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Coastal wetland participatory management strategies: A systematic literature review

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ABSTRACT

Wetlands provide a variety of ecosystem services and vital resources for both nature and local communities, enhancing livelihoods and human well-being. They play a crucial role in coastal protection, recreational activities, and tourism. However, in the past two decades, many wetland areas have either dried up or encountered various threats that could lead to the degradation of this natural heritage. A key factor contributing to these challenges is the lack of participation by local communities in wetland management. This review analyzed 190 selected articles from the Scopus database, examining key dimensions such as wetland management, wetland conservation, wetland governance, lake management, and marsh management. The thematic analysis of 30 scientific documents published by researchers worldwide indicates that coastal wetland management projects have employed several strategies. These include physical and nature-based conservation, restoration, sustainable use, sustainable harvesting, institutional and governance measures, adaptive management, integrated water resource management, knowledge enhancement, and comprehensive stakeholder participation. Engaging stakeholders, particularly local communities, in the decision-making process can facilitate achieving consensus, reduce conflicts, and enhance the success of projects. The results are expected to significantly contribute to future studies on wetland conservation across different countries. Macro-level strategies are crucial in coastal wetland management projects because they provide a long-term and coordinated vision that fosters synergy among diverse institutions and stakeholders. Such strategies help us manage conflicts of interest, optimize resource allocation, and integrate policies to prevent fragmented and short-sighted actions, thus enabling sustainable decision-making. Additionally, by considering environmental dynamics and climate change impacts, it enhances the flexibility and adaptability of management systems, enabling the effective and efficient protection of these sensitive and valuable coastal wetland ecosystems.

Keywords: Wetland, Participation, Local community, Governance, Conservation, Restoration.
Article type: Review Article.

INTRODUCTION

Wetlands are vital ecosystems where water profoundly shapes the environment and influences the myriads of living organisms, along with the surrounding plant and animal life. They are found in areas where the water table is at or near the Earth's surface or where land is covered by water. The Ramsar Convention on Wetlands offers a comprehensive definition, outlining wetlands. According to Article 1.1 of the Convention, wetlands are defined as: "areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that

is static or flowing, fresh, brackish, or salt, including marine areas where the depth at low tide does not exceed six meters" (Ramsar Convention 2023). Some studies have categorized wetlands into five primary types (Crushell & Foss 2010): (i) marine wetlands (coastal areas, lagoons, rocky shores, and coral reefs; (ii) estuarine wetlands, including deltas, tidal marshes, and mangrove swamps; (iii) lacustrine wetlands, associated with lakes; (iv) riverine or fluvial wetlands, found along rivers and streams; and (v) palustrine or marshy wetlands, including marshes, swamps, and bogs (Crushell & Foss 2010).The Ramsar Convention identifies 42 distinct types of wetlands, categorized into three main groups: (i) marine and coastal wetlands; (ii) inland wetlands, and (iii) man-made or artificial wetlands. Some wetlands may embody characteristics of multiple categories; for instance, they can be both inland and man-made, or both coastal and inland. However, it is crucial to recognize that inland wetlands represent the largest proportion of wetlands globally (Ramsar Convention 2023). Wetlands are permanent or intermittent wet areas, shallow waters, emphasizing their importance in maintaining ecological balance and biodiversity (Ramsar Convention 2023). Wetlands provide vital water and primary productivity essential for the survival of countless plant and animal species that depend on them (Clarkson *et al.* 2013). Situated at the intersection of terrestrial and aquatic systems, wetlands are characterized by having an excess water supply for all or part of the year, which fosters the development of unique ecological communities. Additionally, they serve as crucial reservoirs of plant genetic diversity. Wetlands can transform and/or remove various pollutants such as organic matter, nutrients, and trace elements through physical, biological, and chemical processes, thereby improving water quality (Stefanakis 2019). In addition, they are important and sometimes essential, for the health, well-being, and security of the people living in or near these areas.

Although they cover only 1.5% of the Earth's surface, wetlands provide 40% of global ecosystem services. They play a fundamental role in both local and international water cycles and are at the heart of the water, food, and energy nexus. They offer a variety of economic, social, environmental, and cultural benefits, which include maintaining water quality and supply, regulating atmospheric gases, sequestering carbon, protecting coastlines, conserving unique native species, and providing cultural, recreational, and educational resources (Clarkson *et al.* 2013). Wetlands provide numerous functions and services that are vital to people, yet these valuable ecosystems are increasingly threatened by irresponsible human activities worldwide. The wetland crisis primarily arises from human activities rather than natural causes. Key factors contributing to wetland degradation include extensive deforestation, urbanization, unplanned industrial growth, lack of public awareness regarding the values, functions, and vulnerability of wetlands, and inadequately structured management systems. Additionally, social dynamics and the behavior of local communities have further exacerbated the degradation of wetlands, often ignored (Soufi & Jafari 2011).

According to the Ramsar Convention (2024), the primary threats to wetlands are as follows: (i) pollution, (ii) unsustainable exploitation of biological resources, (iii) conversion of natural systems, (iv) unsustainable agriculture and aquaculture practices, (v) human settlement expansion, (vi) invasive species and problematic organisms, (vii) the creation of transportation routes, (viii) climate change, and (ix) energy production and mining (Ramsar Convention 2024). Studies have also identified several major reasons for the decline and loss of wetlands. Some factors include habitat loss, overuse of water resources, and uncontrolled development related to construction, aquaculture, and agriculture (Kokkal *et al.* 2007; Amenu & Mamo 2018; Lindner & Hobohm 2021). Other studies have analyzed pollution, including excessive waste disposal, sewage management, and overuse of pesticides, as well as nutrient, metal, and pharmaceutical residues, has also been highlighted as destructive factors (Kokkal *et al.* 2007; Amenu & Mamo 2018; Lindner & Hobohm 2021).

Changes in the use of natural systems (e.g., the alteration of flow and geomorphology by settlements, industries, drainage, and the construction of dams and hydroelectric power plants) have also been identified as important factors in this regard (Lindner & Hobohm 2021). The use of biological resources (e.g., through fishing and hunting), the introduction of invasive species, and other species and genes, have been assessed as serious threats in this context (Lindner & Hobohm 2021). Wetlands are among the world's most valuable assets for present and future generations, making their protection, sustainable use, restoration, and enhancement of the natural environment essential (Sharma *et al.* 2010; Shrestha 2011; Tomislav 2018; Stefanakis 2019). Achieving these goals requires a deeper understanding of the wetlands increasing importance and wise use through effective conservation planning (Barbier 2011; Behbahani *et al.* 2012). In recent years, there has been growing recognition of the multiple roles that wetland ecosystems play and their importance to humanity. However, restoring degraded or lost wetlands and their hydrological and biological functions often incurs significant costs (Kokkal *et al.* 2007;

Amenu & Mamo 2018). Efforts in natural resource management, particularly concerning wetlands, have intensified due to heightened concerns about efficient resource management, ecosystem protection, and sustainable use. Economic and political challenges remain central to local, regional, national, and international policies for wetland management (Watson *et al.* 2019; Zafeiriou *et al.* 2020). Current wetland management strategies emphasize adaptation to environmental conditions and natural processes. These strategies include reducing the number of dams, preventing the construction of new ones, regulating water withdrawals for human use, promoting community to reduce pesticide and fertilizer use, and expanding or establishing new natural reserves (Byomkesh *et al.* 2009; Cools *et al.* 2013; Lindner & Hobohm 2021).

Conversely, as population growth continues and the need to sustain livelihoods through the use of natural ecosystems and wetlands becomes more pressing, there is an increasing call for a holistic approach to wetland management (Adeli *et al.* 2020). This approach necessitates participatory methods, decentralizing power and decision-making to local levels, and implementing strategies that focus on the protection, maintenance, and sustainable use of wetlands (Zanen & de Groot 1991; Thornton 2013). Strengthening the sustainable and efficient management of wetlands requires complex solutions designed with future applicability in mind, following an integrated approach. To achieve long-term benefits through a holistic view of sustainable development, it is essential to invest time in re-evaluating policies related to natural resources and wetland environmental policy-making. Moreover, the multiple benefits and functions of wetland ecosystems for achieving the Sustainable Development Goals (SDGs) emphasizes the importance of raising public awareness and engaging local communities as key stakeholders in decision-making, policy-making and conservation of natural ecosystems. Fostering a sense of responsibility for natural resources cannot rest solely on government organizations; it necessitates a participatory process that includes cooperation among various stakeholders, particularly local communities. In this context, the Ramsar Convention has been established as an international treaty aimed at protecting wetlands, emphasizing both their conservation and sustainable use. Many countries have committed to developing and implementing programs for wetland management as part of this initiative. By applying main measures and programs, stakeholders can effectively contribute to the protection of these ecosystems. However, without a shift in attitudes among stakeholders, threats to and degradation of wetlands are likely to persist exist (Valizadeh *et al.* 2021; Frantzeskaki *et al.* 2024).

Various strategies have been introduced and implemented by policymakers and wetland planners, and it is necessary to determine to what extent these strategies have been reflected in research related to wetland governance and management. In recent years, there has been a significant increase in scientific articles that focus on the conservation, restoration, sustainable use, and management of wetlands. These articles have been published and indexed in recognized databases such as Scopus and Web of Science. As this body of research continues to grow, attention has shifted to the involvement of local communities in wetland management. However, there is still a gap in understanding the management and governance strategies related to wetlands and the role that local communities play in these processes. This understanding is crucial, especially given the concerning trend of wetland degradation. Therefore, conducting a systematic literature review is essential to clarify potential future research directions. The primary objective of this study is to analyze the international scientific literature on wetland management strategies using a content analysis approach.

MATERIALS AND METHODS

This study employed an interpretive approach to examine the relationship between wetland management and local communities' participation. Using a quantitative-qualitative perspective, it analyzed a substantial body of literature sourced from a database (Putnam & Banghart 2017). Although there are different evaluation techniques such as narrative reviews, systematic reviews, and meta-analyses to analyze the extensive literature in databases (van Dinter *et al.* 2021). Locating and retrieving relevant literature is essential for a successful systematic review, as sourced materials form the foundation for evidence, conclusions, and recommendations. Establishing a systematic search strategy before commencing the literature search is crucial to ensuring accurate and effective information retrieval (Linares-Espinós *et al.* 2018). This planning assists in addressing the requirements of a systematic review and research questions. It is also essential to describe each step of the systematic review process, its automation potential, and current tools already developed (Tsafnat *et al.* 2014). The purpose of the current systematic literature review is to enable researchers evaluate the existing intellectual realm and improve existing knowledge by identifying important points (Azarian *et al.* 2023). The review follows six main steps: (i) identifying

the research subject, (ii) selecting databases and assessing articles published in these databases using a set of predetermined keywords, (iii) reviewing abstracts, (iv) selecting studies by reading their contents, (v) coding, extracting concepts, and developing categories, and (vi) identifying variables through content analysis (Alves & Mariano 2018).

The first step involved identifying the research subject or need. The second step focused on selecting appropriate databases. The Scopus database was chosen due to its extensive collection of articles, conference papers, and books from publishers worldwide. The keyword *"wetland management"** was selected to align with the research focus. A search for this keyword in the Scopus database, covering the period from 1985 to 2024, returned over 199 articles. The analysis of these documents reveals a significant increase in publications in this field since 2006. The term *"wetland management"** was chosen as it directly relates to the core topic of this article. Consequently, all searches were initiated using a combination of the following keywords:

(TITLE-ABS-KEY ("wetland manag*" OR "wetland conserv*" OR "wetland governance" OR "wetland protection" OR "lake management" OR "lake governance" OR "Marsh Management") AND TITLE-ABS-KEY ("Participat*" OR "Partner*" OR "involvement" OR "collaborat*" OR "Cooperation") AND TITLE-ABS-KEY ("people" OR "local communit*" OR "Rural") AND (LIMIT-TO (LANGUAGE, "English").

Finally, out of the 199 articles retrieved, 8 were in Chinese, 2 in Slovenian, 1 in French, and 1 in Japanese. To refine the search, an additional filter was applied to include only articles written in English. This resulted in the initial selection of 190 scientific articles on wetland management, all published by September 6, 2024. In the third stage, the abstracts of these articles were evaluated for a more detailed review. During the fourth stage, some articles were excluded due to insufficient alignment with the full research topic. Ultimately, 30 scientific articles with full-text availability and relevance to the research scope, emphasizing participatory coastal wetland management, were analyzed, and the related concepts and categories were extracted. The resource screening process in the field of wetland management is illustrated in Fig. 1.

RESULTS

This section begins by presenting the quantitative results of a bibliometric analysis of the documents extracted from Scopus. It includes the study areas of authors, document types, source types, citation patterns, authors' affiliations (by country and institutions). Then, the study highlights key findings from the thematic analysis, outlining both initial and principal categories and themes, and the interconnections among the selected categories.

Bibliometric analysis

The analysis of authors' affiliations by country shows that researchers in the field of wetland management are primarily concentrated in the United States and Europe. Out of the 30 articles examined, six were from the United Kingdom, five from Iran, and four from the United States. Additionally, Australia, China, and Nepal each contributed three researchers to the selected articles. This indicates a significant presence of researchers from Asian countries in wetland management research, suggesting that scholars in this region may place considerable importance on the topic (see Table 1 and Fig. 2). The authors of the analyzed documents were mainly affiliated with institutions in the United States, Europe, and Asia. Specifically, six articles were co-authored by researchers from the United Kingdom, five from Iran, and four from the United States. The remaining three countries—Australia, China, and Nepal—each contributed three articles. This analysis highlights a notable concentration of researchers in Asian regions who are actively engaged in wetland management research, indicating strong interest and significance attributed to this subject by scholars in that area (refer to Table 1 and Fig. 2).

Subject area analysis. This study examines the distribution of subject areas in publications from 1994 to 2024. Since an article may cover multiple fields, the most prevalent subject areas were environmental sciences (43%), followed by social sciences (16%), agriculture (14%), geology (11%), and engineering (4%; Table 2 and Fig. 3).

Authors' affiliations by institutions. This analysis identifies the top five institutions with the highest number of published articles in the field of wetlands. The University of Tehran in Iran ranks first, having published three documents. The second position is jointly held by the Chinese Academy of Sciences in China, two universities from Slovenia, and Shiraz University from Iran. Additionally, seventy-four other institutions have each contributed one document, either independently or in collaboration (Table 3).

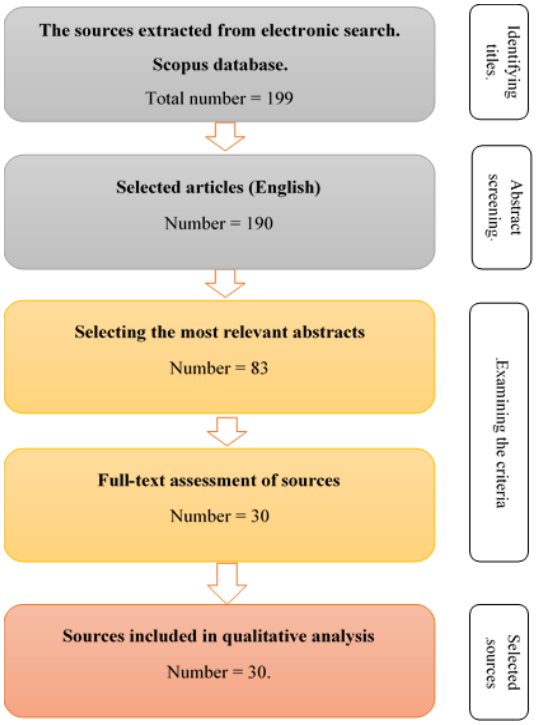

Fig. 1. Screening and selecting wetland management scientific products for the systematic review.

Table 1. The analysis of authors' affiliations by country (n = 30).

Country	Number of documents (out of 30)	Percent
United Kingdom	6	20.0
Iran	5	16.7
United States	4	13.3
Australia	3	10.0
China	3	10.0
Nepal	3	10.0
Canada	2	6.7
India	2	6.7
Netherlands	2	6.7
Slovenia	2	6.7
0ther countries (17)	1	3.3

Note: *Total countries= 27, Total documents = 30.

Document type. the analysis of 30 publications over a 30-year period revealed that articles were the most frequent (76%, n = 23), followed by book chapters (13%), and conference papers and books (10% each; Fig. 3).

Documents' citations analysis. The analysis reveals that Chen *et al.* (2019) published the article "Farm Ponds in Southern China: Challenges and Solutions for Conserving a Neglected Wetland Ecosystem," which has become the most cited work on the topic, receiving 97 citations.

This article addresses the challenges and solutions related to wetland conservation. Other frequently cited works also focus on wetland management, conservation efforts, and the involvement of local communities (Table 4).

Table 2. Subject areas of the documents pertaining to wetland management (n = 30).

Subject area	Number of documents	Percent
Environmental Science	24	80.0
Social Sciences	9	30.0
Agricultural and Biological Sciences	8	26.7
Earth and Planetary Sciences	6	20.0
Business, Management and Accounting	2	6.7
Engineering	2	6.7
Computer Science	1	3.3
Decision Sciences	1	3.3
Economics, Econometrics and Finance	1	3.3
Mathematics	1	3.3

Total subjects = 10

Table 3. The top five institutions publishing articles on participatory wetland management from 1994 to 2024 (n=30).

Affiliation	Country	Number of documents
University of Tehran	Iran	3
Chinese Academy of Sciences	China	2
The Slovenian Academy of Sciences and Arts	Slovenia	2
Shiraz University	Iran	2
Znanstvenoraziskovalni Center Slovenske Akademije Znanosti in Umetnosti	Slovenia	2
0ther institutions (74)		1

Total institutions = 79.

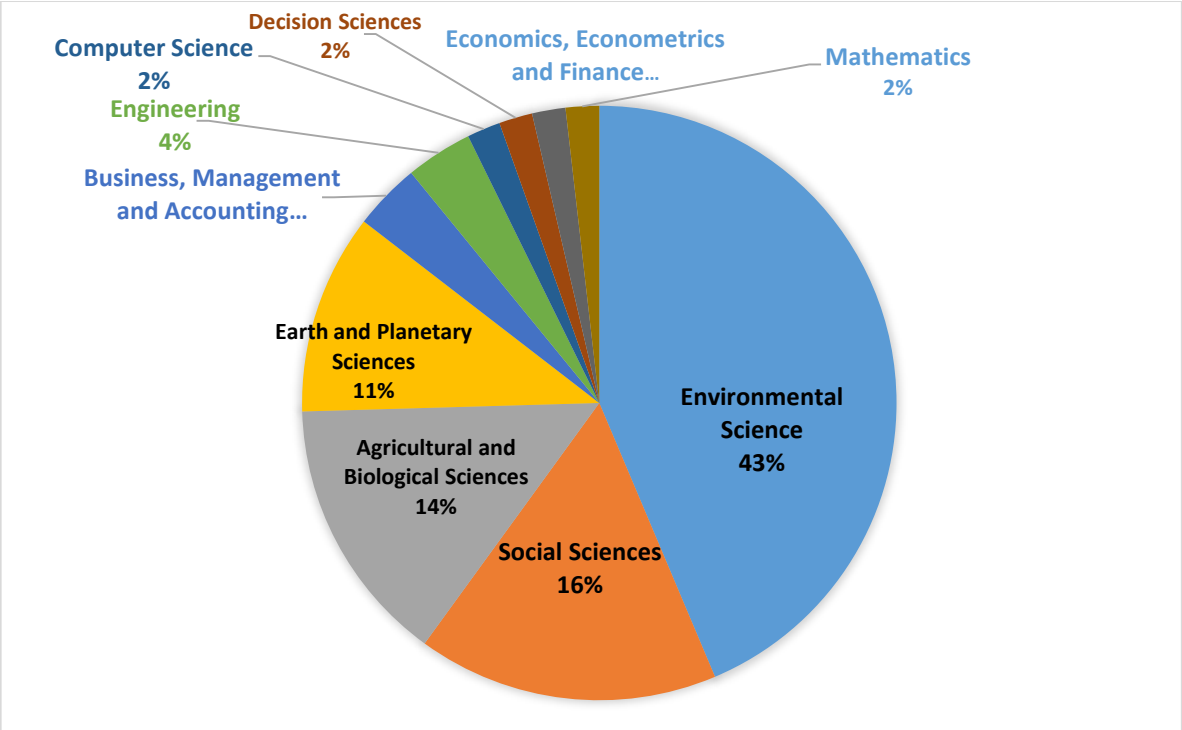

Fig. 3. Distribution of subject areas in documents.

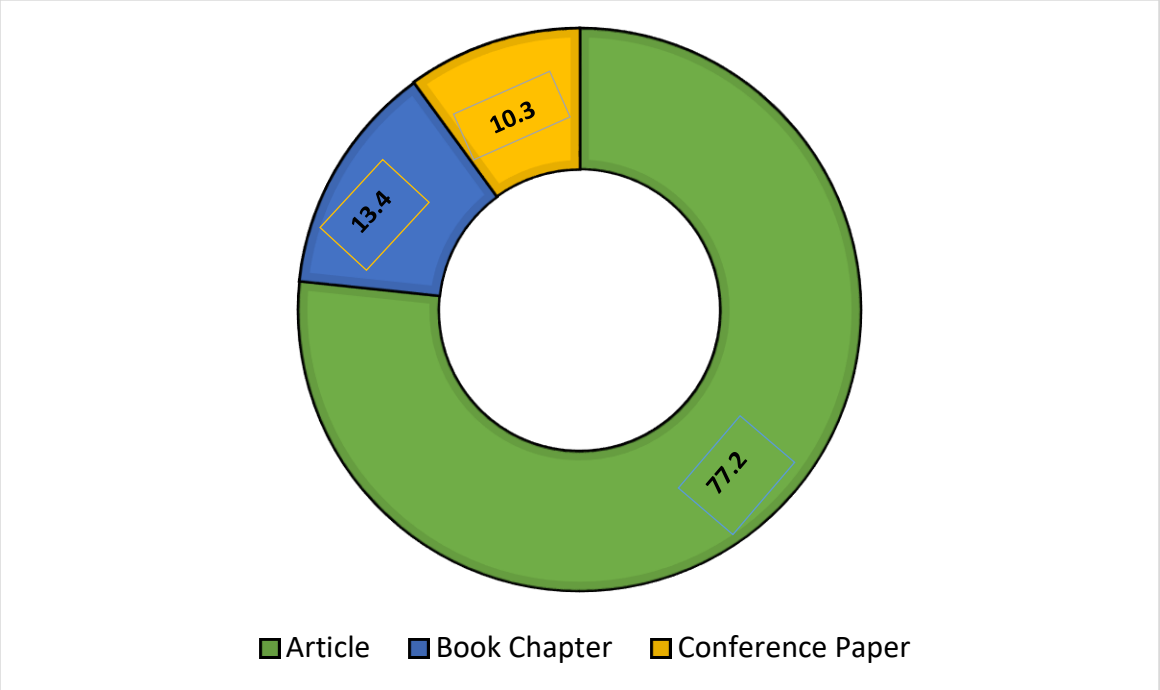

Fig. 3. Types of publications for the documents.

Table 4. Cited publications from 1994 to 2024 (n = 30).

No.	Document Title	Authors	Publication Year	Source title	Total Citations
1	Farm ponds in southern China: Challenges and solutions for conserving a neglected wetland ecosystem	Chen *et al.*	2019	Science of the Total Environment	97
2	Wetland resource use and conservation attitudes among indigenous and migrant peoples in Ghodaghodi Lake area, Nepal	Sah & Heinen	2001	Environmental Conservation	80
3	Public Support for Wetland Restoration: What is the Link with Ecosystem Service Values?	Scholte *et al.*	2016	Wetlands	68
4	Valuing wetland conservation: A contingent valuation analysis among Iranian beneficiary	Ghanian *et al.*	2022	Journal for Nature Conservation	66
5	Building local community commitment to wetlands restoration: A case study of the cache river wetlands in Southern Illinois, USA	Davenport *et al.*	2010	Environmental Management	53
6	Social and economic considerations in conserving wetlands of Indo-Gangetic plains: A case study of Kabartal wetland, India	Ambastha *et al.*	2007	Environmentalist	33
7	Participatory rural appraisal of ecosystem services of wetlands in the Amazonian Piedmont of Colombia: Elements for a sustainable management concept	Ricaurte *et al.*	2014	Wetlands Ecology and Management	31
8	Wetlands need people: A framework for understanding and promoting Australian indigenous wetland management	Pyke *et al.*	2018	Ecology and Society	31

No.	Document Title	Authors	Publication Year	Source title	Total Citations
9	Evaluating rural participation in wetland management: A contingent valuation analysis of the set-aside policy in Iran	Eskandar *et al.*	2020	Science of the Total Environment	31
10	Understanding farmers' intention towards the management and conservation of wetlands	Valizadeh *et al.*	2021	Land	26
11	Decentralization and local institutional arrangements for wetland management in Ethiopia and Sierra Leone	Maconachie *et al.*	2009	Applied Geography	24
12	Village voices challenging wetland management policies: experiences in participatory rural appraisal from India and Pakistan	Pimbert & Gujja	1997	Nature and Resources	15
13	Palaeoecology to inform wetland conservation and management: Some experiences and prospects	Clarke & Lynch	2016	Marine and Freshwater Research	10
14	Indigenous peoples' participation and the management of wetlands in Africa: a review of the Ramsar Convention	Laltaika	2022	Fundamentals of Tropical Freshwater Wetlands: From Ecology to Conservation Management	10
15	Sustainable livelihoods through conservation of wetland resources: A case of economic benefits from Ghodaghodi Lake, western Nepal	Lamsal *et al.*	2015	Ecology and Society	7
16	Public awareness of wetlands and their conservation; [Ozaveščenost prebivalcev o varovanju mokrišč]	Polajnar	2008	Acta Geographica Slovenica	7
17	Transnational research for coastal wetlands conservation in a Cuba–US setting	Ramenzoni *et al.*	2020	Global Sustainability	7
18	Stakeholders' perceptions of wetland conservation and restoration in Wakiso District, Uganda	Kadoma *et al.*	2023	Environment, Development and Sustainability	4
19	Evaluation of ecosystem services vis-à-vis perceptions and attitudes of local communities towards Wetland conservation in Kashmir Himalaya	Dar *et al.*	2024	Environmental Development	2
20	Stakeholders' perceptions of wetland conservation and restoration in Wakiso District, Uganda	Kadoma *et al.*	2023	Environment, Development and Sustainability	2
21	Community Participation and Bio Rights Possibilities in the Conservation of Urban Wetlands: A Study of Deepor Beel (Lake), Guwahati, India	Mahanta *et al.*	2020	ICRITO 2020 – IEEE 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)	1
22	Wetland management planning: Okavango delta (Botswana)	Max Finlayson	2018	The Wetland Book: I: Structure and Function, Management, and Methods	1

No.	Document Title	Authors	Publication Year	Source title	Total Citations
23	Unlocking the power of public awareness: paving the way for sustainable wetland management in Anzali, Iran	Allahyari *et al.*	2023	Frontiers in Environmental Science	0
24	The role of local governments in the governance of wetland protection: The case of the Pichicuy wetland, Chile.; [El rol de los gobiernos locales en la gobernanza de protección de humedales]	Lobos *et al.*	2020	Urbano	0
25	Community-Based Conservation and Restoration in Coastal Wetlands: A Review	Moore & Kumble	2024	Wetlands	0
26	Status quo, analysis and suggestions for public awareness on wetland conservation in China	Zhang *et al.*	2011	Wetland Science	0
27	Wetlands in the Asia-Pacific region: strategies for 9obilizing action for their protection and sustainable use	Hussain	1994	Widening perspectives on biodiversity	0
28	Ecotourism capability in sensitive wetland conservation, case study: Cheqakhor wetland, central Iran	Behbahani *et al.*	2013	Research Studies on Tourism and Environment	0
29	Community-based Deepor Beel wetland management	Rahman & Chowdhury	2005	Proceedings of Conference – International Erosion Control Association	0
30	Assessing the willingness to pay for conservation and management of wetlands at Jagdispur reservoir in Kapilvastu district of Nepal	Gyawali *et al.*	2024	Indonesian Journal of Forestry Research	0

Results of the thematic analysis

In the inductive data analysis process using thematic analysis, open coding was conducted, resulting in the extraction of 540 concepts and the development of 60 initial categories based on these concepts. In the next stage, axial coding grouped conceptually similar initial categories, leading to the formation of 9 principal categories. Ultimately, these principal categories were consolidated into three overarching themes: "wetland conservation," "wetland restoration," and "sustainable use of wetlands" (Table 6). The document analysis revealed various approaches to the conservation, restoration, and sustainable use of wetlands.

Wetland Conservation. This approach is integrated with restoration practices and focuses on three main strategies: (i) Implementing physical and nature-based measures for wetland conservation; (ii) Governing and enforcing laws, policies, and approaches related to wetland conservation and restoration; (iii) Increasing stakeholder awareness and encouraging community participation in conservation and restoration activities. The physical and nature-based measures for wetland conservation include managing invasive species, preventing drainage in and around wetlands, promoting wildlife conservation, and controlling pollution through the removal of harmful substances from the ecosystem. However, successful wetland conservation and restoration cannot rely solely on physical measures; they also require institutional support and efforts to raise awareness and encourage participation in conservation and restoration activities among local communities. Effective extension and education strategies can improve stakeholders' attitudes toward engaging in management and conservation efforts. These strategies can help reduce local communities' reliance increase social awareness and learning, promote innovation to enhance farmers' understanding of sustainable agricultural practices, and implement educational programs. Furthermore, the governance and enforcement of wetland conservation and restoration laws must align with the principles of sustainable management and good governance principles. Ultimately, wetland laws should reflect the value of ecosystem services, promote sustainable management practices by the government, secure

political support for implementing conservation measures, and develop collaborative management plans among various stakeholders—all through effective wetland management.

Wetland restoration. Effective wetland restoration and improvement require not only institutional support but also education and communication programs. Scientific literature suggests that these efforts can be enhanced through extended monitoring periods and conservation initiatives that aim to preserve biodiversity by safeguarding native species and their habitats. Additionally, managing water flow to sustain is crucial for sustaining wetland ecosystems. Physical and nature-based restoration can be achieved by expanding ecosystems, focusing on geographic areas that require attention, controlling and eliminating invasive species, and improving soil quality (Table 6).

Sustainable use of wetlands. Strategies for the sustainable use of wetlands can be categorized into four main areas: (i) sustainable harvesting; (ii) water resource management; (iii) supporting livelihoods and traditional wetland practices; and (iv) enhancing stakeholder awareness and community participation. Documents regarding sustainable harvesting refer to sustainable use of wetland resources, managing livestock grazing, creating economic incentives that link wetland conservation to local communities, minimizing the impact of local activities on wetlands, and promoting sustainable harvesting practices to prevent overexploitation. Comprehensive planning, monitoring, and community involvement are vital to ensuring the long-term benefits of wetland ecosystems.

Table 5. Thematic analysis of participatory costal wetland conservation and restoration strategies (n = 30).

Initial Categories	Principal Categories	References
1. Managing invasive species and preventing weed growth	Physical and nature-based measures for wetland conservation	Ricaurte *et al.* (2014)
2. Preventing drainage in wetland		Ambastha *et al.* (2007)
3. Climate change mitigation		Mahanta *et al.* (2020)
4. Protecting wetland wildlife		Clarke & Lynch (2016)
5. Removal of ecosystem pollutants and pollution control		
6. Conserving wetland water resources		
7. Implementing regulations to value ecosystem services	Governance and implementation of wetland conservation and restoration laws, approaches, and policies	Lamsal *et al.* (2015)
8. Sustainable wetland management by government-led conservation and local communities' participation		Eskandari-Damaneh *et al.* (2020)
9. Enforcing laws and policies that support wetlands		Maconachie (2009)
10. Garnering political support for the management and implementation of wetland conservation measures		Allahyari *et al.* (2023)
11. Leading alliances with higher-scale stakeholders		Lobos *et al.* (2020)
12. Enhancing coordination among wetland managers and policymakers, including government agencies and civil society		Zhang *et al.* (2011)
13. Implementing participatory integrated management programs		Kadoma *et al.* (2023)
14. Developing joint management plans among various stakeholders		Ghanian *et al.* (2022)
15. Decentralization and local institutional arrangements for wetland management		Gyawali *et al.* (2024)
16. Harmonizing community-based local institutions for wetland use		
17. Adopting policies to improve wetland conservation by linking infrastructure and agricultural development programs		
18. Utilizing innovation to increase farmers' awareness toward sustainable agricultural practices		
19. Applying interdisciplinary approaches to socio-ecological systems for wetland conservation		
20. Focusing on ecosystem services and natural capital	Increasing stakeholders' awareness and community participation in conservation and restoration activities	Valizadeh *et al.* (2021)
21. Changing stakeholders' attitudes to participatory conservation and restoration		Scholte *et al.* (2016)
22. Reducing the dependence of local communities on wetlands		Pyke *et al.* (2018)

23.	Increasing awareness and social learning by effective extension and educational programs for conservation and restoration, including through mass media		Polajnar (2008) Pimbert (1997) Ramenzoni *et al.* (2020)
24.	Increasing public participation of local communities in conservation and restoration, particularly in protected areas		Mahanta *et al.* (2020)
25.	Highlighting community-based participatory systems in wetland conservation and restoration		Ambastha *et al.* (2007)
26.	Utilizing local knowledge for conservation and restoration		Dar *et al.* (2024)
27.	Enhancing a sense of ownership among local communities in wetland conservation and restoration planning		Allahyari *et al.* (2023)
28.	Increasing collaboration between scientists and wetland conservation and restoration managers		Clarke & Lynch (2016)
29.	Preserving the socio-cultural values of local communities in wetland conservation and restoration planning		Zhang *et al.* (2011)
30.	Changing community perspectives on wetland restoration		Rahman & Chowdhury (2005)
31.	Transformative collaborations		
32.	Participatory coastal wetlands restoration		
33.	Increasing post-conservation monitoring periods	Wetland restoration and improvement	Chen et al (2019)
34.	Contingent Valuation		Clarke & Lynch (2016)
35.	Preserving biodiversity by protecting native species and their habitats		Dar et al (2024)
36.	Managing water flow to maintain wetland habitats		Rahman & Chowdhury (2005)
37.	Expanding ecosystems and geographic focus	Physical and nature-based reconstruction of wetlands	Moore & Kumble (2024); Ramenzoni *et al.* (2020); Mahanta *et al.* (2020); Ambastha *et al.* (2007)
38.	Controlling and eliminating invasive species		
39.	Soil rehabilitation		
40.	Reducing uncertainty in wetland restoration programs		

Water resource management strategies focus on both conservation measures and the responsible use of wetland water resources. This includes reducing the exploitation of these resources and managing water flow to protect wetland habitats. Additionally, important strategies identified in scientific literature relate to supporting livelihoods and promoting traditional practices tied to wetlands. These strategies involve: (i) Developing livelihood support programs for communities to help restore wetland ecosystems while maximizing benefits for local residents, provided that such benefits do not harm wetland health; (ii) Promoting ecotourism to generate income while minimizing negative environmental impacts; (iii) Reducing local communities' dependence on wetlands by diversifying their sources of livelihood.

The sustainable use of wetlands also requires enhancing stakeholder awareness and community participation. Several measures have been outlined in conservation and restoration approaches, including: (i) Increasing awareness and social learning through effective extension and educational programs aimed at promoting sustainable use, including communication via mass media; (ii) Enhancing public participation of local communities in sustainable activities, particularly in protected areas; (iii) Educating households about alternative livelihood strategies outside of wetlands; (iv) Raising the level of functional literacy within communities; (v) Utilizing local knowledge to promote sustainable practices; (vi) Encouraging interaction among different social groups to raise awareness about the value of wetlands; (vii) Preserving the socio-cultural values of local communities in wetland use planning; (viii) Promoting public support for wetlands from eco-centric, cultural, and economic perspectives. These strategies work in tandem to ensure the effective management and preservation of wetland ecosystems while supporting the communities that rely on them.

Table 6. A thematic analysis of participatory strategies for the sustainable use of coastal wetlands (n = 30)

Initial Categories	Principal Categories	References
41. Sustainable use of wetland resources	Sustainable harvesting	Polajnar (2008)
42. Managing livestock grazing		
43. Establishing an economic link between wetland conservation and local communities		Behbahani *et al.* (2013)
44. Minimizing local burdens on wetlands		
45. Promoting sustainable harvesting of wetland resources to prevent overexploitation		
46. Comprehensive planning, monitoring, and community participation to ensure long-term benefits of wetlands		
47. Reducing the exploitation of wetland water resources	Water resources management	Chen *et al.* (2019)
48. Managing water flow to preserve wetland habitats		Ghanian *et al.* (2022)
		Max Finlayson (2018)
		Behbahani, *et al.* (2013)
49. Developing livelihood support for communities to restore wetland ecosystems	Livelihood support and managing and supporting traditional wetland use practices	Zhang *et al.* (2011)
50. Maximizing benefits for local communities		Laltaika (2022)
51. Promoting ecotourism to generate income while minimizing environmental impacts		
52. Reducing the dependence of local communities on wetlands by diversifying livelihoods		
53. Increasing awareness and social learning by effective extension and educational programs for sustainable use, including through mass media	Increasing stakeholders' awareness and community participation	Valizadeh *et al.* (2021)
54. Enhancing local communities' public participation in sustainable use activities, particularly in protected areas		Scholte *et al.* (2016)
55. Educating households on livelihood strategies outside wetlands		Pyke *et al.* (2018)
56. Raising the level of functional literacy		Polajnar (2008)
57. Utilizing local knowledge for sustainable use		Pimbert (1997)
58. Encouraging interaction among different social groups to increase awareness of wetland value		Ramenzoni *et al.* (2020)
59. Preserving the socio-cultural values of local communities in sustainable wetland use planning		Mahanta *et al.* (2020)
60. Promoting public support for wetlands with an eco-centric, cultural, and economic perspective		Ambastha *et al.* 2007)
		Dar *et al.* (2024)
		Allahyari *et al.* (2023)
		Clarke & Lynch (2016)
		Zhang *et al.* (2011)
		Rahman & Chowdhury (2005)

DISCUSSION

Environmental and natural resource policymakers, specialists, and managers around the world are increasingly emphasizing the involvement of stakeholders, particularly local communities and indigenous knowledge, in

developing integrated coastal wetland management plans. An analysis of scientific documents published by researchers' worldwide reveals that coastal wetland management projects have utilized various strategies, including conservation, restoration, sustainable use, adaptive management, integrated water resource management, knowledge enhancement, and comprehensive stakeholder participation. The active involvement of stakeholders, particularly local communities, in the decision-making process can help facilitate consensus, reduce conflicts, and enhance project success. These findings align with several other studies (Naderi *et al.* 2022; Karamidehkordi *et al.* 2024; Karimi *et al.* 2024; Naderi *et al.* 2024). Additionally, many global studies on local community participation in wetland management support these results. They have explored community participation in wetland conservation from various perspectives, including strategic management (Odero & Odenyo 2021), citizenship rights (Nemutamvuni *et al.* 2020), environmental rights (Mahanta *et al.* 2020; Karimi *et al.* 2025), property rights (Nebel *et al.* 2017; Trenholm *et al.* 2017), gender studies (Abillah *et al.* 2021), and addressing climate change (Alkan *et al.* 2009; Kumalawati *et al.* 2020; Karimi *et al.* 2025). The existing literature on wetland, lake, and marsh management, conservation, and governance faces several key weaknesses. Many studies lack integrated theoretical and interdisciplinary frameworks and fail to adequately address the complexity of social-ecological systems. Research often relies on short-term and purely ecological approaches, overlooking multi-level governance dynamics (local, national, international) and the role of informal institutions and stakeholders. Furthermore, issues of environmental justice and local livelihoods are frequently neglected, while proposed solutions tend to be generic, impractical, and disconnected from real-world implementation challenges. As a result, these limitations hinder the development of effective and sustainable policies and programs for wetland management. Studies indicate that wetland conservation is crucial in both developing and developed countries, including India (Mahanta *et al.* 2020), Iran (Behrouzi-Rad 2013; Karamidehkordi *et al.* 2024), Kenya, Nigeria, Denmark, Sweden, and the United States (Andrianandrasana *et al.* 2005; Ramenzoni *et al.* 2020). They attempted to prevent inefficient management, land-use changes around wetlands, dam construction, illegal hunting and fishing, the over-issuance of permits beyond carrying capacity, water scarcity, drought, and other detrimental factors. Successful environmental and natural resource management in coastal wetland areas requires a focus on the rights and participation of local communities (Truong 2021). This has shifted the perspective from government-centric approaches to the use of public participation in the conservation, restoration, and sustainable use of natural resources. Engaging local communities in the decision-making process is a management strategy that can foster social acceptance and simplify policy implementation. Research shows that local communities are eager to participate in the planning process. While some may hold negative views of the organizations responsible for wetland management, they express a clear and positive attitude toward the conservation and maintenance of wetlands. Thus, even if they might be hesitant to implement established policies, they still seek participation in the planning process (Kottelat & Whitten 1996; Max Finlayson 2018; Maithya *et al.* 2022). This potential can be leveraged by involving indigenous people in the planning process, transforming local communities from potential threats or passive observers into active and influential participants.

CONCLUSION

Our systematic review of coastal wetland management literature reveals critical research gaps and future directions, highlighting a geographical imbalance with most studies focused on environmental and social aspects in northern countries while Asian contexts remain underrepresented—particularly concerning given accelerating wetland degradation in developing nations. The analysis identifies key conservation strategies including physical/nature-based measures (invasive species control, pollution remediation, and climate regulation), extension and communication methods, knowledge enhancement, and governance approaches (community participation, policy implementation, stakeholder awareness), alongside sustainable utilization methods (traditional practice preservation, responsible harvesting, integrated water management). These findings underscore the need for geographically balanced research and multidimensional solutions to address this global challenge.

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