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Emerging attributes of adaptive governance in the global south

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Adaptive governance is widely considered an effective approach to address the complexities and uncertainties of socio-ecological systems. The application of adaptive governance to sustainable environmental governance in the global south has not been sufficiently explored. There is a gap in the literature in the global south, especially given its conceptual roots in the global north. A number of reviews identified some key conceptual and practical gaps related to adaptive governance principles and the challenges to implementing them. To address this gap, this paper presents a systematic literature review of adaptive governance scholarship focused on the global south published between 2003 and 2022. The review discusses adaptive governance's key principles and framings, as well as the challenges of implementing it in the global south. This paper examines the factors that influence the emergence of adaptive governance and how this framing has been used to understand effective environmental governance within the global south's diverse socio-political and institutional settings. The review specifically focuses on Africa and South Asia, which are densely populated with limited financial and institutional capacity. Sustainable environmental governance is crucial in these regions not only for the wellbeing of the population, but also for the health of the planet. A review of adaptive governance scholarship identified emerging attributes that improve government structures and processes, as well as proposed attributes that would minimize challenges and improve adaptive capacity. The key emerging attributes are formal and informal networks, social learning, community engagement and proposed attributes are flexible, integrated and participatory institutional governance, inclusive decision making, context-specific strategies, accountability, and capacity development. These attributes provide a framework for adaptive governance scholarship for examining different governance structures and processes in different socio-ecological systems. This paper concludes with a framework for future research that can facilitate adaptive governance in the context of sustainable environmental management in the global south.

KEYWORDS

adaptive governance, socio-ecological systems, environmental sustainability, adaptive capacity, global south, Africa and South Asia

1 Introduction

Adaptive governance (AG) is an emergent approach to environmental governance to coordinate resource management regimes in the face of the complexity and uncertainty associated with rapid environmental change (Chaffin et al., 2014). Countries in the Global South (GS) have faced tremendous environmental challenges in water, solid waste, transport, land use, ecosystem, and climate change issues (Sierra and Suárez-Collado, 2021). Environmental sustainability is a crucial issue in the Global South, especially in South

Asian and African regions with weak governance structures and financial and institutional limitations (Chaffin et al., 2014; Shinn, 2016; Walch, 2019). Environmental governance in Africa and South Asia is more or less the same in terms of environmental degradation, lack of civil society participation in decision-making, low economic efficiency, minimal localization, non-transparency, and corruption (Carrai, 2021; Li and Puppim de Oliveira, 2021). Governance faces key challenges regarding system integrity and functioning, state legitimacy, lack of inclusivity, absence of environmental rules and regulations, and neo-patrimonialism (Mbaku, 2020; EFSAS, 2021). Further, environmental policies fail to address colonial impacts and social inequalities, which are major challenges to environmental sustainability (EFSAS, 2021; Falayi et al., 2021). These challenges are complex and closely intertwined which require a robust and flexible governance framework that evolves with mounting environmental threats (Evans et al., 2011). The development of sustainable environmental governance is very critical in rapidly populous regions where fast changes in production patterns, economic development, technological advancements, and globalization tend to interact with local problems (e.g., weak institutions, poverty, inequality) (Lazo and Gasparatos, 2019). Given the uncertainties and complexity associated with broader environmental change including climate change, population growth, and massive shifts in land use, governance systems should be highly adaptive. Top-down and state-based governance rarely match the relevant scale of ecological complexity particularly in the face of rapid environmental change (Ekstrom and Young, 2009; Ouyang et al., 2020). Centralized governance or top-down directives often fail to provide effective solutions for highly contextualized and coordinated governance across large-scale ecosystems that cross multiple jurisdiction boundaries (Lemos and Agrawal, 2006).

In response, a growing number of bottom-up governance approaches have emerged via various actors, social networks, community engagement, and leadership sensing the need for alternatives to top-down government and more innovative approaches to environmental governance (Brosius et al., 2005). Cleaver and Whaley, (2018) employed bottom-up governance approaches in Tanzania's Great Ruaha River Catchment to increase sustainable water governance capacity. The need for more innovative approaches to environmental governance is pressing, capable of dealing with highly contextualized socio-ecological systems (SESs) and flexible to adapt to complex, unpredictable feedback between the components of the social and ecological system (Chaffin et al., 2014). SESs can be seen as a set of critical resources (socio-economic, cultural, natural) whose flow and use are regulated by a combination of social and ecological systems (Redman et al., 2004). AG is increasingly being recognized as a solution to this scale and contextual problem applied in several domains of the developed world (Dietz et al., 2003; Folke et al., 2005) but with very limited engagement in GS (Sharma-Wallace et al., 2018). Moreover, AG can be identified as a flexible, collaborative, learning-based, decision-making process, involving both state and non-state stakeholders at multi-levels with the aim to adaptively negotiate and coordinate the management of different SESs (Folke et al., 2005; Chaffin et al., 2014). The attributes of AG include institutional nesting (complex, layered, redundant); variety (hierarchical, networks), and analytical deliberation which provide experimentation, learning, and change within a system

(Dietz et al., 2003). The concept of AG focuses on power-sharing activities between organizations and communities (Karpouzoglou et al., 2016; Shinn, 2016). Dietz et al. (2003) suggest five requirements for AG such as the provision of information, infrastructure, induce rule compliance, conflict resolution, and the encouragement of adaptation.

Since the early 2000s, AG scholarship has advanced rapidly and expanded towards identifying and examining appropriate processes and structures of governance in the Global North (GN) (Chaffin et al., 2014; Karpouzoglou et al., 2016). AG is grounded in developed world economics questioning whether AG is an appropriate approach and/or framing for alternative economic and socio-political contexts (Schmidt et al., 2013; Chaffin et al., 2014). Karpouzoglou et al. (2016), p. 7), suggest "there is considerable scope for taking theoretically and conceptually developed work on AG in the Global North and evaluating the extent to which it can be applied in the context of the Global South". Yasmin et al. (2020) points out that AG needs to be framed in such a way that an appropriate framework and/or approach might reflect the North–South practice and technology transfers based on the diverse socio-political contexts of GS. The socio-economic and socio-political aspects of GS are different from those of GN, which means the framework needs to be modified based on the GS context in terms of policy, technology, and solutions (Munene et al., 2018).

However, few studies have examined how AG can be employed to manage the environment in GS (Cooper and Wheeler, 2015; Yasmin et al., 2020). Existing research argues that more systematic research is required on how AG is operationalized and applied in environmental governance, particularly in Africa and South Asia, due to financial and institutional limitations and constantly changing environmental conditions (Karpouzoglou et al., 2016). Filling this research gap requires a deeper understanding of how AG can be applied to real-world problems and what mechanisms and frameworks can be used to foster new understandings of AG in these regions.

To address this gap, this study uses a systematic literature review of peer-reviewed articles focused on AG in Africa and South Asia. A systematic review of the literature can provide a comprehensive assessment of the state of knowledge, compared to traditional literature (Biesbroek et al., 2013). In a systematic review, conclusions are drawn from the body of scientific literature through rigorous, transparent, and objective criteria and steps (Petticrew and Roberts, 2006). There is a growing inquiry about the utility and applicability of conventional AG approaches in diverse socio-political and institutional contexts of GS (Cosens et al., 2017). This paper identified eight AG principles based on the reviewed papers focused on Africa and South Asia. This paper critically analyses how the principles of AG emerged across diverse socio-political and weak institutional contexts of GS and how the concept is being adapted in the South Asian and African regions. The review also describes how AG approaches can contribute to sustainable environmental governance, what challenges they may face in the adoption of AG, and how they mitigate them.

The contribution of this paper is twofold. First, it examines how AG has been used to understand environmental governance within the Africa and South Asian regions. It uses this to shed further light on the key institutional challenges that exist when applying AG to GS settings. Second, it identifies the attributes of AG that present the most effective fit with GS settings and the opportunities to adapt a

FIGURE 1
Search and selection methods for systematic literature review.
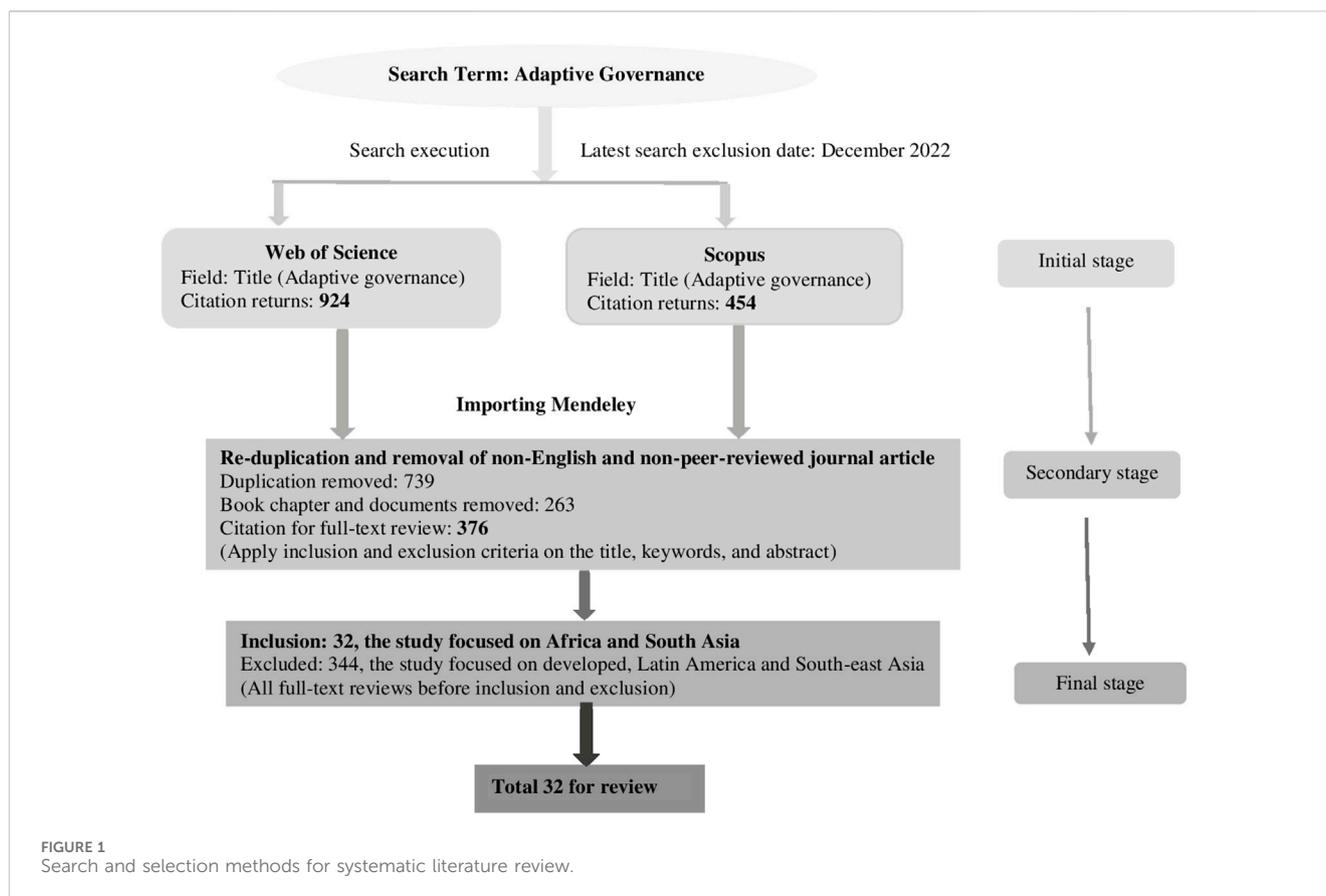
framework for delivering AG outcomes in South Asian and African contexts. The structure of the article is as follows. First, we discussed the aim and objectives of the systematic scholarly review of empirical peer-reviewed journal articles. The next section outlines the methodology and research design employed in this systematic literature review paper. The following section describes the core characteristics and principles that have been identified. It also reveals the factors that influenced the emergence of AG. In addition, it explores the challenges and how AG elements are being used to address the challenges of sustainable environmental governance in Africa and South Asia. Finally, the emerging and proposed attributes and framings of AG are used to provide a guiding framework for future AG interventions for environmental governance in Africa and South Asia.

2 Aim and objectives

There is a critical need to understand how AG can provide a pathway to sustainable environmental governance in GS. This study examines whether and how AG frameworks are applied to GS and whether they provide a sustainable and resilient environmental governance system. To achieve this goal the following research objectives were formulated.

- To map how AG frameworks are used to understand environmental challenges in literature addressing Africa and South Asia.

- To identify the challenges in applying AG attributes that exist across a range of work in this context.
- To understand and synthesise the opportunities to adapt AG to enhance its use in Africa and South Asia.

3 Research methods

To address the research objectives, we conducted a systematic literature review and searched prominent web-based literature databases (see Figure 1 for details). To structure the content and discussion of this systematic review, the PRISMA approach and checklist were used, which are included as Supplementary Data Sheet S1. The quality of the review is ensured by the structural guidelines of the PRISMA approach (Moher et al., 2009).

3.1 Literature identification

We searched two prominent web-based literature databases, Web of Science and Scopus for peer-reviewed academic contributions focused on the term 'adaptive governance'. These databases were chosen in this methodological consideration because they cover broad social, environmental, and natural sciences in order to prevent either European (Scopus) or American (Web of Science) bias to influence the selection of reviewed articles (Biesbroek et al., 2013). 'Adaptive governance' is a key search term because Dietz et al. (2003) used the term to expand the focus from adaptive

TABLE 1 Inclusion and exclusion search criteria.

Inclusion criteria
In Web of Science, Scopus
In English
Both empirical with or transitioning to adaptive framework and theoretical multiplicity
Publications 2003 onwards
Types of Articles: Peer review electronic journal article
Specifically, dealing with adaptive governance
Scientific journal publications only, not book chapters, not a book, or grey literature
Related to socio-ecological systems: Outcome included, methods included, context included
Date range: 2003–2022*
Exclusion criteria
Language: Not in English
Non-peer-reviewed publications and grey literature
Term adaptive governance appears in "abs or keyword or title", but the article does not deal in-depth with adaptive governance
Articles on governance, but not "adaptive governance"
Unrelated to socio-ecological systems: No outcome described, no method described, no context described

*Dietz et al. (2003) introduced adaptive governance in 2003 that's why we choose 2003 as a base year for search inclusion (Dietz et al., 2003).

management or adaptive co-management to address the broader social contexts that enable environmental governance. Table 1 describes the search inclusion/exclusion criteria. Search queries were restricted to 2003 to 2022 (19 years). Database searches were conducted in May and June 2022 and repeated in December 2022 for any additions to the relevant topics.

3.2 Selection of articles and data extraction

We use a systematic approach to assembling review articles and, a three-step screening process was developed (Figure 1). Explanatory analyses were adopted to establish whether the foundational constituent elements of AG that emerged from GN (largely stable and developed economics) are present in the growing body of literature on GS. To identify how the authors presented the empirical and theoretical backgrounds, each of these papers was then analysed, and identified the relevant concepts, characteristics, principles, attributes and tools associated with AG. These understandings were grouped into key principles to characterize the specific elements in operationalizing AG.

3.3 Initial screening

To ensure consistency in the screening process the same search strategies were implemented across all databases based on the criteria outlined in Table 1. In May and June of 2022, the initial search was conducted, yielding a number of articles from web-based databases. The search articles were then imported into the Mendeley reference management software. For reduplication, each set of

Mendeley-suggested duplicates was manually checked and then merge. Further manual checking was conducted on non-English language and non-peer-reviewed journal articles. Results identified 1,378 peer-reviewed journal articles for title, abstract, and keywords review. The citations were imported as BibTex entries in a Microsoft word document to visually assist and the 'Advanced Find & Replace' function was used to highlight the search terms.

3.4 Secondary screening

At this stage, we applied search criteria to the articles read and evaluated. For inclusion, the articles must have directly investigated any aspect of AG. A handful of studies concentrating exclusively on adaptive management or adaptive co-management were excluded. For all citations considered indistinct from titles/abstracts, keywords were reviewed before final inclusion or exclusion. This process allowed us to narrow down the most relevant articles for the study. By secondary screening, we identified 374 papers for a full-text review that focused on AG in both GN and GS.

3.5 Final screening

In the final stage, we excluded the papers focused on South-East Asia, Latin America, and the developed world after a full-text review. To accurately characterize the linkage across AG in Africa and South Asia, we identified 32 papers among them 18 papers focused on Africa and 14 papers focused on South Asia Supplementary Data S2. We reviewed 32 papers and examined three key aspects of each study that met the primary screening criteria: principles or characteristics

of AG emerging in GS; challenges or barriers to AG implementation; and enabling attributes and capacities that may underpin a framework for delivering AG outcomes in South Asian and African regions.

3.6 Data analysis

Coding, synthesis, and analysis of our data were done manually, with an emphasis on lessons learned from the reviewed papers for AG practice in South Asia and Africa. We used the PRISMA checklist for assessing the papers. Through line-by-line coding we identified the themes of the reviewed papers and grouped them accordingly to our research objectives. In particular we tried to explore the questions 1) what principles of AG are emergent? 2) what institutional challenges exist in a range of literature addressing Africa and South Asia? and 3) what insights can be synthesised to enhance AG use? Dietz et al. (2003) identified a number of AG principles that are beneficial to sustainable natural resource use in GN. These principles were further developed by Folke et al. (2005), Olsson et al. (2007), Chaffin et al. (2014) and Sharma-Wallace et al. (2018) in the broader context of GN and GS. Based on the theme from the coding of the reviewed papers, we identified eight AG principles from those identified in relation to the GS. These principles were found to be conducive to sustainable environmental governance in Africa and South Asia. Coding is the process of labelling and organizing qualitative data to identify different themes and relationships between them (Braun and Clarke, 2006). Section 4.2 discusses each of the AG principles based on the reviewed papers in complex socio-economic and institutional contexts. In section 4.3, we grouped the institutional challenges existing across the literature based on themes from coding. In these regions, we also examined potential governance opportunities to mobilize and purposefully shape AG emergence. Further, based on the coding of the reviewed papers, we identified two key domains of adaptive attributes: "emerging attributes" and "proposed attributes". Emerging attributes represent the characteristics of improving the current government structures and processes. On the other hand, to minimize the challenges and improve adaptation capacity, the reviewed papers suggested the proposed attributes of AG. The emerging and proposed attributes for sustainable water governance in the GS have been highlighted by (Yasmin et al., 2020). But in this paper, we identified the percentage of each emergence and proposed attribute in Africa and South Asia by line-by-line coding which is represented in Table 4. In section 4.4, we discussed how these emergence and proposed attributes shape AG's emergence in sustainable environmental governance in these two regions. In conclusion, the paper proposes a framework for future research that can facilitate the implementation of adaptive governance in sustainable environmental management in the global south.

4 Results and discussions
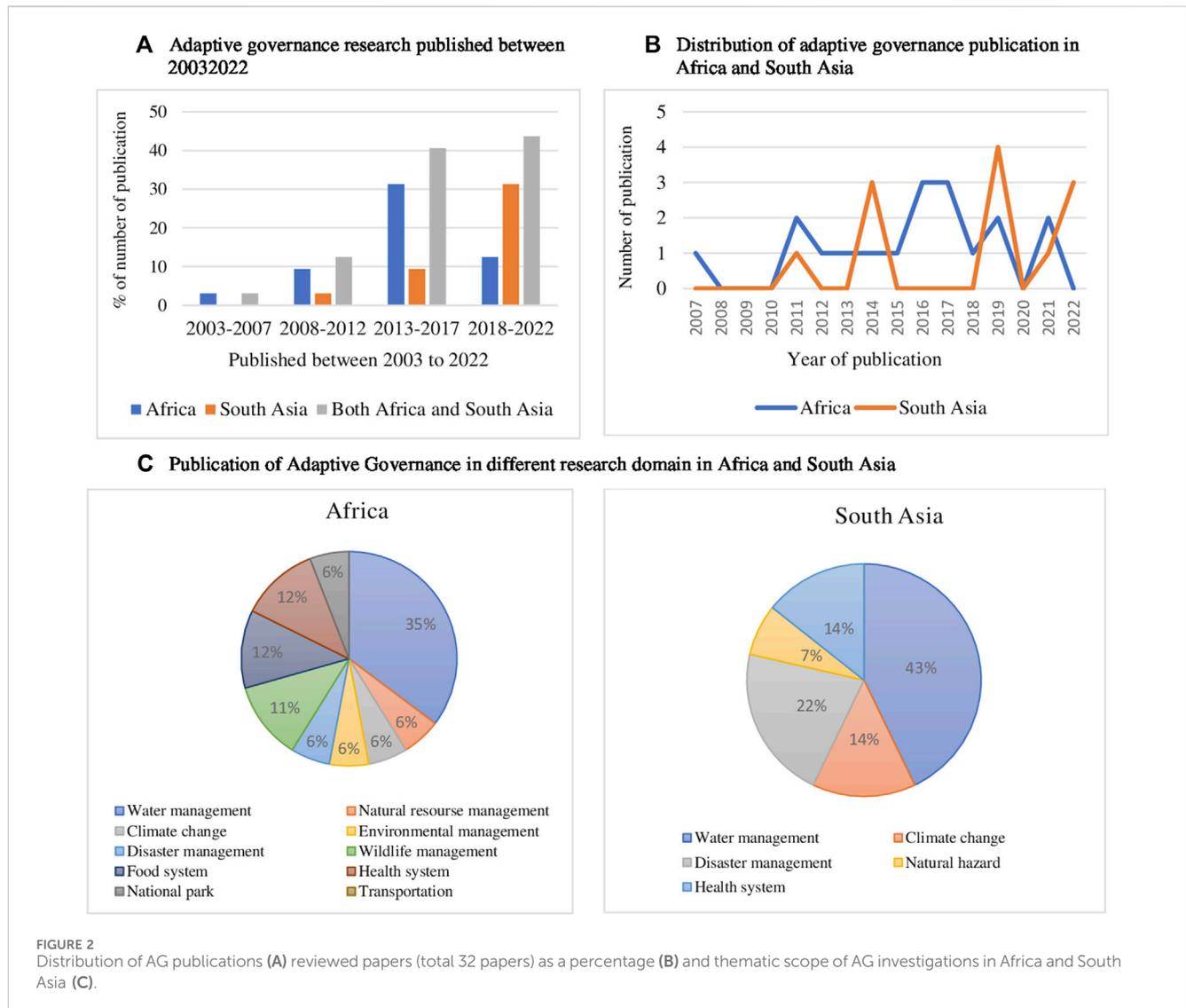
4.1 Key features of the literature search result

The literature search resulted in total 32 full articles from the total cumulative search of 924 articles in Web of Science and 454 articles in Scopus that were obtained based on their applicability to AG in Africa

and South Asian regions. These reviewed documents adopted several research methods and analytical lenses, and the methods are diverse, comprising a mix of qualitative and quantitative approaches. Different techniques were adopted for data collection such as case study, empirical study, observation, survey, document analysis and participatory data-collection techniques including semi-structured interviews, key informants' interviews, and focus group discussions. This systematic review provided a percentage of articles addressing the key issues discussed in Africa and South Asian academic focus and gaps in the research study area (Figure 2).

AG publication began in 2007 in Africa. The number of AG publications has been increasing but decreased between 2018 and 2022. In South Asia, AG publication started in 2011 and increasing trend in recent year above 30% in 2018–2022. There were four papers published in 2019 focused on South Asia, followed by three papers published in Africa in 2014 and 2022. While, in 2016 and 2017, the most (three) papers were published specifically on Africa. Majority of the reviews focused on water governance and some focused on disaster management, climate change, health systems, food systems, wildlife management, etc., rather than sustainable environmental governance. Africa's AG publications focus on a different research domain than South Asia's. In South Asia, AG publications emphasize water management, disaster management, climate change, and the health system. Along with these AG publications in Africa also focus on wildlife, park management, transportation, and food systems. The review found only one paper concentrating on AG in environmental governance in Botswana (Shinn, 2016) whereas there is no study on AG in environmental governance in South Asia Supplementary Data S3. Due to rapid population growth, unplanned urbanization, and climate change impacts, these regions are susceptible to environmental mismanagement. In addition, there is no research on basic urban services (waste, water, energy), yet these regions are among the fastest urbanizing in the world (Abubakar et al., 2022). More research is required to find out how AG works on urban environmental governance (waste, water, energy) and resource management in Africa and South Asia.

4.2 Emergence of AG in African and South Asian regions

The review identified AG transitions that appear consistent across African and South Asian regions in varying degrees and combinations in empirical socio-economic outcomes. The analysis identified AG's presence in eleven key domains including water management (37.5%), disaster management (12.5), health system (12.5%), and climate change (9.3%). Only one paper explicitly examined and theorized environmental governance strategies that embrace the complexity of governance and can respond effectively to changing and unpredictable environmental dynamics in Africa (Shinn, 2016). Across these papers, the authors express a pressing need to shift away from current development paths to sustainability guided by AG principles (Niekerk, 2014; Blekking et al., 2017; Novellie et al., 2017; Chomba et al., 2019; Yasmin et al., 2020; Yasmin et al., 2022). Various factors such as socio-economics, politics, institutions, technology, knowledge sharing, and the involvement of donor agencies play a crucial role in this transformation. Dietz et al. (2003), Folke et al. (2005), Olsson

FIGURE 2
Distribution of AG publications **(A)** reviewed papers (total 32 papers) as a percentage **(B)** and thematic scope of AG investigations in Africa and South Asia **(C)**.

et al. (2007), Chaffin et al. (2014) and Sharma-Wallace et al. (2018) identified the main principles of AG that benefit environmental governance in the broader context of GN and GS. Table 2 highlights the eight AG principles that contribute to sustainable environmental governance in Africa and South Asia from those identified in relation to the GN. Key source references are frequently mentioned for each of the AG principles. Collaboration across sectors and scales has been more frequently mentioned (n = 31) followed by capacity development (n = 30) and coordination between stakeholders and levels (n = 27). Community involvement in environmental governance is reported (n = 26) followed by monitoring and feedback (n = 25) and exploring governance opportunities (n = 23). Leadership (n = 21) and accountability (17) are also reported for environmental governance in these regions.

4.2.1 Collaboration across sectors and scales

The reviewed papers emphasize the importance of effective participation and collaboration of relevant actors to facilitate community-driven principles in AG approaches. Following

previous research in this field, Yasmin et al. (2020), identified that community participation indicated that local actors' experience and expertise led to better opportunities in decision-making processes in water governance in Bangladesh. Tuda et al. (2021) also identified how effective collaboration of diverse actors and multiple interactions foster AG of the Kenya-Tanzania transboundary marine socio-ecological systems that enhance cross-sectoral integration and create opportunities for multi-stakeholder bridging which is also found in water governance in South India (Vallury et al., 2022). Effective collaboration across sectors and scales initiatives had proven successful in enabling building leadership and trust among different stakeholders to minimize conflict and improve power sharing in a collaborative manner in cyclone management in India and Bangladesh (Walch, 2019; Choudhury et al., 2021). In addition, the authors (Djalante et al., 2011; Knüppe, 2011) argued that the participation of relevant actors at different levels and scales encouraged the coproduction of new knowledge which enabled to develop and increase adaptation strategies in natural hazards in Nepal and groundwater management in South Africa. Both formal and informal collaboration proved

TABLE 2 Key principles of AG evolving in African and South Asian regions.

Principles of AG	Number of studies	Key source references
Collaboration across sectors and scales	31	Olsson et al. (2007), Novellie et al. (2017), Walch, 2019; Tuda et al. (2021), Vallury et al. (2022)
Capacity development	30	Evans et al. (2011), Chomba et al. (2019), Walch (2019), Yasmin et al. (2020), Choudhury et al. (2021)
Coordination between stakeholders and level	27	Novellie et al. (2017), Tuda et al., 2019; Walch (2019), Choudhury et al. (2021), Nixon et al. (2022)
Community involvement	26	Djalante et al. (2011), Cooper and Wheeler (2015), Walch (2019), Choudhury et al. (2021), Tuda et al. (2021)
Monitoring and feedback	25	Olsson et al. (2007), Evans et al. (2011), Novellie et al. (2016), Blekking et al. (2017), Novellie et al. (2017)
Exploring governance opportunities	23	Novellie et al. (2016), Novellie et al. (2017), Munene et al. (2018), Walch (2019), Choudhury et al. (2021)
Leadership	21	Knüppe (2011), Cooper and Wheeler (2015), Pelletier et al. (2017), Mumtaz and Ali (2019), Walch (2019)
Accountability	17	Olsson et al. (2007), Herrfahrdt-Pähle (2013), Novellie et al. (2016), Pelletier et al. (2017), Rao et al. (2020)

beneficial to the AG in water governance in India (Vallury et al., 2022). Formal collaboration facilitates regulatory capacity and access to financial and institutional resources, and informal collaboration fosters flexibility and trust in water governance processes in these regions (Evans et al., 2011; Tuda et al., 2021; Yasmin et al., 2022).

Moreover, Shinn (2016) and Yasmin et al. (2020) argue that collaboration between different actors and communities creates connections and involves trust-building to build a platform for conflict minimization and sharing of information between different groups, actors, and organizations in environmental governance in Botswana and water governance in Bangladesh. Tuda and colleagues (Tuda et al., 2019; Tuda et al., 2021), identified how consistency in collaboration and interaction across the planning, functioning, monitoring, and maintenance is essential in all stages of the adaptive water governance process and outcomes in East Africa, as also seen by Mirza, (2014) in South Asia. Successful collaboration is facilitated by bridges that link the multiple dimensions of an environmental problem and potential solutions (Shinn, 2016). These linkages often connect with relevant actors, coordinate governance actions, and disseminate knowledge and lessons learned through organizational and community networks in disaster management in India and Bangladesh (Walch, 2019; Choudhury et al., 2021). In Zambia, Pakistan, and Bangladesh, this approach may improve the institutional and management capacity of governance to support sustainable water resource management policies (Mian, 2014; Chomba et al., 2019; Yasmin et al., 2022).

4.2.2 Capacity development

A range of scholarship covering institutional collaboration, learning, and knowledge sharing accelerate AG's efforts to foster and enhance capacity development in disaster management in South Asia (Walch, 2019; Choudhury et al., 2021), and health governance in Africa (Olsson et al., 2007). Capacity can be developed through community-run training courses, organizational partnerships, knowledge transfer through stakeholder collaboration, peer group

mentoring, loans or gifts of equipment, and learning by doing both on and off the field in water governance in Zambia (Chomba et al., 2019) and wildfire management in South Africa (Niekerk, 2014). Evans et al. (2011) identified how long-term monitoring, donor investment, and capacity building by nongovernmental organizations are strengthening AG in the fisheries sector in Kenya. The review revealed an increasing focus on capacity development needs to strengthen relevant state and non-state actors' capacity to make effective policy-making decisions and management approaches in Botswana, India, and Bangladesh (Shinn, 2016; Walch, 2019; Yasmin et al., 2022). Moreover, the reviewed papers demonstrated that capacity-building engagements can help Africa and South Asia develop effective governance structures and processes as well as innovative strategies (Cooper and Wheeler, 2015; Shinn, 2016; Walch, 2019; Yasmin et al., 2022).

4.2.3 Coordination between stakeholders and levels

Coordination between various stakeholders or polycentric governance (complex, multi-layered with multiple centres of decision-making) is effective in sustainable water governance in Bangladesh (Yasmin et al., 2022). Noveli and colleagues (Novellie et al., 2016; Novellie et al., 2017) revealed that polycentrism supported the resolution of nested across levels of governance, function, structured with multiple centres of power, and connected through networks in South African park management and water governance in Bangladesh (Yasmin et al., 2020; Yasmin et al., 2022) and disaster management in India (Walch, 2019). Choudhury et al. (2021) gathered evidence that multilevel institutions (local, regional, and national) adopt collaborative multi-loop social learning which significantly enhances community resilience to climate-induced disaster shocks and reduces gaps between local disaster governance capacities and responsibilities in Bangladesh. Djalante et al. (2011) and Walch, (2019) recognized AG as a useful strategy for dealing with uncertainty associated with climate-induced disasters in South

Asia. Djalante et al. (2011) identified three main strategies of AG: nesting-multi-layered institutions; analytical deliberation–dialogue with different actors and institutional variety-active participation of state, non-state and community-based organizations in natural hazard management in Nepal. These three strategies are also identified in food security in South Africa (Pereira and Ruysenaar, 2012) and water resource management in East Africa (Tuda et al., 2019; Tuda et al., 2021). Further, the authors argue that AG seeks to integrate coordination across different institutional arrangements, political processes, and policy aspects of governance for accountability and legitimacy (Tuda et al., 2019; Tuda et al., 2021; Vallury et al., 2022). In the real world, active participation and collaboration are needed among various organizations, formal and informal institutions, actors, and stakeholders at every stage of environmental governance (Shinn, 2016).

4.2.4 Community involvement

The review argued that community-engaged AG is successful when it is consistent (planning, implementation, maintenance) diverse (variety of forms), and trustworthy. Djalante et al. (2011), Walch, (2019), and Choudhury et al. (2021) identified that building and strengthening community resilience/capacity to extreme climatic events requires an adaptive, innovative, and forward-looking approach to disaster management in Bangladesh, Nepal, and India. Mirza and others (Mirza, 2014; Bedi, 2019; Nixon et al., 2022; Vallury et al., 2022) discussed how active community participation, adequate financial support, and political will are essential for sustainable water management in India. In addition, stakeholder involvement is crucial to sustainable water and groundwater management in South Africa but is generally weak and barely acknowledged by government agents (Knüppe, 2011; Herrfahrdt-Pähle, 2013). Furthermore, Novellie et al. (2016) identified public participation as an imperative element of park management in South Africa, which is not reflected in national park management plans. On the other hand, Walch, (2019) and Choudhury et al. (2021) identified that the local community should be incorporated into the earliest stages of disaster management governance planning for sustainable disaster management in India and Bangladesh. The community actors have initiated the AG process in crisis health management in India and Bangladesh during the COVID-19 pandemic (Khan et al., 2020; Rao et al., 2020) and health governance in Africa (Olsson et al., 2007). Governance interventions should further be clearly co-designed to acknowledge and address the specific needs and context of the affected community and design stages by soliciting, then incorporating community feedback in natural resource management in Uganda (Sanginga et al., 2010) and water resource management in East Africa (Tuda et al., 2021). This governance intervention is also found in disaster management in India and Bangladesh (Walch, 2019; Choudhury et al., 2021). In contrast, where local actors are excluded from decision-making and governance processes, long-term governance outcomes may not be sustained in marine governance in Southern Kenya (Evans et al., 2011).

4.2.5 Monitoring and feedback

To address the current environmental challenges, stakeholders need access to information about the scope and character of the problems and potential solutions. According to (Shinn, 2016), social learning (values, experiences, debates, and decision-making processes) and knowledge sharing can serve as a strategy for dealing with environmental change and uncertainty in Botswana. Blekking et al. (2017) identified how continuous monitoring and clear feedback mechanisms for actors can lead to the improvement of urban food systems that are capable of mitigating shocks and stresses in Zambia. In a complex adaptive system, continuous learning and sharing of knowledge are necessary to keep up with uncertainty and change in natural hazard management in Nepal (Djalante et al., 2011). The authors (Mian, 2014; Walch, 2019; Choudhury et al., 2021) identified how a multilevel learning strategy incorporates local lessons learned from nature-triggered disasters and scaling up these lessons into national-level policy and practices for disaster management in South Asia. Flexible institutions allow feedback that enables learning from past experience and supports efficient practices and rules for water resource management in South Africa (Herrfahrdt-Pähle, 2013). Moreover, continuous monitoring and feedback mechanisms facilitate learning, highlight knowledge gaps, reveal the shortcomings of problems and knowledge, and create a culture of candidness and experimentation in the policy run in marine governance in southern Kenya (Evans et al., 2011) health system in Africa (Olsson et al., 2007) and multi-sectoral nutrition in Burkina Faso, Mali, Ethiopia, and Uganda (Pelletier et al., 2017; Niekerk, (2014)) pointed out that collecting, monitoring, and disseminating reliable socio-ecological essential information is not sufficient to change stakeholders' and the public's behaviour and should instead be coupled with initiatives targeting social capital and stakeholder engagement.

4.2.6 Exploring governance opportunities

AG recognizes and seizes windows of opportunities for governance transition and regime change (Knüppe, 2011). The review identified the process of AG was initiated in response to the present health crisis (COVID-19 pandemic) in India and Bangladesh (Khan et al., 2020; Rao et al., 2020) or past or impending crises such as natural disasters or resource management in both Africa and South Asia confirming a high reliance on devious moments for empirical governance change (Djalante et al., 2011; Novellie et al., 2016; Novellie et al., 2017; Walch, 2019; Choudhury et al., 2021). Yasmin et al. (2022) reveals how social movement creates pressure on governance to adopt more adaptive water governance in Bangladesh. However, the maintenance of AG is required to provide baseline and monitoring data for governance stakeholders about potential problems and their solutions in marine transboundary conservation in East Africa (Tuda et al., 2019; Tuda et al., 2021). Continuous monitoring and evaluation help to improve the decision-making process, increase transparency and accountability, and effective implementation of climate change policy in Pakistan (Mumtaz and Ali, 2019). These policies retain sufficient flexibility to align governance strategies with political and social contexts. Further, the successful creation and nurturing of governance opportunities requires flexibility, preparation, political shrewdness, and leadership.

4.2.7 Leadership

The reviewed scholarship demonstrated that effective leadership could help reframe environmental problems, coordinate organizational and financial support, build networks across actors and scales, and design and implement management interventions where resources and technology are scarce in climate resilience in Uganda (Cooper and Wheeler, 2015) and Pakistan (Mumtaz and Ali, 2019) and natural hazard management in Nepal (Djalante et al., 2011). Leadership can motivate the broader community to participate in planning and monitoring bodies or multiple, horizontally integrated governance subgroups in climate resilience in Uganda (Cooper and Wheeler, 2015). Walch (2019) found that committed political leadership is vital to reforming previous governance practices to create a more resilient and successful example of disaster management in India's poorer provinces. According to some authors (Mian, 2014; Walch, 2019), leadership is essential to overcoming local government weaknesses towards achieving sustainable government processes and outcomes in Pakistan and India. The authors (Djalante et al., 2011; Choudhury et al., 2021) identified local leaders who can act as mediators and brokers to fill in the gaps where the government cannot function properly due to a lack of capacity, funding, capabilities, legitimacy and access in disaster management in Nepal and Bangladesh. Additionally, these local leaders facilitate the strengthening of networks and coordination of effective governance structures (Walch, 2019; Yasmin et al., 2020).

4.2.8 Accountability

Accountability is essential to develop rules that govern information flow and communication between natural resource organizations at multiple scales in South Africa (Novellie et al., 2016; Novellie et al., 2017). Bedi, (2019) identified how meaningful public participation and collaboration can enhance transparency and accountability in the water governance planning and decision-making process in Pakistan which is also essential in integrated water management in South Africa (Herrfahrdt-Pähle, 2013). The government should bear accountability to ensure stakeholder participation in environmental planning and resource allocation in climate resistance in Uganda (Cooper and Wheeler, 2015), railroad mega projects in Kenya, and Ethiopia (Carrai, 2021), water governance in Bangladesh (Yasmin et al., 2022). According to Cooper and Wheeler, (2015) critical evaluation and monitoring provide better transparency and accountability to link information to decision-making over multiple scales in Uganda's climate resilience, which is also essential for ensuring multi-sectoral nutrition in Burkina Faso, Mali, Ethiopia, and Uganda (Pelletier et al., 2017).

This is combined with AG strategies to ensure governance effectiveness is maintained over a long period of time. The review identified there are lots of governance challenges that hinder the implementation of AG in these regions. It also identified various governance opportunities that may be mobilized and purposefully shaped by various groups of stakeholders willing and able to mobilize formal and informal networks and resources.

4.3 Challenges and opportunities in AG towards environmental governance sustainability

In Africa and South Asia, AG principles and attributes face significant challenges to capacity building and organizational inactivity. These significant challenges are associated with persistent institutional barriers, political will, shared power, trust, and lack of relevant actors' capacity. These barriers continue to hinder AG principles application. Table 3 highlights the institutional challenges reported by 32 reviewed papers in Africa and South Asia. As a result of this review, seven institutional challenges have been identified that are multifaceted in the emergence of AG. Further we order these institutional challenges according to the number of times they are mentioned in the reviewed papers. Key source references are frequently mentioned for each of the institutional challenges. Institutional coordination has been more frequently reported (n = 32) followed by challenges related to political will (n = 30) and institutional mismatch (n = 26). Institutional challenges related to monitoring and feedback, finance and guidelines for acute plans are reported equal time (n = 24) followed by skill and capacities (n = 22) and accountability (n = 21).

4.3.1 Institutional coordination

Lack of coordination and fragmented institutions and power differentials among bureaucrats and civil society organizations is a persistent problem for organizational capacity building and implementing AG principles both in South Asia and Africa (Evans et al., 2011; Mian, 2014; Novellie et al., 2016; Bedi, 2019; Khan et al., 2020; Choudhury et al., 2021; Yasmin et al., 2022). Lack of long-term relationships and trust among different actors inhibits social learning activities in environmental health governance in Africa (Olsson et al., 2007). The existence of external and institutional coordination may fail due to the active participation of local stakeholders in natural hazard management in Nepal (Djalante et al., 2011). Increasing the adaptive capacity of trans-boundary water resource governance in Africa may be improved by vertical (multi-level), horizontal (bottom-up), and upstream and downstream coordination between stakeholders and marginalized communities (Tuda et al., 2021).

4.3.2 Political will

Lack of political devolution and legitimate intent to share power are the most identified challenges inhibiting AG. Lack of power-sharing, the nature of local politics, and existing forms of bureaucracy limit the success of AG in these regions (Evans et al., 2011; Cooper and Wheeler, 2015; Tuda et al., 2019; Choudhury et al., 2021). Lack of political will and policy clarity along with difficulties in coordinating institutions are major obstacles to operationalizing AG in these regions (Olsson et al., 2007; Mirza, 2014). Local-level politics and decision-making dynamics facilitate a contextualized understanding of the underlying causes of institutional mismatches and lack of coordination between different stakeholders (Evans et al., 2011; Choudhury et al., 2021). Central governance with rigid bureaucracies, weak institutions, scant or no accountability or

TABLE 3 Key institutional challenges in AG interventions towards environmental sustainability.

Key institutional challenges of AG implementation	Number of studies	Key source references
Institutional coordination	31	Pereira and Ruysenaar (2012), Pelletier et al. (2017), Choudhury et al. (2021), Tuda et al. (2021), Vallury et al. (2022)
Political will	30	Olsson et al. (2007), Pereira and Ruysenaar (2012), Varma et al., 2014; Walch (2019), Yasmin et al. (2020)
Institutional mismatch	26	Evans et al. (2011), Cooper and Wheeler (2015), Bedi (2019), Choudhury et al. (2021), Vallury et al. (2022)
Monitoring and feedback	24	Evans et al. (2011), Knüppe (2011), Novellie et al. (2016), Blekking et al. (2017), Tuda et al. (2021)
Finance and guidelines for acute plans	24	Novellie et al. (2016), Shinn (2016), Pelletier et al. (2017), Carrai (2021), Yasmin et al. (2022)
Skill and capacities	22	Herrfahrdt-Pähle (2013), Bedi, 2019; Chomba et al. (2019), Nixon et al. (2022), Yasmin et al. (2022)
Accountability	21	Herrfahrdt-Pähle (2013), Mian, 2014; Niekerk (2014), Rao et al. (2020), Vallury et al. (2022)

transparency, tight information controls, and corruption may hinder AG structures and processes of marine governance in Sub-Saharan Africa (Cooper and Wheeler, 2015). However, the shift in decentralization and capacity development of governance is significantly influencing power dynamics and decision-making processes in resource management in these regions (Evans et al., 2011; Yasmin et al., 2022).

4.3.3 Institutional mismatch

Choudhury et al. (2021) identified three forms of mismatch such as spatial (financial, technical), temporal (inability of an institution to respond rapidly to a crisis in real-time), and functional (lack of adequate staff, equipment, and training, etc.) which hinder institutional capacity in disaster management in Bangladesh. Institutional mismatch also found in natural resource management in South Africa (Novellie et al., 2016; Novellie et al., 2017). Local-level multi-sectoral coordination between different formal, informal, quasi-informal, and civil society organizations may help overcome functional, spatial, and temporal mismatches in disaster management and disaster risk reduction governance in Bangladesh (Choudhury et al., 2021). Bridging organizations (NGOs, civil society), network formation, and leadership play a significant role in institutional capacity development and reducing institutional mismatches (Mumtaz and Ali, 2019; Choudhury et al., 2021).

4.3.4 Monitoring and feedback

Lack of regular monitoring and/or feedback on environmental changes is subsequently flagged as a problem in AG processes in extreme climate events management in these regions (Evans et al., 2011; Mian, 2014; Cooper and Wheeler, 2015; Choudhury et al., 2021). Weak monitoring systems hamper effective water resource management in South Africa (Knüppe, 2011) transboundary marine resources management in East Africa (Tuda et al., 2019; Tuda et al., 2021), and water management in India and Pakistan (Mian, 2014; Nixon et al., 2022). Lack of investment in monitoring infrastructure,

unreliable monitoring, and marginalization of local communities hinder monitoring activities. Moreover, a lack of continuous monitoring and feedback may hamper natural resource management and extreme climatic event management in South Asia and Africa (Djalante et al., 2011; Evans et al., 2011). Evans et al. (2011) identified how long-term marine monitoring systems excluded indicators related to complex system resistance due to centralized government structures and narrow political priorities in water governance in Kenya. However, a flexible institution allows feedback and enables learning from past experiences and supports actors to rapidly identify ineffective practices and rules and the need to change in resource management in Africa (Herrfahrdt-Pähle, 2013).

4.3.5 Finance and guidelines for acute plans

Lack of adequate finance and stakeholder involvement in financing and continuity of funding is one of the major persistence challenges in these regions (Varma et al., 2014; Yasmin et al., 2022). Lack of funding hinders multi-actor participation, collaboration, and knowledge exchange, reducing the adaptability of governance. Tuda et al. (2019) revealed that a lack of financial sustainability is one of the major operational challenges in transboundary water governance in Kenya and Tanzania. However, the experience from AG shows that the higher levels of government need to provide considerably more technical and financial support to agencies and organizations operating at the lower levels of governance for sustainability (Djalante et al., 2011). Besides these, the absence of guidelines for implementing plans is also a significant barrier in environmental governance. This indicates a need for continued donor engagement and guidance to address future challenges and capacity development of environmental governance.

4.3.6 Skill and capacities

AG approaches with inclusive community support, capable participation, and bridging structures are unlikely to succeed without considering planning and implementing capacities of governance, such as adequate human and financial resources, and management and

TABLE 4 Emerging and proposed AG attributes identified from research on the South Asian and African region.

Adaptive governance principles	Adaptive attributes	Africa				South Asia			
		Emerging attributes		Proposed attributes		Emerging attributes		Proposed attributes	
		Mentioned	%	Mentioned	%	Mentioned	%	Mentioned	%
Collaboration across sectors and scales	Multilevel and cross-scale	11	64.7	14	82.3	11	78.6	11	78.6
	Adaptive decision making	8	47.0	13	76.5	7	50.0	9	78.6
	Resource distribution and access	8	47.0	15	88.2	6	42.8	12	85.7
	Mixed approach (top-down/ demand-driven bottom-up strategies/integrated approach)	10	58.8	14	82.3	9	64.3	10	71.4
Capacity development	Flexible, integrated, and participatory	9	52.9	17	100	7	50.0	13	92.8
	Networked (Formal and informal interaction)	16	94.1	9	52.9	13	92.8	8	57.1
	Context specific strategies/ culture of experimentation	7	41.2	16	94.1	6	42.8	13	92.8
	Capacity and skill (Local actors in decision making)	6	35.3	16	94.1	7	50.0	13	92.8
	Innovation	7	41.2	15	88.2	9	64.3	11	78.6
	Tailor made training	7	41.2	12	70.6	6	42.8	11	78.6
	Rules and regulations	9	52.9	14	82.3	8	57.1	11	78.6
Coordination between stakeholders and level	Polycentric institutions	12	70.6	14	82.3	10	71.4	11	78.6
	Bottom-up learning	10	58.8	13	78.6.5	8	57.1	11	78.6
Community involvement	Stakeholder diversity and engagement	15	88.2	11	64.7	9	64.3	10	71.4
	Multi-stakeholder approach (decision making and implementation)	10	58.8	13	76.5	5	35.7	12	85.7
	Inclusive decision making	8	47.0	16	94.1	7	50.0	14	100
Monitoring and feedback	Learning	16	94.1	12	70.6	13	92.8	10	71.4
	Experimentation	11	64.7	14	82.3	8	57.1	11	78.6
	Shared vision	10	58.8	13	76.5	9	64.3	9	64.3
Exploring governance opportunities	Development strategies (avoiding ideological and institutional dependencies, national and international led strategies)	5	29.4	10	58.8	4	28.6	10	71.4
Leadership	Political and local leadership	8	47.0	15	88.2	7	50.0	11	78.6
	Collective actions and decision making	9	52.9	14	82.3	6	42.8	11	78.6
Accountability	Accountability	9	52.9	17	100	6	42.8	14	100

Source: (Olsson et al., 2007; Sanginga et al., 2010; Djalante et al., 2011; Evans et al., 2011; Knüppe, 2011; Pereira and Ruysenaar, 2012; Herrfahrdt-Pähle, 2013; Mian, 2014; Mirza, 2014; Niekerk, 2014; Varma et al., 2014; Cooper and Wheeler, 2015; Novellie et al., 2016; Shinn, 2016; Blekking et al., 2017; Novellie et al., 2017; Pelletier et al., 2017; Munene et al., 2018; Bedi, 2019; Chomba et al., 2019; Mumtaz and Ali, 2019; Tuda et al., 2019; Walch, 2019; Khan et al., 2020; Rao et al., 2020; Yasmin et al., 2020; Carrai, 2021; Choudhury et al., 2021; Tuda et al., 2021; Nixon et al., 2022; Vallury et al., 2022; Yasmin et al., 2022)*See (Folke, 2006; Pahl-Wostl, 2009; Rijke et al., 2012) for further explanation.

action capacities (Knüppe, 2011; Bedi, 2019). An AG's success is often hampered by stakeholders' lack of skills and capacities to manage the organization or deal with concerns of water governance in Africa (Chomba et al., 2019). This results in losing interest in such governance structures formed to manage environmental issues and eventually people are not able to sustain such organizations (Bedi, 2019). Training, mutual learning, and knowledge exchange may increase the skill and capacities of relevant actors in decision-making and implementing resource management decisions (Bedi, 2019; Chomba et al., 2019).

4.3.7 Accountability

Lack of accountability and procedures for holding actors accountable is one of the major institutional challenges in implementing AG effectively. Unclear policies, lack of participation, complex community ties, and corruption limit accountability. In the study of water governance in South Africa Herrfahrdt-Pähle, (2013) identified accountability and transparency increase the predictability of system behaviour which creates trust and confidence in institutions and organizations which is also applicable to water governance in South Asia (Djalante et al., 2011; Pereira and Ruysenaar, 2012; Yasmin et al., 2022). Accountability increases the stability and predictability of the social system and its functioning, which is a counterbalance to uncertain socio-ecological systems (Herrfahrdt-Pähle, 2013). The review also identified that a lack of downward accountability and a lack of transparency in the division of rules has hindered the decentralization of governance in natural resource management in Africa and South Asia (Herrfahrdt-Pähle, 2013; Mian, 2014; Yasmin et al., 2022).

This review argues that building and strengthening governance capacity for environmental management requires adaptive, innovative, and flexible approaches to mobilize and prioritize resources to meet the emerging need for unpredictable and complex systems. Applying the AG framework in the reviewed papers we documented four novel contributions to sustainable environmental governance in Africa and South Asia. The manifestation of nested and multi-level institutional structures at all scales helps to overcome the institutional mismatch and facilitates the capacity-building process. The active participation of stakeholders in the decision-making process and the implementation of decisions at a local, regional and national level. Social learning and innovation using a strategy to continually deal with environmental change and uncertainty and scaling up these learnings into national policy and practices. Formal and informal networks create connections and involve trust-building to build a platform for conflict minimization and sharing of information between different groups, actors, and organizations.

4.4 Emerging and proposed AG attributes identified in research on the African and South Asian region

This systematic review identified 8 AG principles and 27 adaptive attributes in Africa and South Asia through coding and organizing themes from the coding. These principles and attributes are also identified in GN contexts. Environmental governance in the GN has the necessary resources, innovative ideas, and processes to frame environmental problems and possible solutions. On the other hand, South Asia and Africa have limited resources, institutional capacity and innovative ideas to frame environmental problems and solutions. Moreover, AG is an emerging concept in environmental governance in these regions. Many of the reviewed papers revealed key emerging attributes in environmental governance and improved by applying them in the real world. In the meantime, some reviewed papers found several challenges to implementing AG in these regions. These challenges need to be addressed critically to minimize them. To address these challenges, the reviewed papers suggested some attributes necessary to enhance adaptive capacity and sustainable resource management. Based on the theme from the coding, we identified two key domains of adaptive attributes: "emerging attributes" and "proposed attributes". Emerging attributes represent the characteristics of improving current government structures and processes. On the other hand, to minimize challenges and improve adaptation capacity, the reviewed papers suggested the proposed attributes. Yasmin et al. (2020) highlighted the emerging and proposed attributes for sustainable water governance in the GS. In this paper, we identified the percentage of each emerging and proposed attribute in Africa and South Asian contexts by line-by-line coding and ordered them according to 8 AG principles. These principles and attributes of AG are highlighted in Table 4. The percentage of attributes is calculated separately from total papers from Africa and South Asia. These attributes are interconnected and provide a platform for guiding interventions towards sustainability of environmental governance.

4.4.1 Collaboration across sectors and scales

To develop cross-sectoral integration, collaboration between sectors and scales builds connections and enhances trust. It creates opportunities and bridges for multi-level environmental governance. Multilevel and cross-scale adaptive attributes are being proposed (82.3%) in Africa because rigid top-down control or capture of management decision making challenges environmental governance to adapt to a multilevel and cross-scale governance structure. In South Asia multi-level adaptive attributes are emerging (78.6%) and are being proposed (78.6%). Because, in disaster management government organizations, NGOs, civil society and local people collaborate and interact with each other during cyclones, but in resource management, these integrations are missing. Top-down controls interfere with governance accountability, efficiency, and flexible collaboration between different government organizations and stakeholders. As Kuzdas et al. (2015), the absence of integrated and collaborative governance hinders sustainable water governance in Central America. Moreover, top-down control reduces relevant stakeholders' adaptive decision making and rigidifies resource distribution and access. Adaptive decision making and resource distribution and access attributes are proposed in Africa (76.5% and 88.2%) and South Asia (78.6% and 85.7%). Lack of political commitment, accountability, and corruption hinder adaptive decision making and resource access in Africa and South Asia. Demand-driven

strategies (bottom-up approach) or mixed approach is proposed to involve stakeholders in decision-making, access resources and develop stakeholder capacity (82.3% and 71.4%). Bottom-up approach involves local stakeholders in the decision-making process to build trust among different stakeholders, encourage collaborative power-sharing and assist in resolving conflicts in natural disaster management in Indonesia (Butler et al., 2014; Bakkour et al., 2015).

4.4.2 Capacity development

In Africa and South Asia, a flexible, integrated, and participatory governance structure is needed to involve local stakeholders in contributing to adaptive decision-making and in instigating demand-driven bottom-up initiatives (planning and implementing) (Nastar, 2014; Benson et al., 2015). This attribute is a proposed attribute (100% and 92.8%) in these regions. Institutional coordination, networks (formal and informal), tailor-made training, and knowledge sharing through collaboration accelerate and enhance the capacity of organizations to improve environmental governance. Social networks (formal and informal) are emerging (94.1% and 92.8%) attributes in these regions. NGOs, donor agencies, and civil society in Africa and South Asia strive to establish formal and informal environmental governance networks. Local stakeholders' capacity and skills are proposed attributes in Africa (94.1%) and South Asia (92.8%). Tailor-made training and knowledge sharing can enhance local stakeholders' capacity and skills.

4.4.3 Coordination between stakeholders and level

Polycentric institutions are essential for effective governance strategies and distribution of power over environmental decision-making across different levels of stakeholders that can respond to change (Folke et al., 2005; Pahl-Wostl, 2009). Polycentric institutions are a proposed attribute (82.3% and 78.6%) in Africa and South Asia. This involves multiple decision-making centres combined with decentralization to distribute power and authority across a variety of scales. Transnational donors provide key guidance and financial support to emerging polycentric institutions. According to researchers (Rijke et al., 2012; Hurlbert and Gupta, 2017), polycentric institutions offer better governance through the involvement of multiple stakeholders, accountability, and fair sharing of resources. Successful implementation of a polycentric approach requires bottom-up learning and strategies for scaling up local learning and context-specific strategies, as well as establishing strong connections between science and policy. In South Asia and Africa, as proposed attributes context-specific strategies have been identified (78.6% and 78.6% respectively). A study by Janssen and van der Voort (2016), showed that polycentric systems can be incorporated with bottom-up initiatives and strategies for scaling up local initiatives in GS. Clark and Semmahasak, (2013) emphasized that polycentric approaches including multilevel systems were necessary to connect different actor groups (Clark and Semmahasak, 2013). These approaches were necessary to establish formal and informal networks, develop cross-scale interactions, encourage shared understanding, and support the scaling-up of innovations in water governance in north-west Thailand.

4.4.4 Community involvement

Dietz et al. (2003) identified that adaptive governance requires community involvement at different levels. This facilitates broad community participation to formulate locally appropriate rules, actions, and conflict resolution processes. A variety of context-specific rules and regulations (82.3% and 78.6%) have been proposed, which require effective action plans based on the local area to be implemented. Stakeholder diversity and engagement in decision making processes is emerging (88.2%) in Africa whereas it is a proposed attribute in South Asia (78.6%). Community involvement in inclusive decision making and implementation is a proposed attribute in Africa (94.1%) and South Asia (100%). Centralized state bureaucracies are unwilling to share decision-making power with community participants, which results in a failure to develop stakeholders' capacity and foster community-facilitated planning and implementation.

4.4.5 Monitoring and feedback

Continuous monitoring and feedback is essential to identify ineffective practices and rules and the need to change environmental governance in these regions. Bridging organizations (NGOs, civil society) play a significant role in upscaling social learning and innovation in these regions whereas experimentation is being proposed attributes in Africa (82.3%) and South Asia (78.6%). Innovation is a proposed attribute in Africa (88.2%) and South Asia (78.6%).

4.4.6 Exploring governance opportunities

Exploring governance opportunities through development strategies (avoiding ideological and institutional dependencies, national and international led strategies) are proposed attributes (58.8% and 71.4%) in these regions. The socio-economic, political and institutional context of Africa and South Asia is different from GN and requires context-specific strategies for environmental sustainability.

4.4.7 Leadership and accountability

Local leaders can act as mediators and brokers to fill in the gaps where the government cannot function properly. This is due to a lack of capacity, funding, capabilities, legitimacy and access to resources. Leadership is proposed as adaptive attributes in these regions (88.2%, 78.6%) although leadership is critical for overall adaptation and resilience of environmental governance. Political and institutional accountability is essential for decentralization of governance structures and increases adaptive capacity which is a proposed attribute (100%) in these regions. Unclear policies, lack of community participation and corruption limit accountability. Lack of downward accountability and clarity in roles division has impeded environmental governance sustainability.

It is evident that existing forms of bureaucracy, lack of power sharing and local politics limit the emergence of multi-level and polycentric adaptive attributes in Africa and South Asia. According to this review, AG requires multiscale and polycentric governance that involves local stakeholders in decision making, implementation, and access to resources. Institutional collaboration, capacity development, context-specific strategies, leadership and accountability are crucial for maintaining a sustainable environment. NGOs, donor agencies and civil society play a significant role in environmental governance to

adopt integrated, flexible and participatory governance, develop social networks, innovate and share knowledge. AG is born in GN where environmental governance allows for broad participation and experimentation to harmonize the system at different levels and scales (Chaffin et al., 2014). This establishes a culture of learning that increases knowledge generation and sharing across a multi-level governance structure. In order to involve local communities, promote innovative ideas, and scale up local knowledge, multi-level learning and social networks are crucial adaptive attributes for sustainable and adaptive environmental governance in these regions.

To promote sustainable environmental governance, the governance institutions in GN have a long history, established capacity and culture, prior political relationships, and responsibilities (Chaffin et al., 2014). In Africa and South Asia, lack of institutional capacity, resources, infrastructure, political will and leadership reduce environmental governance adaptive capacity. Strong leadership and accountability are significant attributes of AG's emergence. Academics, development agencies and policymakers continue to be attracted to AG approaches to environmental governance. Environmental governance needs to be more adaptive, flexible and collaborate with stakeholders at various levels to facilitate the adoption of AG. Using a systematic literature review, this study identified how AG principles emerged and how the concept is being adapted in the South Asian and African regions. This review describes how AG approaches can contribute to sustainable environmental management, what challenges they may face in AG adoption, and how they mitigate them.

4.4.8 Concluding remarks

According to the review, AG principles are embraced in both GN and GS, with some differences in understanding and implementation due to capacity levels. Adaptation of AG principles and attributes faces significant institutional challenges in capacity building and organizational inactivity in GS. The significant challenges associated with persistent institutional barriers, political will, sharing power, trust, and lack of relevant actors' capacity continue to hinder the application of AG principles. Though our review thus supported the tradition of previous conceptual work in AG following Yasmin et al. (2020) which acknowledges the need for flexibility, resilience, and willingness and capacity for change, we also extended a real-world practice, context-sensitive approach to support the emergence of AG in Africa and South Asia. We identified eight principles of AG such as collaboration across sectors and scales, capacity development, coordination between stakeholder and level, community involvement, monitoring and feedback, exploring governance opportunity, leadership, and accountability emergence in these regions. Implementing the AG framework in these regions is challenged but civil society organizations, NGOs and donor agencies as pressure groups are employing force to receive new learning and innovation and make environmental governance more flexible and adaptive.

The review also highlights the emerging and proposed attributes of AGs at the ground level for handling different SESs, as well as the pathways to addressing real-world challenges. The review identified key emerging attributes of AG such as formal and informal network, social learning and community engagement that are practiced in governance structure and processes in GS. On the other hand, integrated, flexible and participatory governance, context-specific strategies, accountability, and capacity development are proposed attributes in these areas. Multilevel and polycentric attributes are both emerging and proposed in these regions. These attributes of AG are interconnected and can be modified to shape the environmental governance system toward sustainability. This article demonstrated each of the attribute's particular manifestations and nuances in Africa and South Asian context though these attributes generally derive from GN contexts. These attributes can provide a guiding framework for AG scholarship considering how to support the investigation of different structures and processes of governance at different SESs. Further researchers need to investigate how AG can be applied to environmental and resource management (waste, water, energy) in the context of GS.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/Supplementary Material.

Author contributions

SA: Writing–review and editing, Writing–original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Funding acquisition, Formal Analysis, Data curation, Conceptualization. JE: Writing–review and editing, Supervision.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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