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Coastal wetlands and climate change in Ghana: Analysis of the regulatory framework

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Abstract
Despite constituting less than 6 percent of the global landmass, coastal wetlands contribute enormously to the global economy especially the economies of developing countries such as Ghana. However, climate change and other anthropogenic activities have brought wetlands are constant threat of destruction. Using coastal wetlands in Ghana as a case study, this paper examines the adequacy of environmental laws and policies for protecting coastal wetlands in the context of climate change. Thus, the paper examines existing environmental laws and policies for protecting coastal wetlands against natural degradation and anthropogenic destruction with reflections on climate change impacts and how they negatively affect coastal wetlands across Ghana. The analysis establishes a comprehensive environmental framework (laws, policies, and regulations) for protecting coastal wetlands in particular and the environment more broadly. However, there is a low enforcement regime that undermines the effectiveness of the laws and policies in protecting the environment. To effectively protect coastal wetlands in the face of various environmental and climate change challenges, coastal wetlands management and conservation must be decentralized so that resources can be moved from the national to the local levels for rapid response and enhanced protection of the vulnerable wetlands from degradation.

Keywords
Coastal wetlands; climate change; coastal mangroves; environmental law and policy; environmental protection; Ramsar sites

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1. Introduction

Coastal wetlands such as mangroves, salt marshes, and tidal flats play a pivotal role in socioeconomic development, particularly in developing countries (Yi et al., 2024; Ghosh & Swades, 2023; Duncan et al., 2023; Constanza et al., 2021; Kankam et al, 2013; Addo et al, 2011;). Coastal wetlands constitute a mere 6% of the total landmass but they contribute to the global economy (Durand et al., 2022; Reis et al., 2017; Vorosmarty et al, 2009). Coastal wetlands provide a multitude of invaluable benefits, ranging from facilitating tourism and recreational activities to enabling transport, food production, and energy generation. Coasts and wetlands are dynamic systems that are continually experiencing morphological changes at different spatiotemporal scales in response to both geomorphological and oceanographic factors (Avornyo et al., 2023; Neumann et al, 2015). Despite their ecological and economic significance, coastal wetlands are vulnerable ecosystems in terms of sensitivity and self-sustainability. In sub-Saharan Africa, coastal wetlands are vulnerable to natural and human interferences. An estimated 50% of the majority of the global urban communities are situated in coastal areas with 40% of the global population living within 100 km of the coastal and wetland zones. The human activities generated around a growing population around coastal areas have also negatively impacted the natural ecology of these zones (Durand et al., 2022).Furthermore, countries are heavily reliant on natural resources such as fisheries, fossil fuel, minerals, and other economically valuable resources which are found in the coastal wetlands (Coffel et al, 2018). For instance, industrial activities and operations such as ports and harbours, oil and gas production, generation of thermal power, fishing, and fish farming, as well as other agricultural activities along the coast adversely affect the sustainability of wetlands (Boateng et

al., 2016; Coffel et al., 2018). Coastal wetlands also find themselves under heightened peril from the far-reaching impacts of climate change (Ankrah, 2018; Kumi et al., 2015). Climate change and the associated increase in global temperatures have consequences for the health and sustainability of coastal wetlands. (Russell, 2012; Coffel et al, 2018). Increased sea surface temperature has led to the melting of glaciers, causing oceans to open and expand. This in turn threatens coastal zones and wetlands across the globe (Durand et al., 2022). Aside rising temperatures and sea level rise, changes in rainfall intensity and frequency, and extreme climatic events such as drought, flooding, and storm frequency affect coastal wetlands adversely (Salimi et al., 2021; Goose et al, 2010; Thomas et al, 2017; Wang et al., 2016). Rising sea levels can cause increased flooding, erosion, habitat loss, and changes in species composition. According to the Intergovernmental Panel on Climate Change (IPCC)'s Special Report on the Ocean and Cryosphere in a Changing Climate (2019), coastal flooding will become more frequent and severe as sea levels rise. Furthermore, the IPCC's Fifth Assessment Report states that climate change can modify precipitation patterns, altering freshwater imports as well as salt levels and nutrient dynamics. Rising temperatures can have an impact on wetland species' growth and survival, including their reproductive cycles. Furthermore, extreme weather events such as hurricanes, typhoons, and heavy rainfall can harm coastal wetlands by causing erosion, saltwater intrusion, and physical destruction (IPCC, 2021; Wang et al., 2016). In addition to its primary impact on marine habitats, ocean acidification can also have an impact on coastal wetlands, especially those near estuaries (Pacella et al., 2024; Osborne et al., 2022). Climate change and human activity pose grave threats to Ghana's coastal wetlands (Ankrah, 2018). The biophysical characteristics of coastal wetlands have been adversely impacted by many risks, leading to changes in shoreline morphology and the disappearance of aquatic ecosystems and wetlands (Boateng et al, 2016; Duncan et al., 2023). While coastal wetlands by some Acts of Parliament, Regulations, and Policies there is limited literature which evaluates the phenomenon of wetlands loss arising from climate change impacts and the efficacy of existing laws in the management of coastal wetlands in Ghana. For this reason, this review paper aims to evaluate wetlands conservation and management under Ghana's regulatory framework. The paper is divided into four parts. The introduction takes the first part, which is then followed by an overview of climate change and coastal wetlands. The next section appraises the regulatory framework for the protection of wetlands in Ghana. And the final part concludes with key findings and recommendations.

2. Climate change and coastal wetlands: impacts, vulnerabilities, and emerging interventions

Coastal wetlands are fragile ecosystems that are characterized by sensitivity, complexity, dynamism, self-sustainability, and their ability to cope with natural and artificial inducing negative impacts. The ecosystems that exist in wetlands serve as the transitional link between aquatic and terrestrial ecosystems which provide important ecosystem services (Becani et al, 2016; Wu et al, 2018). Rapid urbanization and industrialization, as well as extreme weather conditions have led to the degradation of coastal wetlands (Keddy, 2010). Climate change impacts threaten coastal areas in Africa because wetlands are sensitive, and therefore, vulnerable to climate impacts (Cheung et al, 2010). This puts many aquatic species and the entire coastal ecosystem at risk of extinction. The coastal ecosystem contributes to over 50 percent of the dietary protein of the population on the continent which may be at risk due to the impact of climate change (Gemeda & Sima, 2015). The coastal freshwater ecosystem may also be affected by drought which may lead to nutrient reductions as a result of reduced river inflows which will lead to less ecological production and subsequent reduction in freshwater fish production (Lam et al, 2012). This is likely to lead to reduced protein sources and accompanying reduction in income for fishers in most communities on the continent. Given this, the population of the continent can be threatened by projected sea level rise and flooding as well as drought which will go a long way to negatively affect the coastal population, infrastructure, and economy (James & Washington, 2013). Climate change has significantly altered the topographical nature of coastal wetlands globally. established that over 50% of the world's wetlands have been lost since the 1900s, with the rate increasing 3.7 times during the 20th and 21st centuries. The 21st century has witnessed a massive rise in sea levels of over 1.8 ± 0.5 millimeters per year, accompanied by an increased surface temperature of about 0.6°C (Jonah et al., 2016). Rising sea levels in coastal areas cause environmental challenges such as wetland flooding, saltwater intrusion into freshwater sources, and human displacement. The coastal wetlands in Ghana are significant ecological resources such as roosting grounds and nesting sites for various migratory and territorial birds, marine species, provision of foods for the populace as well as many other plant genetics materials for research (Ministry of Environment, Science, Technology and Innovation, 2022). Table 1 captures the official wetland Ramsar sites and their properties.

Despite their significance, the constant rise in sea levels has detrimental impacts, including accelerated erosion, coastal flooding, threats to piers, docks, and seawalls, shifts in estuarine salinity levels, intrusion of coastal river

Table 1. Ramsar Sites in Ghana (MESTI, 2022)

Name and Site Number	Location	Size (km2)	Description	Major Impacts affecting the site
Keta Complex (567)	5°55'N, 0°50'E	1,010.22	Open lagoon with brackish water from the Volta River. Coastal savannah grasses with pockets of trees and bushes. Largest seabird populations in Ghana's coastal wetlands.	The Keta Lagoon Complex Ramsar site faces both natural and manmade challenges to the ecosystem and biodiversity. The overexploitation of resources has altered the KLCRS's flora and fauna. Certain species no longer exist, while others have altered shape and no longer expand in size, but instead remain small. Salinity levels in the environment are increasing, leading to the extinction of certain fish and plant species, as well as a rise in certain pests in the water. (Mattah et al., 2024; Mahu et al. 2023).
Songor (566)	5°45'N– 6°00N,	511.33	A closed lagoon with a high salinity and a wide mudflat with scattered mangroves.	The Songor Ramsar Site faces environmental degradation due to wildfires, erosion, small-scale, enterprises, fishing, and farming operations. Other issues include mangrove overgrazing, overfishing, and unrestricted sand and salt winning. Poaching and predation of marine turtles hinder tourism growth, while sand winning causes erosion and damage to structures in settlements. Public education is crucial to address these issues.
Sakumo (565)	0°20'E–0°35'E 5°30'N, 0°08'E	13.6	A brackish lagoon with a restricted connection to the sea. The primary habitats are the open lagoon, adjoining floodplains, freshwater marsh, and coastal savannah grasslands.	Human interference, including land conversion for residential and agricultural purposes, has significantly altered the hydrological characteristics of the land surface and water flow of the Sakumo wetland. The wetland is threatened by pollution, overexploitation, and urbanization, which impairs water quality. This has led to decreased groundwater recharge, lowered water tables, and intermittent dry streams. These human impacts negatively impact the wetland's drainage processes, affecting its ecological health and functions. (Asamoa-Boateng, 2023; Nonterah et al., 2015)
Densu Delta (564)	5°30'N, 0°15'E	58.9	Dunes, lagoons, salt pans, marshland, and scrub. Mangrove stands are scattered, with large expanses of open water.	The wetland is surrounded by human settlements, which have recently deteriorated due to the Accra metropolitan area's desire for housing sites. Wetland regions that were originally covered in woody vegetation are becoming more barren and built up, implying a loss of critical habitats such as breeding sites for local water birds. (MESTI, 2022)
Muni-Pomadze (563)	5°23'N, 0°40'E	94.6	Dunes, open lagoon, degraded forest, and scrubland. The lagoon opens into the sea during the rainy season.	The rapid rise in sea level caused by climate change is undermining the sand bar that acts as a barrier between the wetland and the ocean. The lagoon catchment is experiencing rapid encroachment, as shown by the presence of residential constructions and agricultural practices. The pace of invasion has nearly tripled. (Okyere et al., 2023; Davies-Vollum et al., 2018; Davies-Vollum and West 2015)

water supply intakes, and contamination of coastal freshwater wells (Olympio & Amos-Abanyie, 2014; Jonah et al, 2014). The coastal recession has also happened throughout the coastal areas of Ghana which was initiated with the construction of the Akosombo Dam (Jonah et al, 2016). Ghana has six Ramsar sites, five wetlands along the coast, and one in the interior region. The impact of climate change on coastal wetlands in Ghana has been increasing in terms of intensity. Coastal wetlands in Ghana have been regarded as wastelands as they were being used as dumping sites for waste, constantly dredged to facilitate the drainage of stagnated water or reclaimed for other uses (Jayson-Quashiga et al, 2013). Rapid urbanization and industrialization have exerted significant strain on coastal wetlands, with these zones increasingly utilized for human settlements or industrial facilities (Boateng et al., 2016; Jayson-Quashiga et al., 2013). This situation, coupled with the impacts of climate change, has subjected coastal wetlands to various challenges, including rising temperatures, coastal erosion, flooding, loss of marine species, and ecosystem depletion (Davidson, 2014).

3. Coastal wetlands conservation in ghana: review of international instruments, legislation, policies and institutional mechanisms

Ghana is guided by several international environmental laws and agreements in implementing best practices, establishing guidelines, and collaborating with other nations to manage and conserve wetlands in a manner that promotes biodiversity, climate resilience, and sustainable development (Botchway, 2021). Ghana is signatory to the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), the United Nations Convention on the Law of the Sea (UNCLOS), CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), Paris Agreement and The African Convention on the Conservation of Nature and Natural Resources. As a signatory to these international treaties and conventions, Ghana is obligated to regulate the protection and conservation of its wetlands. These international regulations set forth principles, guidelines and standards that influence domestic laws and policies for the preservation and sustainable use of wetlands.

Notably, as a party to the United Nations Framework Convention on Climate Change (UNFCCC), Ghana is

required to consider the significance of wetlands in its climate change mitigation and adaptation policies, particularly concerning their conservation and restoration. The UNFCCC, which entered into force on March 21, 1994, aims to prevent "dangerous" human interference with the climate system (UNFCCC, 1992). Article 4(d) of the Convention calls on parties to promote sustainable management, conservation, and enhancement of sinks and reservoirs of greenhouse gases, including biomass, forests, oceans, and other terrestrial, coastal, and marine ecosystems, considering their common but differentiated responsibilities and respective national and regional development priorities (UNFCCC, 1992). Since wetlands act as carbon sinks Ghana could achieve its climate change mitigation goals through the protection and restoration of wetlands. Additionally, the Paris Agreement, the third international legal accord addressing climate change, details Ghana's long-term climate support efforts, in line with Article 4.19 of the Paris Agreement. Ecosystem-based adaptation methods, such as wetland restoration, are crucial for enhancing resilience and mitigating climate change impacts (Awuni et al., 2023; Valach et al., 2021). The need for wetlands conservation was further stressed by the Ramsar Convention, which emphasized the wetlands' continued value (Maltby, 2022; MESTI, 2022; Gell et al., 2023). The Ramsar Convention on Wetlands, established in 1971, emphasizes the importance of wetlands and encourages their conservation (Kingsford et al., 2021; Gell et al., 2023). As a party since 1988, Ghana commits to designating and managing Ramsar sites, ensuring responsible wetland use, and collaborating internationally on wetland protection (Donatus et al., 2022). However, efforts to protect wetlands have not always been successful (Reis et al., 2017; Kumi et al., 2015), as the level of protection among sites may vary due to the involvement of local, regional, and international stakeholders (Reis et al., 2017; Gardner et al., 2015). The Convention on Biological Diversity (CBD), ratified by Ghana in 1994, aims to protect biological diversity, promote its sustainable use, and ensure the equitable sharing of benefits derived from genetic resources (Botchway, 2021). Article 6 of the CBD mandates parties to develop national strategies, plans, or programs for biodiversity conservation and sustainable use, integrating these efforts into relevant sectoral policies (CBD, 1992). Wetlands are crucial ecosystems that host a wide diversity of species and provide various ecological functions (Ballut-Dajud et al., 2022; Martínez-Megías and Rico, 2022). However, implementation challenges, such as decentralization of policy processes and consultation with indigenous communities, have hindered Ghana's efforts to fully realize the CBD's objectives (Botchway, 2021).

The CBD has played an important role in strengthening global environmental governance and biodiversity protection (Campbell et al. 2014). Wetlands are important ecosystems because they provide a variety of ecological functions and host a wide diversity of species. Wetland conservation is critical for maintaining biodiversity and ecological health. Wetlands suffer multiple anthropogenic stresses, including habitat degradation and pollution, which endanger their biological variety and ecological functions (Ballut-Dajud et al, 2022; Martínez-Megías and Rico 2022). Remote sensing technologies have been used to map, monitor, and maintain wetland habitats, such as the Harike Wetland in Punjab, India, proving the value of novel approaches to wetland conservation (Singh et al., 2020). Invasive alien species pose a significant threat to biodiversity conservation efforts worldwide. Invasive alien species threaten global biodiversity protection efforts. The International Union for Conservation of Nature (IUCN)'s Invasive Species Specialist Group (ISSG) works to provide practitioners, policymakers, and decision-makers with up-to-date information on invasive species to support the implementation of biodiversity conservation agreements, such as the CBD (McCay & Lacher, 2021; Pyšek et al., 2020). CBD is critical to the protection of large carnivores. These accords help to safeguard large carnivore species, which are critical for biodiversity conservation but are frequently threatened internationally because of their diverse habitats (Trouwborst, 2015). Important Bird and Biodiversity Areas (IBAs) play an important role in conservation policy, advocacy, and action, emphasizing the necessity of focusing conservation efforts on specific species and ecosystems (Waliczky et al., 2018). Botchway (2021) notes that decentralizing policy implementation processes, employing divergent approaches instead of one-size-fits-all approaches, and avoiding over-centralization of policy processes are some of the challenges faced by Ghana in implementing CBD policies. Additionally, the author highlights the complexity of joint action and the lack of consultation with indigenous people. To create a legal framework for the preservation of marine resources, especially wetlands, the United Nations Convention on the Law of the Sea (UNCLOS) is essential (Dawson, 2023; UNCLOS, 1982). Wetlands conservation efforts can be aided by the requirements for maritime environment preservation outlined in UNCLOS Article 145 (UNCLOS, 1982). Moreover, rules for cooperating on the preservation and sustainable use of marine biological resources are included in UNCLOS (Berry, 2021; Gann et al., 2019). Moreover, another international agreement to protect wetlands is the Ramsar Convention on Wetlands, which was created in 1971 (Donatus, 2022). UNCLOS's (1982) efforts to conserve and develop marine resources, especially wetlands, are expanded upon by this treaty. A government agreement known as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was made to safeguard endangered species (CITES, 1973; Simmons et al., 1976). The treaty was ratified in the 1970s as the Ghanaian government realized how crucial wetlands were for maintaining the

water table and providing a habitat for animals (Donatus, 2022). Concerning wildlife protection, the Convention on the Protection of Migratory Species of Wild Animals is helpful (Caddell, 2013). The National Strategy for Wetlands Conservation being implemented by Ghana is in keeping with the goals of CITES (Ministry of Land and Forestry, 1999). The conservation of endangered species, particularly those inhabiting wetlands, depends on the CITES regulations.

Ghana's wetlands protection depends on the African Convention on the Protection of Nature and Natural Resources (Revised African Convention) (An Introduction to the African Convention on the Conservation of Nature and Natural Resources, 2004). These vital ecosystems and wetlands provide many benefits to wildlife and people alike (Ministry of Land and Forestry, 1999). Regarding wetland conservation and restoration, stakeholder attitudes emphasize the importance of these natural areas and the need for sustainable management techniques (Kadoma et al., 2023). Wetlands are among the natural resources that Ghana's 1999 Ramsar Regulation emphasizes for conservation (Donatus et al, 2022). To reduce vulnerability to climate change, ecosystem-based adaptation (EBA) is the process of preserving, managing, and restoring ecosystems like wetlands. To preserve natural resources and secure the welfare of future generations, the Revised African Convention places a strong emphasis on the maintenance of healthy habitats (An Introduction to the African Convention on the Conservation of Nature and Natural Resources, 2004; Erinosho, 2013). As evidenced by initiatives to track the decline in biodiversity in Africa, maintaining a balance between resource utilization, population growth, and conservation is essential for the preservation of significant ecosystems like wetlands (Achieng et al., 2023). In addition to these significant international agreements, which Ghana has complied with, the nation's wetlands are protected by equally significant national laws, regulations, and policies. The Ghanaian constitution is the first and most important of them all. The supreme law governing social relations and behavior in the nation is the 1992 Constitution. Given that, the national Constitution provides the needed legal guidelines and framework for regulating the management of the environment for the current and future generations. This is made explicit in Article 36(9) of the Constitution which states that; "the State shall take appropriate measures necessary to protect and safeguard the national environment for posterity, and shall seek co-operation with other states and bodies for purposes of protecting the wider international environment for mankind". More so, Article 41 (k) also calls on citizens to protect and safeguard the natural environment of the country as part of their civic duties and responsibilities (Donatus et al, 2022; Ankrah, 2018).

The Environmental Protection Act, of 1994 (ACT 490), was enacted to establish the Environmental Protection Agency (EPA) in the country. The EPA is mandated with the responsibility and powers of ensuring the protection and conservation of the natural environment (Ankrah, 2018). The EPA Act therefore gives responsibility to the EPA to ensure a responsible environment through the planning and execution of projects that seek to interfere with the quality of the environment. It is also tasked with coordinating with other governmental agencies to enact and implement the needed environmental laws and regulations in the country. The Agency is further mandated to seek environmental impact assessment from anyone who seeks to undertake a developmental project that in the considered view of the Agency, will impact the environment (Yeboah-Tutuah, 2014; Aboagye et al, 2020). The Environmental Assessment Regulations, 1999 (LI 1652) gives the needed guidelines to the country's Environmental Impact Assessment procedure as enshrined in the Environmental Protection Agency Act, 1994 (ACT 490). The crust of this regulation is the requirement that all developmental projects and activities conducted across the country that are likely to impact the environment must be taken through an environmental impact assessment (Okley, 2004). The primary objective is to ensure that these developmental initiatives and activities are carried out in an environmentally friendly and sustainable manner as a direct result of the impact of climate change on the environment (Aboagye et al, 2020). This legislative provision further provides complete legal support for Environmental Impact Assessment (EIA) systems and puts in place the needed criteria for the preparation, submission, review as well as approval of EIA and the application and granting of such permits (Adade et al., 2017). The Fisheries Act, of 2002 (ACT 625) sought to modernize and consolidate the laws on fisheries in the country and as such, repealed the Fisheries Commission Act (ACT 457) of 1993. The ACT seeks to regulate, manage and develop the fishing sector of the country while promoting the adoption of sustainable usage of fisheries resources (Aboagye et al, 2020). Because of this, the ACT permits the creation of marine reserves and as such, prohibits the dredging, fishing, removal of gravels or sand, and the disruption of the natural environment. Again, the ACT makes it illegal to pollute water and other marine resources in such a way that it harms those aquatic resources and also spells out the consequences (Kudjordie, 2014).

There are other existing environmental laws and policies applicable to the protection of coastal wetlands and mangroves. For instance, there are existing laws and policies that are all aimed at protecting the environment from man-made (anthropogenic) destruction. Some of these laws and policies entail but are not limited to the National Environmental Policy (NEP), 2012. The NEP, 2012 as captured under the second bullet of section 4.4. seeks to ensure that the protection of the coastal wetlands

is observed in line with the principles of the Ramsar Convention. The National Climate Change Policy, 2013 was launched to provide strategic direction and coordination on issues of climate change in the country. Under Focus Area 5 of the policy, wetland ecosystem, and marine resource degradation due to development activities resulting in the loss of mangroves, migratory birds, and marine turtles was cited as a key challenge, and a policy focus was indicated to improve the management of such a national asset. There is also the National Environmental Action Plan (NEAP), 1991 that was aimed to help the Government maintain and improve the environment, including the marine and ocean area contained within the Exclusive Economic Zone, and to manage the resources contained therein such as wetlands for the collective benefit and enjoyment of present and future generations (Boateng et al, 2016). There are other existing laws and policies such as the Ministry of Fisheries and Aquaculture Development – Medium Term Expenditure Framework (MTEF), 2019 – 2022; Forest and Wildlife Policy, 2012; National Water Policy, 2007; Riparian Buffer Zone Policy, 2011; Wetland Management (Ramsar Sites) Regulations, 1999 (LI 1659) among others that target marine or coastal areas management. Despite the existence of these laws and policies that are aimed at protecting the environment, the country's environment, and to be specific, coastal wetlands and Ramsar sites of the country continue to be destroyed at an alarming rate. This is a direct result of the lack of enforcement mechanisms that would have ensured the full adherence to these laws and policies on environmental sustainability. This therefore shows that Ghana as a country and a signatory to various international environmental protection frameworks has in place stringent environmental laws and policies that can protect the environment from anthropogenic activities but is struggling with enforcement measures.

Having healthy coastal wetland ecosystems in Ghana offer a wide range of socio-economic opportunities, ecological benefits, and cultural values. Protecting and sustainably managing these valuable ecosystems is essential for promoting resilient coastal communities, safeguarding biodiversity, and preserving cultural heritage. There are several opportunities Ghana can derive from its Coastal Wetlands if managed sustainably . This section throws light on the socio-economic, ecological resilience and cultural values benefits. Socio-Economic benefit includes tourism and recreation. Coastal wetlands attract tourists and nature enthusiasts, offering opportunities for recreational activities such as bird watching, fishing, boating, and ecotourism (Wang et al., 2022; Shi et al., 2019). These activities stimulate local economies through the creation of jobs, hospitality services, and the sale of goods and souvenirs. Another socio-economic is , fisheries and aquaculture. Coastal wetlands serve as crucial habitats for fish breeding, spawning, and nursery grounds. Healthy wetlands support vibrant fisheries, providing livelihoods for coastal communities engaged in fishing and aquaculture activities (Hiruy & Eversole 2020). Sustainable management of wetlands ensures a long-term viability of fisheries and associated industries and the provision of coastal protection and infrastructure. Mangroves and salt marshes act as natural buffers against coastal erosion, storm surges, and flooding (Temmerman, et al., 2023; Asari et al., 2021). Investing in the conservation and restoration of these wetlands help protect coastal communities, infrastructure, and valuable assets from the impacts of climate change and extreme weather events.

The benefits of Ecological Resilience considers the aspect of biodiversity and habitat protection. Healthy coastal wetlands support rich biodiversity, including a variety of plant and animal species, many of which are endemic or migratory (Navarro et al., 2021). Preserving these ecosystems ensures the conservation of biodiversity and maintains the ecological balance of coastal habitats. Another aspect for consideration is climate adaptation and resilience. Coastal wetlands act as natural buffers against the impacts of climate change, such as sea-level rise, extreme weather events, and coastal erosion (Newton et al., 2020; Schuerch et al., 2018). Maintaining intact wetland ecosystems enhances the resilience of coastal communities by providing protection and adaptation options in the face of environmental challenges. The last aspect to consider under this benefit include water quality and ecosystem services. Wetlands play a vital role in maintaining water quality by filtering pollutants, trapping sediments, and absorbing excess nutrients (Balwan & Kour 2021). This helps improve water clarity, supports healthy aquatic ecosystems, and provides essential ecosystem services such as water purification, flood control, and groundwater recharge (Shahid et al., 2018).

The benefits of cultural values also have various dimension including traditional knowledge and practices. Coastal wetlands hold cultural significance for local communities, often embodying traditional knowledge, practices, and spiritual connections (Sangha et al., 2018). Indigenous peoples and coastal communities rely on wetlands for food, medicine, building materials, and cultural ceremonies, maintaining deep-rooted cultural ties to these ecosystems (Marques et al., 2021). Another contributing factor is cultural heritage and identity. Coastal wetlands contribute to the cultural heritage and identity of communities, shaping their customs, traditions, folklore, and way of life (Marques et al., 2021). Cultural practices such as fishing, harvesting of non-timber forest products, and artisanal crafts are deeply intertwined with wetland ecosystems, reflecting the cultural richness and diversity of coastal communities (Zerbe, 2022). Wetlands also provides educational and recreational value. Wetlands serve as outdoor classrooms, providing opportunities for environmental education, research, and cultural exchange

(Alikhani et al., 2021). They offer recreational spaces for community gatherings, storytelling, and cultural events, fostering a sense of belonging and stewardship among local residents. Ghana having a healthy coastal wetland ecosystems can offer a myriad opportunities for the local communities and the people.

4. Conclusion

The paper examined at Ghana's environmental regulatory framework for coastal wetlands conservation in the face of climate change, focusing on international treaties such as Ramsar, UNCLOS, and UNFCCC, as well as national laws such as the Environmental Protection Act of 1994 (Act 490), the Environmental Assessment Regulations of 1999 (LI 1652), and the Fisheries Act of 2002 (Act 625). Other measures aiming at protecting and conserving coastal wetlands were also explored. The analysis indicated that, despite the adoption of several legal instruments and regulations in Ghana to protect and conserve coastal wetlands, their effectiveness has been hindered by inadequate institutional development and fragmentation, as well as weak enforcement regimes. The coastal wetlands of Ghana still face significant threats from both climate change and human activities, putting at risk the invaluable ecological services they provide and the socioeconomic well-being of communities reliant on them. The impacts of climate change, including rising sea levels, extreme weather events, and changes in precipitation patterns, exacerbate the vulnerability of these ecosystems. Additionally, anthropogenic activities such as industrialization, urbanization, and agricultural expansion further degrade coastal wetlands, jeopardizing their integrity and resilience. Despite the existence of a comprehensive legal framework at both the international and national levels aimed at conserving wetlands and mitigating climate change, enforcement and implementation remain significant challenges. While Ghana has ratified various international agreements such as the Ramsar Convention, the Convention on Biological Diversity, and the United Nations Framework Convention on Climate Change, translating these commitments into effective conservation actions on the ground has proven difficult. The effective conservation of Ghana's coastal wetlands requires a thorough evaluation and reform of the legal system, enhanced enforcement mechanisms, stakeholder engagement, and public awareness to ensure compliance with existing laws and policies. Fostering multi-sectoral collaboration and integrating wetland conservation considerations into development planning processes are essential steps toward achieving sustainable management of coastal wetlands in Ghana. Decentralizing wetland management and conservation efforts, enabling resource allocation from national to local levels, is crucial for rapid response and enhanced protection of these vulnerable ecosystems from degradation.

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