SA Systematic Review of Institutional Arrangements Fostering Inclusive Environmental Governance Systems in Zimbabwe: The Case of Lake Chivero Catchment Area

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Abstract

Lake Chivero, a vital water resource for Harare, Zimbabwe, and surrounding communities. It draws its water from three main urban centres, Harare, Chitungwiza and Ruwa. These urban areas are characterised by poor environmental governance, which has led to soil and water pollution, sedimentation, and deforestation. The main objectives of the review centre on the lake's status, water quality, drivers of contamination, policy contexts, and opportunities for repair to establish habitability through inclusive governance. The review also analyses the frameworks and methodologies employed by the reviewed studies and reports. This systematic review includes 109 peer-

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reviewed articles, policy-related documents from 2005 to 2025, and community-based reports spanning the past two decades. The review examines how stakeholder engagement, gender-sensitive approaches, and indigenous knowledge are integrated into environmental governance through interdisciplinary methods, including socio-hydrology and political ecology. It evaluates studies with empirical data and transparent methods, excluding those lacking an environmental governance context. Findings show declining water levels, increased nutrients, and microbial contamination from urban and agricultural sources, driven by sewage, land-use changes, and climate variability. Institutional fragmentation and limited participation hinder progress. The review advocates for reforms via multi-level governance and stresses the importance of inclusive, adaptive strategies. It underscores the urgency of coordinated efforts to restore Lake Chivero and safeguard its ecosystem services amid climate change and urban growth.

Keywords*:* environment, management, stakeholder engagement, inclusive management systems, adaptation

INTRODUCTION

Environmental governance in Zimbabwe is characterised by ongoing institutional fragmentation, insufficient enforcement, and limited stakeholder engagement, especially in ecologically sensitive zones such as the Lake Chivero Catchment. As the primary water source for Harare and its surrounding communities, the lake has experienced significant ecological deterioration, including pollution, eutrophication, and biodiversity loss, threatening its ability to meet both human and ecological needs. These issues are exacerbated by rapid urbanisation, industrial waste discharge, and agricultural runoff, underscoring deficiencies in current governance frameworks. Although policies like the Environmental Management Act and principles of Integrated Water Resources

Management exist, concerns persist about their effectiveness in promoting inclusivity, accountability, and resilience. The core problem centres not only on ecological decline, but also on institutional structures that fail to incorporate diverse stakeholders and knowledge systems into decision-making processes.

This review examines environmental governance frameworks in Zimbabwe's Lake Chivero Catchment. The review comprises five parts: an introduction, methodology, findings on current conditions, drivers of contamination, governance, and inclusivity; a discussion of policy implications; and a conclusion with recommendations. This structure ensures a logical flow from problem identification to solutions, contributing to debates on resilience and sustainability in Zimbabwe's environmental management.

CONCEPTUAL FRAMEWORK

This study is anchored in the understanding that inclusive environmental governance emerges from the interaction of institutional arrangements, stakeholder participation, and adaptive management processes within socio-ecological systems. The framework conceptualises Lake Chivero Catchment governance as a dynamic arena where state agencies, local authorities, civil society, and community actors negotiate roles, responsibilities, and power relations. Institutional arrangements, formal policies, legal instruments, and organisational mandates provide the structural foundation, while participatory mechanisms enable knowledge integration and legitimacy. Inclusivity is assessed through the extent to which marginalised groups, indigenous knowledge systems (IKS), and local stewardship are incorporated into decision-making. The framework further recognises external drivers such as climate variability, urbanisation, and economic pressures that shape governance outcomes. By synthesising these dimensions, the

conceptual framework guides the systematic review in evaluating how institutional arrangements foster or hinder inclusive governance in the Lake Chivero Catchment and identifies opportunities to strengthen resilience and sustainability.

THEORETICAL FRAMEWORK

This study is underpinned by an interdisciplinary theoretical foundation that integrates political ecology, adaptive governance, and participatory institutionalism to examine critically environmental governance dynamics in the Lake Chivero Catchment. Political ecology offers perspectives for analysing how historical legacies, socio-economic inequalities, and power imbalances shape access to natural resources and influence decision-making processes. It questions the technocratic, top-down methods often used in environmental policy, showing how dominant actors, such as state agencies and private-sector interests, can marginalise local communities and IKS. In the context of Lake Chivero, political ecology helps explore the structural drivers of exclusion and ecological decline, including urban expansion and industrial pollution. It also highlights the importance of examining whose interests are prioritised by current institutional arrangements and how governance outcomes mirror broader political and economic frameworks.

The Adaptive Governance Theory emphasises the importance of institutional flexibility, learning, and collaboration in managing complex socio-ecological systems under uncertainty. It promotes polycentric governance structures that enable multiple actors to co-manage resources through feedback, experimentation, and shared responsibility. This is especially relevant for Lake Chivero, which faces ecological challenges such as climate variability, eutrophication, and declining water quality, requiring responsive governance. Participatory institutionalism emphasises inclusive rule-making, co-

production of knowledge, and the recognition of diverse actors, such as civil society, traditional leaders, and grassroots networks. It challenges the idea that legitimacy stems only from formal mandates, stressing embeddedness, trust, and social capital. Together, these theories provide a framework for evaluating institutional arrangements, guiding the development of a typology to assess governance models, stakeholder engagement, and resilience in Lake Chivero.

LITERATURE REVIEW

Institutional arrangements refer to the broader social, political, and economic environment in which governance occurs, guided by an institutional framework encompassing the formal arrangements and regulations that govern governance activities (Sarker *et al.*, 2022). In contrast, institutional structure concerns the organisation of governing bodies. The policy framework, as a subset of the institutional framework, focuses explicitly on policies that direct management practices (Padilla *et al.*, 2025). The role of institutional frameworks in the adoption of proactive environmental strategies has been widely debated in the literature, particularly in terms of the external pressures that drive stakeholders to implement voluntary ecological strategies and to go beyond the performance levels required by environmental law (Darnall *et al.*, 2010; Zhu *et al.*, 2013). Institutions have been identified as "regulative, normative and cognitive structures and activities that provide stability and meaning for social behaviour" (Scott, 2005).

The centrality of collaborative environmental governance hinges on how the 'rules of the game' structure the power, benefits, and responsibilities among state agencies, local agencies, the people, and other stakeholders. In Zimbabwe, environmental governance is primarily guided by the provisions of the Zimbabwe Constitution Amendment No. 20 of 2013 that serves as the supreme legal framework. According to section 194(1)(g),

there is a mandate for cooperation and coordinated action among various institutions, stakeholders, and actors to achieve common environmental objectives. Evidence of such collaboration is observed in partnerships between local governments, NGOs, community groups, and academics focused on water resource management. However, political disagreements and conflicts of interest sometimes impede these collaborative efforts, especially when the central government opposes initiatives led by opposition parties, indicating challenges in fostering unified cooperation (Muchadenyika and Williams, 2018).

Lake Chivero is the primary water source supporting a total population of 2 427 231, up from 200 000 in the 1950s, at a growth rate of 1.3% (ZimStat, 2022), for Harare and adjacent towns of Chitungwiza, Norton, Epworth, and Ruwa. Key areas of concern for the catchment area include water quality and pollution fluxes, environmental aspects, urban water management and inclusive stakeholder participation (Magadza, 2009). Inclusive governance has become a key approach for addressing the needs of diverse communities by promoting strategies that enhance government responsiveness. The increasing polarisation across social, political, economic, and environmental spheres presents both challenges and context-specific opportunities. This approach goes beyond formal institutions by involving activists, organisations, and social movements to advance social justice and build equitable societies that resist authoritarianism and injustice (Hariram *et al.*, 2023).

This study provides a comprehensive systematic review of the various institutional arrangements that promote inclusive and sustainable environmental management systems within the

Lake Chivero Catchment. Recognising the crucial importance of effective governance structures, the review examines multiple aspects, including the current condition of Lake Chivero, its water quality, the main drivers of environmental degradation such as pollution and desiccation, and the broader policy frameworks shaping management practices. The study analyses these interconnected factors to identify intervention opportunities and strategies for enhancing the lake's ecological health and social sustainability. This review aims to offer valuable insights into how inclusive governance can support the restoration and sustainable utilisation of Lake Chivero's resources, thereby fostering resilient and habitable ecosystems in the region.

RESEARCH METHODOLOGY

The study conducted a systematic review of institutional arrangements that promote inclusive environmental management systems in Zimbabwe. A systematic review is a structured process for collecting, analysing, and combining data related to a specific topic or research questions (Owens, 2021). It follows a defined protocol and is usually carried out by experienced researchers working with subject matter experts to ensure rigour and relevance (Higgins *et al.*, 2019). The methodology adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, consisting of five sequential stages: (1) defining inclusion criteria to identify eligible studies; (2) performing a thorough, systematic search across relevant databases; (3) screening and selecting studies based on set eligibility criteria; (4) systematically extracting key data from the selected literature; and (5) synthesising the extracted data to achieve the research objectives (Figure 1).

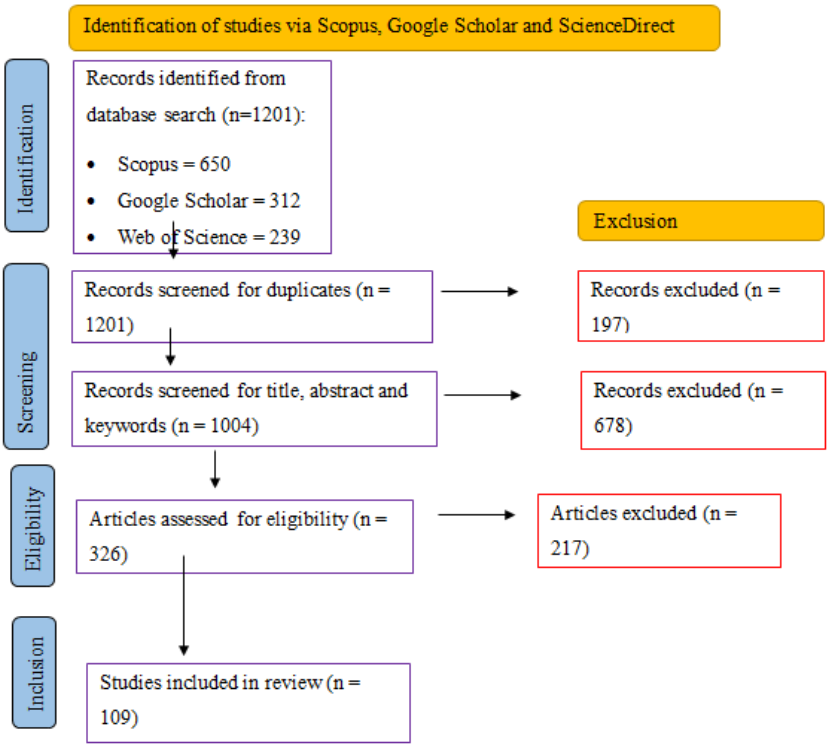

Figure 1: *PRISMA (2020) Flow of Information Across the Various Stages of a Systematic Review* (Authors, 2025)

To systematically assess institutional arrangements that foster inclusive environmental management systems in Zimbabwe, the study first establishes a set of inclusion criteria informed by contemporary African contexts. Recognising the importance of scholarly credibility, this review exclusively considers peer-reviewed literature, including journal articles and book chapters, that directly engage with Lake Chivero's status, water quality, drivers of contamination and desiccation, policy contexts, and opportunities for repair to establish habitability through inclusive governance. For consistency and to ensure quality control, Grey literature such as working papers, government

reports, and institutional publications that often lack standardised peer-review processes, were deliberately excluded. The temporal scope spans publications from 2010 to 2025. This period captures the Harare Lake Chivero Catchment area that has been experiencing environmental and socio-economic challenges which have resulted in the degradation of natural resources, loss of biodiversity, and a decline in essential ecosystem services.

Building on the inclusion criteria outlined above, a comprehensive literature review to identify peer-reviewed publications on institutional arrangements that foster inclusive environmental management systems was conducted. To ensure exhaustiveness and disciplinary breadth, three major electronic databases: Scopus, Google Scholar and IEEE Xplore were utilised. This initial search yielded a total of 1 201 records, distributed as follows: Scopus (650), Google Scholar (312) and Web of Science (239). To refine the search and ensure thematic alignment, the following Boolean search string was applied:

> ("inclusive" OR "engaging" OR "participatory" OR "collective") AND ("institutional arrangements" OR "institutional frame*" OR "regulatory frameworks" OR "governance structures" OR "systems") AND (“Environmental Management Systems”).

This string was designed to capture literature that engages explicitly institutional arrangements that foster inclusive environmental management systems in the Lake Chivero Catchment area. The use of wildcard operators and logical connectors (AND/OR) enabled a targeted yet inclusive retrieval of relevant studies. All 1 201 records were uploaded into Rayyan, an AI-powered systematic review management platform, where they were screened for relevance, duplicates were removed, and data were extracted in accordance with the review protocol. This multi-stage strategy ensures a robust and thematically coherent evidence base for analysing adaptive

governance models that support climate-resilient urban transitions across Southern Africa.

Given duplicate entries across databases, 1,201 records were imported into Rayyan. An initial check found 197 duplicates, and were excluded. The remaining 1 004 records underwent first-round screening based on titles, abstracts, and keywords, evaluating geographical relevance, thematic fit with inclusive institutional arrangements, and methodological rigour. At this stage, 678 papers were excluded mainly for not focusing on climate resilience and adaptive governance. A second screening reviewed 326 papers where 217 were excluded, mostly descriptive and not meeting criteria. Multiple reviewers conducted the process, reaching consensus in disagreements. Ultimately, 109 papers met all criteria and were analysed, underpinning institutional arrangements for inclusive environmental management in Lake Chivero.

Aligned with the goals of this systematic review, a structured data extraction from the final set of 109 peer-reviewed studies using Rayyan was performed. A custom extraction template was created to gather information across five key areas: (i) authorship and geographic scope, (ii) thematic focus, (iii) methodological approach, (iv) scenario details, and (v) key modelling assumptions.

This systematic review aims to comprehensively evaluate the current status of the lake, analyse long-term water quality trends, and identify the key socio-environmental drivers influencing contamination levels and the drying process. Additionally, it seeks to critically examine existing policy frameworks and explore opportunities for inclusive governance that can facilitate ecological restoration and improve habitat sustainability. To accomplish these objectives, a detailed and structured data extraction process was undertaken,

encompassing 109 peer-reviewed studies. The data extraction was facilitated using Rayyan, an advanced systematic review tool, and guided by a specially designed template that captured five essential dimensions: (1) authorship and geographic coverage, to assess regional research representation and equity; (2) thematic focus, to map the distribution of research themes such as pollution, biodiversity loss, and governance strategies; (3) methodological approaches, to understand the diversity of evidence generation, including participatory research, spatial analysis, and modelling techniques; (4) scenario analysis, to evaluate how future projections and stakeholder-driven pathways are incorporated into planning processes; and (5) key assumptions underlying modelling efforts, to assess the robustness, validity, and applicability of the simulation tools employed. This comprehensive and systematic framework facilitated an in-depth synthesis of evolving knowledge systems, methodological orientations, and governance structures, providing a solid foundation for developing evidence-based, community-engaged interventions for land diagnostic repair strategies and sustainable habitat management.

FINDINGS

This section presents key findings of the systematic review that examined peer-reviewed literature, policy reports, and case studies on institutional arrangements that foster inclusive environmental management systems.

The sustainability of current urban water-cycle practices concerning water quantity and quality management has declined in the Lake Chivero Catchment area (Nhapi, 2008). The lake remains in a severe hypereutrophic state, caused mainly by persistent high nutrient loadings and evidenced by significant changes in its physicochemical and biological characteristics (Mhlanga *et al.*, 2006; Nyarumbu and Magadza, 2015; Tendaupenyu and Magadza, 2017). Overall, water quality

has been worsening since the 1960s, with conditions deteriorating further due to ongoing pollution (Mhlanga *et al.*, 2006; Shekede *et al.*, 2008).

Measurements from various studies on physicochemical parameters indicate that Lake Chivero is degraded. The lake is hypereutrophic, with phosphorus and nitrogen levels of 2.77 mg/L and 3.21 mg/L. Between 2010 and 2011, phosphorus averaged 2.77 mg/L (Nyarumbu and Magadza, 2015). Surveys conducted from December 2005 to March 2006 found phosphate levels of 1.2 mg/L, up from 0.3 mg/L in 2001 (Shekede *et al.*, 2008). Nutrient input from wastewater, industrial discharge, and agriculture leads to algal blooms and oxygen shortages, impacting biodiversity, causing fish kills, and changes in aquatic communities (Dalu *et al.*, 2016; Utete *et al.*, 2018).

The estimated total phosphorus loading into Lake Chivero for 2010 was 564 tonnes per annum (Nyarumbu and Magadza, 2015). Non-point sources contributed approximately 492.5 tonnes of phosphorus per annum, while point sources contributed 634 tonnes per annum. Continued high nutrient loads, primarily from sewage and industrial effluents discharged into the Marimba, Mukuvisi, and Manyame rivers, significantly affect in-lake water quality (Shekede *et al.*, 2008). Modelling results suggest an 82% decrease in nutrient loading would reduce phosphorus from 564 to 34.1 tonnes per annum, potentially improving the lake from a hypereutrophic to a eutrophic state over 10 years (Nyarumbu and Magadza, 2015).

Eutrophication has caused excessive growth of aquatic weeds and cyanobacteria blooms since 1963 (Dalu *et al.*, 2016; Mhlanga *et al.*, 2006; Shekede *et al.*, 2008), often reducing

water transparency (Dalu *et al.*, 2016). Large outbreaks, such as the 1985 water hyacinth that covered 35% of the lake, have been recurring (Mhlanga *et al.*, 2006). Although biological control decreased coverage to 3-5% by 2000, ongoing growth depends on reducing nutrient loadings (Mhlanga *et al.*, 2006; Shekede *et al.*, 2008). Cyanobacterial blooms, mainly Microcystis and Anabaena, Multiple case studies indicate that severe siltation has reduced the lake's maximum depth from 27.4 metres in 1966 to 20 metres, altering its physical and ecological characteristics (Nyarumbu and Magadza, 2015).

A detailed lake survey found that surface sediments consist of approximately 24% sand, 22% silt, and 54% mud (Tendaupenyu and Magadza, 2017). The high levels of soluble reactive phosphorus, ammonium, total phosphorus, total nitrogen, and total organic carbon in the mud sediments indicate substantial nutrient enrichment that promotes eutrophication and degrades water quality. Elevated pH, dissolved oxygen, and nitrate concentrations in the sand sediments may also affect biogeochemical processes, potentially disrupting nutrient cycling. These sediment features highlight the importance of sediment composition and nutrient fluxes as key factors affecting water quality in the catchment, contributing to problems like algal blooms, reduced oxygen levels, and ecological imbalance (*ibid.*).

The ongoing sustainability of urban water-cycle management practices in the Lake Chivero Catchment area has declined, particularly in terms of water quantity and quality (Nhapi, 2008). Pollution loads are increasing annually faster than the development of adequate treatment facilities, while the diversity of pollutants is expanding due to various industrial activities (Magadza, 2003). Poor waste management drives pollution, with

much waste uncollected (Nhapi, 2008). Pollution is also linked to poor urban growth management and uneven investments in waste infrastructure in the city and peri-urban areas. Research on Lake Chivero attributes pollution mainly to failures in catchment management (Magadza, 2003).

Other studies have observed that the recycling approach using sewerage treatment plants along rivers to maintain water quality became ineffective as systems became overloaded, exacerbating water pollution (Nhapi *et al.*, 2003). At the beginning of the 21st century, expectations grew that new environmental laws would promote sustainable water resource management (Nhapi and Gijzen, 2002). The Environmental Management Act, enacted in 2003, was driven by hopes of improving catchment management (Government of Zimbabwe, 2003). Nevertheless, current evidence suggests that conditions have not improved, with continued poor environmental management and persistent high pollution levels (Hove and Tirimboi, 2011; Masere *et al.*, 2012).

Climate change has led to decreased water availability in the catchment area over recent years. Zimbabwe has experienced more frequent drought cycles, with meteorological records indicating four seasons of below-average rainfall in the past decade alone (Toriro, 2020). The review highlights that two upstream dams, Seke Dam and Harava Dam, were decommissioned from water abstraction in 2019 and 2020, respectively, due to water levels dropping below the minimum required for treatment and consumption. Additionally, bio-monitoring showed that Lake Chivero's water levels have significantly declined, concentrating existing pollutants in a smaller volume of water and intensifying the toxic effects of nutrients and heavy metals (Magadza, 2018). Records from the Zimbabwe National Water Authority (ZINWA) also show

declining water levels, with the water reservoir level at Lake Chivero dropping from 94.1% in 2004 to 55.3% in June 2020.

Urban expansion into wetlands in Harare and Chitungwiza has compromised their ecological functions, leading to increased surface runoff, sedimentation, and pollution of river systems that feed into Lake Chivero. Unplanned development in areas such as parts of Kuwadzana and Budiriro, low-income suburbs of Harare, further exemplifies wetland encroachment. These developments, carried out by private developers and the Harare municipality, often occur without adequate environmental planning. Similarly, new construction in Budiriro (Figures 2 and 3) has impinged on wetlands and river courses. Case studies of satellite imagery analyses from 2009 to 2019 (Figures 2 and 3) have documented significant wetland loss over this period (Cunliffe, 2020).

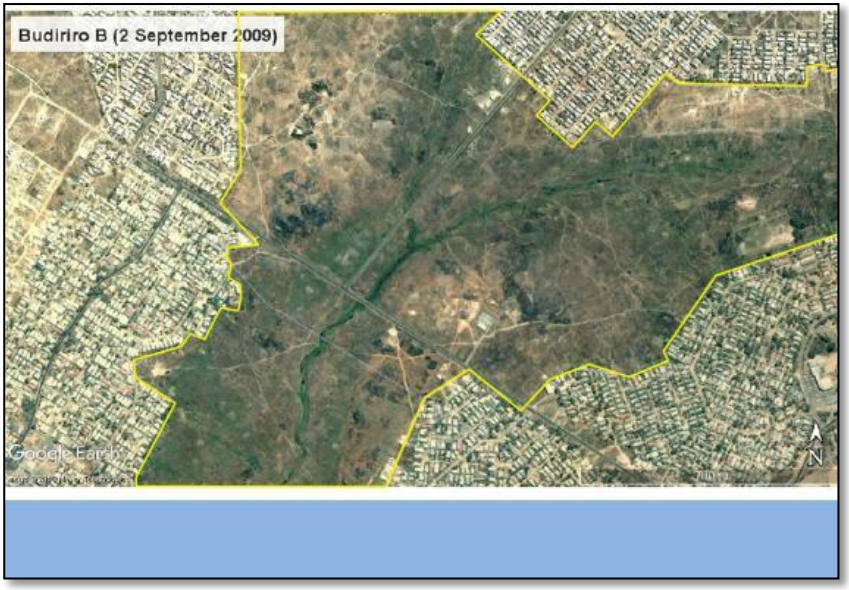

Figure 2: *Budiriro B (02 September 2009)* (Cunliffe, 2020:15)

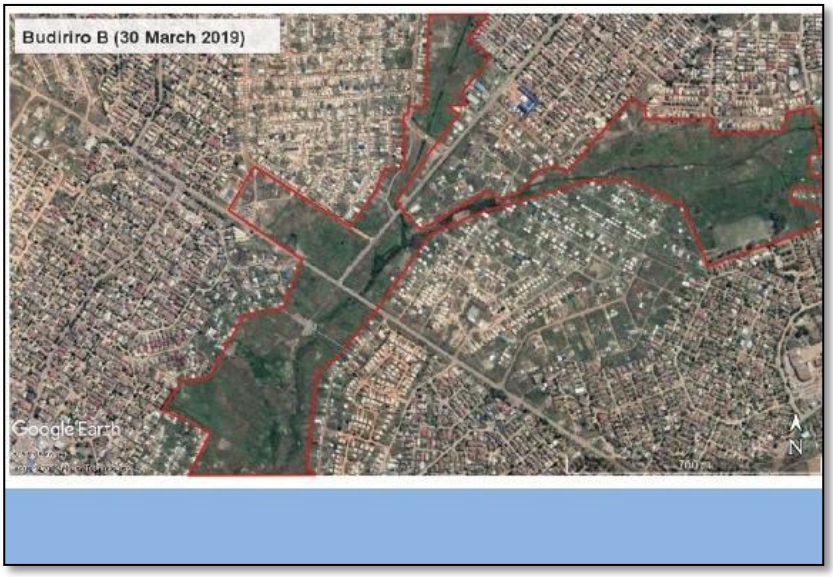

Figure 3: *Budiriro B (02 September 2009)* (Cunliffe, 2020:15)

Despite the risks, the literature also suggests that the cumulative impact of wetland loss across these sites weakens the catchment's resilience, worsens pollution flows, and jeopardises the sustainability of Lake Chivero as a vital water source for the catchment area.

Literature indicates that managing the catchment area is a collaborative responsibility among different government ministries and agencies. They work together to promote sustainable water management, safeguard the environment, plan land use, and support agricultural development within the catchment regions.

The Environmental Management Act [Chapter 20:27], enacted in 2002, serves as the primary legal framework for overseeing activities within the catchment area. The agency oversees solid waste management, enforces environmental regulations, issues

protection orders, and pursues legal actions against violators. The Act mandates compliance with environmental principles and rights detailed in Section 4 (Environmental Management Agency, 2007). Over the last decade, the Environmental Management Agency (EMA) has been instrumental in controlling pollution and fostering sustainable management of Lake Chivero Catchment, the primary water source for Harare, Epworth, Ruwa and Chitungwiza. The EMA Act promotes participatory governance and catchment-wide planning. EMA has collaborated with civil society organisations (CSOs) such as the Harare Wetlands Trust and the Upper Manyame Sub-Catchment Council to monitor pollution, promote sustainable land use, and involve communities in stewardship activities (Muchini *et al.*, 2018). These partnerships have exemplified the Act's focus on inclusive environmental management and align with broader lake-basin management principles (Magadza, 2010).

Environmental Impact Assessments (EIAs), required by the Environmental Management Act [Chapter 20:27], are essential for managing the Lake Chivero Catchment. They regulate development and reduce pollution risks. Over the past decade, EIAs have evaluated the impacts of urban growth, industry, and infrastructure, ensuring pollution control and sustainable land use (Dube, 2015). Case studies reveal that EIAs identified high-risk effluent zones and guided the placement of waste treatment sites (Nhapi, 2009). However, their effectiveness is limited by weak enforcement, lack of public participation, and political interference, leading to some projects proceeding without mitigation (Chikozho, 2010). Despite these challenges, EIAs remain vital for catchment management, promoting accountability and ecological stewardship.

The Public Health Act [Chapter 15:09] governs the management of solid waste, covering institutional refuse, at both local and

national government levels. Under section 83, the Harare City Council, the Epworth Local Board, the Ruwa Town Council, and the Chitungwiza Municipality bear primary responsibility for safeguarding public health, including water quality, sanitation, and disease control. For the past decade, the Public Health Act has complemented the EMA Act by addressing health risks from environmental pollution, particularly water-borne diseases, arising from the discharge of raw sewage. The review highlights that this provides a statutory basis for inter-agency collaboration between health and environmental authorities in managing catchment health.

The Water Act [Chapter 20:24] of 1998 serves as Zimbabwe's main legal framework guiding water resource development and use (Musemwa, 2008). It establishes a legal basis for managing the catchment area through decentralised governance and pollution control strategies. The act establishes Catchment and Subcatchment Councils responsible for water allocation, dispute resolution, and stakeholder coordination within hydrological boundaries. These councils are empowered to issue water permits and enforce conservation measures, especially during periods of scarcity (Mazvimavi, 2010). In the Lake Chivero area, where eutrophication and urban runoff threaten water quality, the act's pollution control provisions are vital, mandating users to prevent contamination and allowing authorities to impose penalties for violations (*ibid.*). The Sub-catchment Councils Regulations of 2000 further facilitate stakeholder participation, ensuring rural district councils, farmers, and urban authorities are included in decision-making.

The Water Pollution Control Unit (WPCU), operating under the Ministry of Land, Agriculture, Fisheries, Water and Rural Development as specified in the Water Act, is responsible for monitoring water quality and enforcing regulations on both government and non-government entities for violations of water

standards. The 2013 National Water Policy (NWP) emphasises the importance of adequate water supply for urban development. Developed during the Government of National Union (GNU), the NWP acknowledges the collapse of the urban water sector and highlights the necessity for rehabilitation, as it was once considered the best in southern Africa. The policy outlines efforts to support sector recovery, including activities aimed at preventing further deterioration of water and sanitation infrastructure before irreversible damage occurs (Government of Zimbabwe, 2012).

An evaluation of environmental governance in the literature highlights the use of the World Lake Vision (WLV), created by the International Lake Environment Committee (ILEC) and UNEP-IETC that establishes seven guiding principles for the sustainable management of lake basins. Assessing the management of Lake Chivero against the seven principles a structured framework for enhancing inclusive governance and sustainable catchment management. These principles, formulated by the ILEC and UNEP-IETC, identify key areas for improving governance to mitigate ongoing environmental degradation and institutional fragmentation.

Table 1: *Evaluation of the Management of Lake Chivero Catchment Area against the World Lake Vision Committee Principles* (Magadza, 2008; Musemwa, 2008; Chikozho, 2010)

Principle	Compliance Status	Comment
A harmonious relationship between humans and nature is essential for the sustainable use of lakes.	Conflicts between nature and humans.	Low adherence to policy and legal provisions by society, industry, and state institutions.
A lake drainage basin is the logical starting point for planning and management actions for sustainable lake use.	Principle not applied	There are no linkages between different jurisdictions and management authorities within the drainage basin, despite the existence of institutional

		structures (watershed councils) established to facilitate them.
A long-term, preventative approach directed to preventing the causes of lake degradation is essential.	No evident long-term plan.	Management strategies now involve responding to crises.
Policy development and decision-making for lake management should be based on sound science and the best available information.	Poor application of the scientific approach.	During the initial planning of the lake, scientific understanding of aquatic system functions was limited, but later research has established a solid knowledge base for managing the lake.
The management of lakes for their sustainable use requires the resolution of conflicts among competing uses of lake resources, taking into account the needs of present and future generations and of nature.	No attempt to resolve conflicts.	The central conflict centres on the lake's multiple uses: drinking water, recreation, fisheries, and wastewater reception. The state opposes stakeholders' participation.
Citizens and other stakeholders should be encouraged to participate meaningfully in identifying and resolving critical lake problems.	Principle not adhered to.	The state system allows minimal inclusive participation by non-state entities. Managers show no intention of consulting with ratepayers or other technical expert groups, such as universities and the Zimbabwe Academy of Sciences.
Good governance, based on fairness, transparency and empowerment of all stakeholders, is essential for sustainable lake use.	Poor, but punitive governance.	Although the national water authority was founded on this principle, it has become a revenue collector mainly, offering little in return. Breached sewers remain unattended for weeks or months. Meanwhile, the municipality's refuse collection is infrequent.

The core concept emphasises the establishment of a balanced and harmonious relationship between human activities and the natural environment. Achieving this balance requires maintaining ecological integrity, while also pursuing socio-economic development. In the Lake Chivero Catchment, various environmental stressors, including nutrient overloads, sewage effluent, and industrial discharges, pose significant threats to local biodiversity and the health of nearby communities. To address these issues and promote sustainable management, strategies such as adopting environmentally friendly land use practices, restoring natural riparian zones, and implementing strict pollution regulations are essential. These measures not only align with the overarching principle of ecological-socioeconomic harmony, but also contribute to the long-term sustainability of the ecosystem and the community.

Effective management of the lake basin as a hydrological unit is crucial for achieving integrated water resource planning. Although the Water Act [Chapter 20:24] establishes the framework for catchment and sub-catchment councils, there remains a significant challenge in fostering coordination among urban, peri-urban, and rural areas. Enhancing basin-wide governance by developing harmonised land-use policies and fostering cross-sector collaboration can play a vital role in ensuring that activities upstream do not adversely affect water quality downstream. Such integrated management approaches are essential to address the complexities of water governance across diverse geographical and administrative zones.

The third principle emphasises the importance of adopting a long-term and preventive strategy to combat lake degradation. Historically, the management of Lake Chivero has been predominantly reactive, characterised by a lack of proactive measures and adaptive planning. To effectively address future environmental challenges, it is crucial to integrate scenario-

based planning, climate resilience strategies, and early warning systems. These measures would enable stakeholders to anticipate and respond to threats, such as population growth and land-use changes, more proactively. This approach aligns with section 13 of the Constitution of Zimbabwe (Amendment No. 20 of 2013) that underscores the importance of inclusive and sustainable development practices.

Sound science and data-driven decision-making, central to the fourth principle, are frequently underused in current management practices. Although previous research has provided insights into Lake Chivero's trophic status, there remains a lack of comprehensive, continuous monitoring systems. To address this gap, investing in advanced tools such as Geographic Information Systems (GIS), remote sensing technologies, and participatory data collection methods, could significantly enhance stakeholder engagement. These improvements would facilitate the generation of actionable insights, thereby strengthening the transparency and effectiveness of policy-making processes.

The fifth and sixth principles focus on resolving conflicts among stakeholders and encouraging active and meaningful participation. In the catchment area, there are various actors, including urban authorities, farmers, and industries, each with often conflicting interests. To address this, establishing platforms for diverse stakeholders to engage in dialogue, along with strengthening the representation of local communities in subcatchment councils, can promote cooperation and reduce disputes over water resources. Additionally, employing participatory mapping techniques and implementing environmental education programmes can serve to empower marginalised groups and amplify their voices in decision-making processes.

The seventh principle emphasises the critical role of good governance that encompasses fairness, transparency, and accountability. Although legal frameworks are in place to support these principles, their enforcement often faces challenges, leading to low levels of institutional trust among the public. Implementing and integrating performance audits, open data portals, and mechanisms for citizen oversight, can help restore public confidence and promote equitable resource management. Constitutional provisions further reinforce these reform measures: section 264 on devolution empowers local authorities, while section 73 on environmental rights enables communities to participate in environmental stewardship actively. Collectively, these policies and constitutional guarantees aim to strengthen governance structures, promote participatory decision-making, and foster sustainable development by increasing community engagement and transparency.

Aligning catchment governance with the principles of the World Lake Vision provides a strategic framework for implementing inclusive, resilient, and evidence-based management practices. Achieving this requires institutional reforms, technological investments, and community empowerment to enhance ecological health and ensure sustainable water resources for future generations, informed by these key principles of governance dynamics (Table 2).

Table 2: *Key Principles of Governance Dynamics Relevant to the Catchment Area* (Authors, 2025)

Key Principles	Description	Relevance
Path dependency	Historical paths shape decision-making and strategies in institutions. Once set, these patterns are intricate to alter, leading to enduring behaviours (Thelen, 1999).	The ongoing influence of catchment systems continues to shape today's strategies and challenges, underscoring the importance of considering historical context in reform efforts.

Institutional compatibility	The extent to which institutions support and reinforce one another enhances governance effectiveness by ensuring coherent, aligned policies across levels and sectors. (Li *et al.*, 2018).	Alignment between local governance practices and national policies can resolve conflicts and inefficiencies in service delivery.
Institutional isomorphism	Institutions tend to align over time via coercive, mimetic, and normative forces DiMaggio and Powell (1983).	Municipalities might adopt similar management technologies or policies in urban water governance because of regulatory pressures or the successes of their peers.
Adaptive efficiency	The ability of institutions to change and adapt over time in response to evolving conditions (1990).	Essential for managing complex and evolving urban water systems in Zimbabwe, especially when dealing with unpredictable events like droughts or technological changes.

These principles emphasise the importance of implementing institutional reforms to overcome existing limitations and enhance compatibility, investing in technology to support standardised and data-informed management practices, and empowering local communities to achieve inclusive, adaptable, and context-specific governance. Incorporating these principles into the management strategies of Lake Chivero Catchment area facilitates ecological recovery and ensures sustainable water resources in the long term.

DISCUSSION

The review has emphasised Lake Chivero's worsening ecological condition, characterised by decreasing water levels, nutrient build-up, and microbial contamination. These findings match

global trends observed in urban catchments facing rapid population growth, poor waste management, and climate variability. Evidence indicates that sewage inflows, land-use changes, and agricultural runoff are the main sources of pollution, exposing systemic governance failures in Harare, Chitungwiza, and Ruwa. A recurring issue in the literature is institutional fragmentation, in which overlapping responsibilities among agencies weaken enforcement of environmental laws and accountability. This lack of coordinated governance hinders effective monitoring and remediation efforts. Furthermore, community participation remains limited, especially among marginalised groups such as women and indigenous peoples, who are often excluded from decision-making processes, thereby reducing the potential for inclusive governance and adaptive strategies.

The review highlights the importance of interdisciplinary frameworks, such as socio-hydrology and political ecology, for understanding the issues facing Lake Chivero. These approaches demonstrate how hydrological processes are connected to social factors like power relationships, resource access, and cultural traditions. Including indigenous knowledge offers valuable options for sustainable management, though its use in formal policies remains limited. Gender-sensitive strategies are acknowledged but unevenly implemented, indicating a need for their broader integration into environmental governance. Policy reviews from 2005 to 2025 show a gradual recognition of the importance of ecosystem services, but actual implementation remains slow. Challenges such as weak enforcement, limited funding, and political inaction continue to worsen the condition of Lake Chivero. The findings emphasise the need for concrete reforms with binding commitments, accompanied by transparent monitoring and accountability systems.

The review highlights repair opportunities via reforms in multi-level governance, emphasising coordinated actions across government levels to boost accountability and adaptive strategies. Stakeholder engagement, especially through participatory water governance, is key to rebuilding trust and fostering collective action. Combining indigenous knowledge with scientific monitoring enhances resilience to climate variability. Practical steps like improved sewage treatment and catchment management can restore ecological balance. Lake Chivero exemplifies conflicts between urban growth and sustainability in Sub-Saharan Africa. The findings stress that water security depends on resolving governance issues and integrating environmental concerns.

CONCLUSION

This systematic review highlights the major ecological and governance issues facing Lake Chivero, a vital resource for Harare and nearby urban areas. Based on 109 diverse sources over 20 years, the data reveal a concerning decline in water quality, sediment accumulation, and ecosystem health, driven by urban growth, poor waste management, and climate variability. The review emphasises that fragmented institutional systems and limited stakeholder involvement have worsened these problems, hindering progress. The study also identifies promising reforms. Interdisciplinary methods, especially those rooted in socio-hydrology and political ecology, provide strong frameworks for integrating scientific data with community insights. Incorporating gender-sensitive approaches and indigenous knowledge is essential for developing inclusive and adaptable governance. To restore Lake Chivero's health and safeguard its ecosystem services, coordinated governance reforms across multiple levels are vital, focusing on transparency, participatory planning, and long-term resilience. This review advocates a shift in environmental governance, one that embraces complexity, empowers local communities, and

links ecological restoration with social equity. The future of Lake Chivero depends not only on technical solutions, but also on political resolve to implement inclusive, evidence-based changes.

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