficiently supported by data-driven geographical contexts (Larsen et al., 2022). Textbook comparison makes both conceptual knowledge and concrete conditions available for interpretation. Such knowledge supports the interpretation and integration of geographical concepts (Maude, 2018) and helps students examine the conservation

implications of natural hazards (Aksa et al., 2020a). Students' geographical competence should encompass spatial thinking, knowledge of place, human impacts, environmental problems, and geospatial technology (Larsen & Solem, 2022).

The analysis clarifies the structure and instructional relevance of the concepts presented in environmental geography textbooks. Textbook content can foster geographical literacy (Downs, 2014), while maps and photographs can support conceptual change when they are linked to analytical tasks. Representations of space, place, and spatial-ecological change help students interpret human-environment relationships. Socio-cultural and ecological attributes can also serve as qualitative indicators of conservation outcomes, and individual or community meanings can inform responses to environmental degradation. Knowledge of environmental hazards, in turn, influences students' perceptions and decision making (Aksa et al., 2020b).

Contemporary environmental geography examines how human-environment interaction transforms ecological systems across space. Cultural practices can significantly alter landscapes, sometimes with adverse effects, but communities also play important roles in ecosystem restoration. The reviewed textbooks address conservation through environmental determinism, natural hazards, human impacts, and sustainability. These themes can support contextual problem-based learning and strengthen future generations' understanding of human-environment relationships (Larsen et al., 2022).

Maintaining conservation areas across past, present, and future conditions is fundamental to spatial ecology. Conservation priorities must be context-specific, and spatial-ecological methods should guide human action. Conservation helps mitigate land-use change and maintain ecosystem quality at multiple scales, including the biosphere. Textbooks should therefore explain how endogenous and exogenous processes interact with human-environment relationships.

Understanding spatial-ecological change can support sustainable ecosystem conservation. A process-based approach should connect problems, solutions, and sustained action while developing students' capacity to understand, predict, and map environmental change. Applying geographic skills and theory in this way strengthens GeoCapabilities and provides a basis for developing new environmental geography learning resources.

4. Conclusion

Environmental geography curricula should guide the organization of higher-education reference books. The three textbooks reviewed address conservation and sustainability, but their treatment of spatial-ecological change is predominantly conceptual and is not adequately supported by spatial data, maps, or case-based geographic skills. Visual illustrations may influence student engagement, yet the connections among visuals, evidence, and analytical tasks remain limited. These findings show that textbook quality depends on the alignment of content, contemporary scientific development, and learning objectives. Future textbooks should integrate spatial data, maps, multiscale case studies, and explicit frameworks for observing interpreting, mapping, and evaluating human-environment change within Indonesia's diverse environmental and cultural contexts. Such resources would strengthen students' geographical knowledge, environmental responsibility, and capacity to support conservation and sustainable ecosystem restoration.

Funding. This research received no external funding.

Conflict of Interest. The authors declare no conflict of interest.

Data Availability. Not applicable.

AI Use Declaration. AI-assisted language editing was used during copyediting. The authors are responsible for reviewing the revised text and remain fully accountable for the article's content.

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