RESIDENTS' AWARENESS AND ATTITUDE TOWARDS URBAN WETLANDS IN ACCRA, GHANA: IMPLICATIONS FOR SUSTAINABLE URBAN DEVELOPMENT

Charles Yaw Oduro[1], Francisca Atta-Boateng[2], Justice Kufour Owusu-Ansah[1], Clifford Amoako[1]

[1]*Department of Planning, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*
[2]*Land Use and Spatial Planning Authority, Ashanti Region, Ghana*

*Corresponding author: yawoduro68@gmail.com

ABSTRACT

The paper assesses the awareness and attitudes of residents on the value of urban wetlands and existing policies and regulations on wetland protection. Using the Densu Delta and Sakumo Ramsar sites in the Greater Accra Metropolitan Area of Ghana as a study area, data was collected through field observation, a survey of household heads, and key informant interviews with wetland managers. The findings revealed that although none of the surveyed residents knew about wetland benefits such as water purification and ground water recharge and discharge, most of them were aware of other benefits such as serving as sources of livelihood, water for domestic and agricultural use, habitats for wildlife, and flood control. They also demonstrated positive attitudes towards wetland protection. However, their awareness and positive attitudes did not necessarily translate into environmentally-responsible behaviour that would promote sustainable development. This was evident in the rampancy of undesirable human activities that had degraded the wetlands, which was partly attributed to ineffective governance and poor enforcement of wetland protection measures. Therefore, there is the need to strengthen the governance dimension of sustainability through the enforcement of existing wetland protection measures, fostering closer engagements with local communities and sensitising residents on the collective benefits of personal-level pro-environmental behaviour. There is also the need to sensitise the political class and resource the administrative set-ups of municipal authorities and other relevant state agencies towards pro-environmental policymaking and implementation.

Keywords: Attitude, Awareness, Ramsar Site, Sustainable Urban Development, Wetland

INTRODUCTION

Wetlands slow down global warming through carbon sequestration, purify and store surface water, recharge underground water, control floods, provide fresh water, food and fuels to humans, support biodiversity, and serve as recreational spots (Appiah & Yankson, 2012; Cobbinah *et al*., 2022; Ibarra *et al*., 2013; Kanaujia & Kumar, 2014; Yepsen *et al*., 2014; Zhu *et al*., 2016). In view of these vital functions, effective wetland management is key to sustainable urban development. Unfortunately, this fact is often not adequately appreciated, particularly in large urban centres where wetlands are sometimes perceived as no-man's lands, leading to their destruction through land use conversion and other anthropogenic activities (Campion, 2012). To address this challenge, various policy initiatives have been put in place at global and national levels to protect and restore wetlands (Yepsen *et al*., 2014). In 1971, member countries adopted the Ramsar Convention on Wetlands to ensure "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world" (Ramsar Convention Secretariat, 2016:9). As of January, 2016, the Convention's List of Wetlands of International Importance (i.e., wetlands designated for special protection as Ramsar Sites) numbered over 2,220 and covered 2.14 million square kilometres. One of the commitments made by parties to the Convention is the wise use of wetlands (Article 3 of the Convention), which refers to a general obligation to consider wetland conservation in land-use, water-resource management and other planning endeavours. In the United States, the Department of Agriculture incentivises landowners to voluntarily "protect, restore, and enhance wetlands" by providing financial and technical support (Yepsen *et al*., 2014). Moreover, Target 7A of the United Nations' Millennium Development Goals (MDGs) was formulated to "Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources" while Target 7B was to "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss" (United Nations, 2015). The United Nations further amplified the need for sustainable use of wetlands in Goal 15 of the Sustainable Development Goals (SDG 15), which seeks to "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" (The World Bank, 2016:32). More specifically, Target 15.1 of SDG 15 seeks to promote the "conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services" with emphasis on wetlands (Bauer & Meijer, 2015:77). Notably, SDG 15 also contributes to the achievement of SDG 11, which focuses on the promotion of sustainable cities and communities.

In spite of the above efforts, wetlands continue to be degraded and destroyed through uncontrolled conversion of green spaces to residential, commercial, industrial and other urban land uses in response to rapid urbanisation (Asamoah *et al*., 2016; Campion & Owusu-Boateng, 2013; Kanaujia & Kumar, 2014; Torres-Lima *et al*., 2018) Although Ghana is a signatory to the Ramsar Convention, the MDGs and the SDGs, little has been achieved in terms of restoring and protecting wetlands against urbanisation-driven human activities. As a result, wetlands are reclaimed for residential, commercial and industrial development or degraded through waste dumping (Agyapong *et al*., 2018; Campion, 2012; Twumasi-Ampofo *et al*., 2018).

A considerable amount of scholarly research has been conducted on various aspects of wetlands in both the global north and south. In

particular, the fact that poorly managed urban development, waste disposal, agriculture and other anthropogenic factors have led to large-scale degradation and loss of wetlands around the world has widely been reported (Agbeti *et al*., 2022; Agyapong *et al*., 2018; Campion, 2012; Ekumah *et al*., 2020; Faulkner, 2004; Howard *et al*., 2014; Kometa *et al*., 2018; Ondiek *et al*., 2020; Twumasi-Ampofo *et al*., 2018).

There have also been studies on: wetlands and climate change (Gopal, 2013; Rodríguez-Labajos, 2013); wetland restoration and conservation (Yepsen *et al*., 2014; Zhu *et al*., 2016); the public's valuation of wetlands (Cherono *et al*., 2018; Hassan *et al*., 2019; Ibarra *et al*., 2013); and wetland protection, land use planning and governance (Cobbinah *et al*., 2022; Materu *et al*., 2018), among others. In recent times, there have also been investigations into public awareness and attitudes towards wetlands (Hu *et al*., 2022; Sholahuddin *et al*., 2021; Sinthumule, 2021; Sinthumule & Netshisaulu, 2022; Torres-Lima *et al*., 2018; Truong, 2021). For instance, in China, Hu *et al*. (2022) found that there was little public awareness about ecosystem services provided by wetlands with environmental purification and leisure being the only exception. In South Africa, Sinthumule & Netshisaulu (2022) found that although both urban and rural dwellers exhibited positive attitudes towards the conservation and restoration of wetlands, that was not enough to guarantee wetland protection. Notwithstanding the gamut of wetland-related studies, not much has been investigated about the nexus between wetland residents' awareness about the value of wetlands, their attitudes towards wetland protection and the issue of sustainable urban development in African cities. Using two coastal wetlands in the Greater Accra Metropolitan Area (GAMA) as reference, this paper explores residents' awareness about the value of coastal wetlands, government's wetland protection policies and regulations their attitudes towards wetland protection, and the implications of these (awareness and attitudes) for sustainable urban development.

Conceptual and Theoretical Framework

Environmental and socio-economic benefits of wetlands

The Ramsar Convention Secretariat (2016: 9) defines wetlands rather broadly to include "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres". Thus, wetlands include a wide range of transitional ecosystems that have the characteristics of both aquatic and terrestrial environments, and "where the water table is usually at or near the surface, or the land is covered by shallow water" (Kanaujia & Kumar, 2014). The Ramsar Convention classifies them into five (5) main types: marine; estuarine; lacustrine; riverine; and palustrine. Marine wetlands are associated with the sea or coastlands, and they include coastal lagoons, rocky shores, seagrass beds and coral reefs. Estuarine wetlands are found within or along estuaries and deltas, and may take the form of tidal marshes, mudflats, or mangrove swamps. Lacustrine wetlands are those that are associated with lakes, while palustrine wetlands refer to marshes, swamps and bogs. Lastly, riverine wetlands are those formed along rivers and streams (Ramsar Convention Secretariat, 2016). This research focuses on two major coastal wetlands in Ghana that have been gravely threatened by rapid urbanisation.

The fact that wetlands combine both aquatic and terrestrial features make them uniquely rich ecosystems that perform various environmental and socio-economic functions, which are crucial to sustaining

ecological balance and human survival. First and foremost, wetlands serve as a source of livelihood (i.e., food, income and employment) for millions of people around the world (Ramsar Convention Secretariat, 2016). Indeed, Mitsch *et al.* (2015) have described them as "nature's supermarkets because of the extensive food chain and rich biodiversity that they support". Common livelihood activities in wetlands include salt making, fishing, hunting, farming and lumbering. For example, the chinampas wetland farms of Xochimilco in the peri-urban zone of Mexico City, Mexico, sustained livelihoods before Hispanic colonisation and have continued to do so in the post-independence period (Merlín-uribe *et al.*, 2013) while the Densu Delta Ramsar site has been noted for large-scale salt-making and fishing (Oteng-Yeboah, 1999).

Wetlands also help to mitigate flooding and erosion by receiving, storing, delaying and slowing down the flow of runoffs (Ramsar Convention Secretariat, 2016; Wright *et al.*, 2006; Yepsen *et al.*, 2014). This facilitates flood-flow desynchronization, a process by which flood water is collected and temporarily stored in multiple wetlands before being released into a watershed, and gradually discharged in a staggered manner (Ramsar Convention Secretariat, 2016). Therefore, one of the serious consequences of wetland loss is increased frequency and magnitude of flood disasters in human settlements, especially in urban areas (Kanaujia & Kumar, 2014). By receiving, removing and retaining solid and chemical contaminants (such as nutrients, pesticides and heavy metals) that are carried by run-off and other surface water, wetlands serve as the "kidneys of the landscape" (Mitsch & Gosselink, 2015 as cited in Mitsch *et al.*, 2015). This is done through sedimentation, burial and chemical breakdown of the toxicants, or absorption by wetland vegetation (Ramsar Convention Secretariat, 2016; Wright *et al.*, 2006). Thus, through these

processes, surface water is purified before it flows into streams, rivers, lakes or aquifers. In so doing wetlands serve as mediums through which surface water seeps downward to recharge aquifers, while also facilitating the discharge of excess water from aquifers to the surface (Ramsar Convention Secretariat, 2016; Wright *et al.*, 2006). Thus, the loss of wetlands contributes to the depletion of aquifers, which has serious ramifications for human communities that depend on them for domestic, agricultural and industrial purposes.

Moreover, wetlands serve as habitats for a wide range of flora and fauna, including rare and endangered ones (Ramsar Convention Secretariat, 2016). This is made possible by the fact that wetlands possess several attributes (such as having a considerable biomass, a mixture of aquatic and terrestrial habitat features like cover, food, water, nesting, favourable micro-climatic conditions, and other life-sustaining features) that support different floral and faunal species.

Wetlands also have aesthetic, artistic, recreational and spiritual appeal that forms part of humanity's cultural heritage (Amo *et al.*, 2017; Mitsch *et al.*, 2015; Ramsar Convention Secretariat, 2016). In other words, the "ecological set up of wetlands provides beauty and well-being to the environment" (Amo *et al.*, 2017:2). Although this attribute is difficult to quantify because of its intangibility (Merlín-uribe *et al.*, 2013), it has a positive impact on the quality of life of residents and visitors.

The concept of sustainable urban development

Sustainable development as a modern concept could be traced to the World Commission on Environment and Development, which defined it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987: 54). Based

on this definition, sustainable development has widely been conceptualised as having three interdependent mutually reinforcing pillars: economy, social equity and ecology (or environment) (United Nations, 2014). Primarily, the economic pillar deals with the material well-being of humankind, including the promotion of an economic system in which productive and consumptive activities are carried out in a manner that meets current needs without compromising future economic opportunities. Social equity deals with issues such as social inclusion and cohesion, poverty eradication, human rights, and equity in access to opportunities. Ecology is about ensuring harmony in interactions between humans and the physical environment. In recent times, some have argued for the inclusion of other 'pillars' such as governance, culture and security in the sustainable development framework (Bervar & Bertoncelj, 2016; Hawkes, 2001; Mutisya & Yarime, 2014; United Nations, 2014).

The concept of sustainable urban development is a derivative of sustainable development. However, there is no consensus on its definition. For instance, Wheeler (1996: 55) defined it as development that "seeks to create cities and towns that improve the long-term health of the planet's human and ecological systems." The Urban-21 Conference in Berlin (2001) defined it as "improving the quality of life in a city, including ecological, cultural, political, institutional, social and economic components without leaving a burden on future generations, a burden which is the result of a reduced natural capital and an excessive local debt" (as cited in Sakka, 2016: 51). Tang and Lee (2016: 10) defined it as "the capacity of any significant human settlements to maintain environmental quality and carrying capacity, to support socio-economic development and management, and to provide sufficient services and livelihoods to all current and future inhabitants". Despite differences in emphasis and terminology, there

seems to be a consensus that sustainable urban development is anchored on the three traditional sustainable development pillars, namely economy, environment and social equity. For instance, by virtue of their role as engines of economic growth, cities and towns play a central role in stimulating and maintaining economic development (Colenbrander, 2016; UN-HABITAT, 2011). With respect to environment, one important goal of sustainable urban development is the creation of urban forms that ensure a healthy balance between the built environment (residential, infrastructural, industrial, commercial and other physical developments) and natural ecosystems such as wetlands. The key issues relating to social equity (inclusion, poverty eradication, human rights, etc) are also critical in urban centres.

While emphasising environment, economy and social equity as pillars of sustainable urban development, governance is framed in this study as the bedrock upon which these four pillars stand. Governance has been defined as "the interrelated and increasingly integrated system of formal and informal rules, rule-making systems, and actor-networks at all levels of human society (from local to global) that are set up to steer societies towards preventing, mitigating, and adapting to global and local environmental change" (Biermann *et al.*, 2009: 4). In the context of urban development, governance plays the role of building the institutional infrastructure and decision-making systems that are required to ensure a healthy ecological balance between the built, natural and socio-economic environments so as to minimise environmental risks and vulnerabilities (Mutisya & Yarime, 2014). This includes the formulation and implementation of policies, regulations, and other measures to foster engagement between the state, citizens, and other non-state actors to address urban problems such as environmental degradation, pollution and disasters, as well as stimulate wealth

creation in an equitable and sustainable manner.

The governance consideration in the sustainable urban development discourse is particularly crucial for Africa and the rest of the developing world because most of the challenges associated with rapid urbanization in these regions have been exacerbated by weak governance (Mutisya & Yarime, 2014). As the bedrock of urban sustainability, strong and effective urban governance is required to uphold the three traditional pillars, as well as manage any conflicts that may arise between them. For instance, ensuring wise use and effective management of urban wetlands requires the creation of public awareness about the value of wetlands, engaging and involving urban residents in the formulation and execution of wetland protection policies, appropriate use of police power for sustainable land use through zoning and other urban planning tools, enacting and strictly enforcing local by-laws. It is argued further that, public awareness about the value of wetlands, together with citizen engagement, can create a generally positive attitude towards wetlands. Attributes of positive attitudes would include a high sense of civic responsibility and cooperation with government in efforts to protect wetlands. These conditions, together with law enforcement and other aspects of effective governance, would promote sustainable use and management of wetland services, thereby contributing to sustainable urban development.

Theoretical understanding of environmental awareness and attitude

Establishing the relationship between awareness and attitude is key to understanding environmental behaviour. In general parlance, awareness refers to an individual's consciousness of the existence of something, or the occurrence of an event. In the context of the environment, the term has been broadly conceived to mean a person's understanding of environmental issues, including: the value of a safe and healthy environment; the effects of human activities and other threats to the environment; existing environmental problems, rules, regulations and other measures to remedy the problems; concern for the environment; the need for collective action towards environmental protection; and readiness to adopt environmental protection at the personal level (Geng & He, 2021; Umuhire & Fang, 2016; Wathuge & Sedera, 2021).

According to Gundu and Flowerday (2013 cited in Wathuge & Sedera, 2021), awareness influences behaviour by causing attitudinal change. Attitude refers to "the degree to which a person has a favourable or unfavourable evaluation or appraisal" of a behaviour (Ajzen, 1991: 188). The attitude object can be the environment in general, a component of the environment (such as water or air quality), or an environmental behaviour (Joachim *et al.*, 2015: 4). While environmental awareness is about the cognitive process of receiving knowledge or developing consciousness through information acquisition or personal experience about the environment, environmental attitude is about a person's mindset and opinions that develop over time through the generation of awareness, or lack thereof, about the environment. Implicit in the above conceptions is the assumption that environmental awareness, through attitudinal change, influences environmental behaviour. Based on this assumption, Iizuka (2000) advocated for the creation of environmental awareness through effective dissemination of relevant, quality and sufficient information to the citizenry, including information on environmental benefits, and existing environmental regulations and incentives. Iizuka went further to suggest that heightened awareness would motivate citizens to put up environmentally-responsible behaviour (ERB)

and sanction their neighbours who failed to do same by applying social and economic pressures.

One of the most basic theoretical formulations that attempt to explain or predict the relationships between environmental awareness, attitude and behaviour is the Behavioural Change Model. It suggests that knowledge causes people to develop environmentally favourable attitudes, which in turn leads to ERB (Hungerford & Volk, 1990 cited in Akintunde, 2017). In other words, knowledge increases a person's awareness about the value of the environment and the need for preservation or maintenance. This may, in turn, lead to the development of a positive attitude and responsible behaviour towards the environment. The model has provided the basis for the study of "possible relationship existing between environmental knowledge, environmental awareness and attitude and how these can translate into action or inaction" (Akintunde, 2017: 123). Moreover, some studies have demonstrated the efficacy of awareness creation in modifying behaviour. For instance, in a study of 326 internet users in Sri Lanka, Wathuge and Sedera (2021) found that awareness about environmental damage caused by the internet led to a reduction in internet use. In terms of environmental policy, the behavioural change model has provided the rationale for environmental education and awareness creation campaigns. Although the behavioural change model has substantially impacted policy and research, it fails to account for the possibility that awareness does not necessarily lead to ERB.

Several alternative theories have been propounded to explain the complex relationship between actual behaviour and various behavioural determinants such as intention, awareness or knowledge, attitude, control and situational factors. One of such theories is the Model of Ecological

Behaviour as proposed by Fietkau and Kessel (1981 cited in Kollmuss & Agyeman, 2002). This model asserts that attitude is one of four socio-psychological factors that directly influence environmental behaviour, with the other factors being possibilities to act environmentally, incentives for pro-environmental behaviour, and perceived consequences of behaviour. The model explains further that attitude itself is determined by environmental awareness and perceived consequences of behaviour (Kollmuss & Agyeman, 2002).

On the other hand, *Theory of Planned Behaviour*, propounded by Ajzen (1991), posits that attitude does not directly influence actual behaviour. Instead, a person's actual behaviour is influenced by intention, which is in turn influenced by (a) their attitude towards the behaviour in question, (b) their subjective norms regarding the behaviour, and (c) their perceived behavioural control (Ajzen, 1991; Sawitri *et al.*, 2015). This theory is a refinement of the *Theory of Reasoned Action*, propounded by Ajzen and Fishbein (see Ajzen, 1991). The focus of this paper is to operationalise the key concepts of *awareness* and *attitude* within the context of coastal wetland management and sustainable urban development based on insights from the above theoretical formulations.

Summary: Linking awareness and attitude to sustainable urban development

Figure 1 is an illustration of the conceptual linkage between effective urban governance, residents' awareness, attitude and behaviour, and the sustainable urban development agenda. As theory suggests, residents' awareness and attitudes on the value of wetlands, as well as wetland protection policies and regulations, are among key socio-psychological factors that may directly or indirectly contribute to environmentally

responsible behaviour (ERB) towards wetlands. Residents' ERB, facilitated by effective urban governance (manifesting in effective enforcement of wetland protection policies and regulations), then leads to proper use and effective management of urban wetlands, which ultimately promotes sustainable urban development. For instance, proper use and effective management of urban wetlands strengthen the environmental pillar of sustainable urban development by controlling flooding and erosion, purifying surface water, recharging and discharging groundwater, and provide habitat for diverse plant and animal species. In addition, effective management of urban wetlands contributes to local economic development by way of sustainable fishing, urban agriculture and tourism. Moreover, effective urban wetland management promotes social development by preserving and enhancing the aesthetic appeal of urban wetlands, which in turn contributes to the quality of life of urban residents, and by addressing urban poverty through the provision of livelihood opportunities such as fishing and farming. However, these environmental, economic and social aspects of urban sustainability can only be achieved if they are anchored in effective urban governance, which is the bedrock of sustainable urban development. In summary, effective urban governance is required to increase residents' awareness and positive attitude towards urban wetlands. In turn, awareness and positive attitude promote ERB and effective wetland management, which consequently promote environmental, economic and social sustainability in urban development, thereby contributing to the achievement of both SDG 11 (sustainable cities and communities) and SDG 15 (life on land) (The World Bank, 2016).
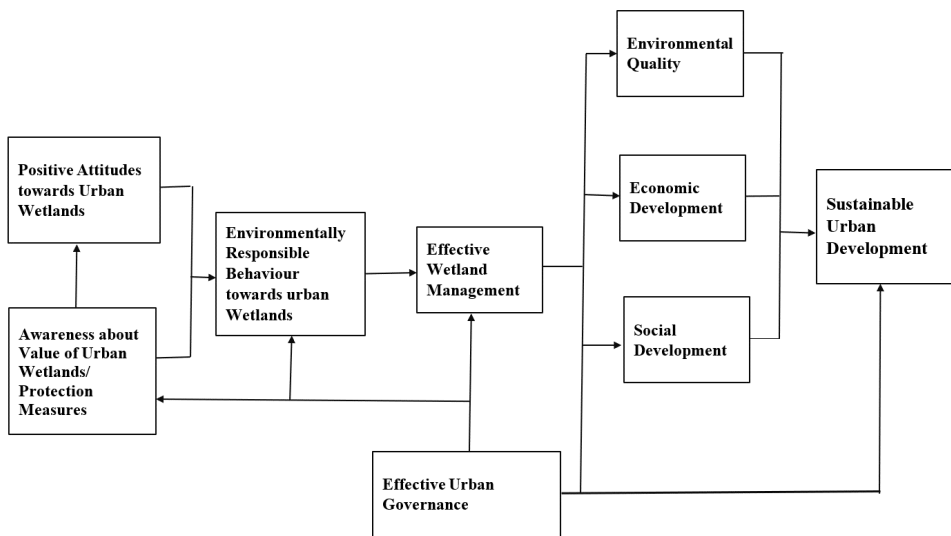

Figure 1: A Conceptual Framework linking Awareness and Attitude on Urban Wetlands to Sustainable Urban Development

Policy and Institutional Framework for Wetland Management in Ghana

As a signatory to both the Ramsar Convention on Wetlands and the SDGs, Ghana has formulated several policies to protect wetlands. For instance, the 1999 National Land Policy sought to ensure consistency between human activities and "sound land use through sustainable land use planning" (Ministry of Lands and Forestry, 1999b: 6). The policy further classifies wetlands as environmental conservation areas and, therefore, prohibits detrimental human activities such as draining of wetland waters, damming or changing the course of water bodies that feed wetlands, building human settlements and related infrastructural development, waste disposal, and mining activities.

In addition, the National Wetlands Conservation Strategy seeks to incorporate wetlands management "into the day-to-day activities of Government, organisations, traditional authorities, communities and individuals" (Ministry of Lands and Forestry, 1999a). Moreover, the country's Riparian Buffer Zone Policy requires the demarcation of a 30-metre buffer zone around the perimeters of wetlands within which physical development is prohibited (Ministry of Water Resources, Works and Housing, 2013). However, the responsibility of implementing the various international and national policy initiatives has been assigned to several state institutions in a parallel and largely autonomous manner. For example, while the Wildlife Division of Forestry Commission is a national agency responsible for the protection of all forms of wildlife (including those in wetlands), the Water Resource Commission "is responsible for the regulation and management of the utilisation of water resources, and for the co-ordination of any policy in relation to them" (Republic of Ghana, 1996). Similarly, the Environmental Protection Agency (EPA) is to "act in liaison and co-operation with government agencies,

District Assemblies and other bodies and institutions to control pollution and generally protect the environment", as well as "promote effective planning in the management of the environment" (see Republic of Ghana, 1994). Under the policy direction and technical guidance of the Land Use and Spatial Planning Authority (LUSPA), the Metropolitan, Municipal and District Assemblies (MMDAs) are also mandated to enact and enforce zoning and other land use control measures to protect wetlands and other ecologically sensitive areas in human settlements (Republic of Ghana, 2016). While these institutions are supposed to operate in a coordinated and collaborative manner with local communities, civil society and academia, anecdotal evidence suggests that this is not the case in practice.

Study Context

The Greater Accra Metropolitan Area (GAMA)

The study was conducted at the Densu Delta and Sakumo Ramsar sites, which are among five (5) coastal wetlands in the country that have been designated as Ramsar sites. (The remaining coastal Ramsar Sites are Keta, Songor and Muni-Pomadze). These Ramsar sites are located in the country's largest and most dynamic urban agglomeration, the Greater Accra Metropolitan Area (GAMA) in the Greater Accra Region (see Figure 2). GAMA, which is Ghana's economic powerhouse, occupies an area of about 1,488 square kilometres and shares boundaries with Shai-Osudoku and Ningo-Prampram Districts to the east, Eastern Region to the north, Central Region to the west and the Gulf of Guinea to the south. GAMA is made up of 25 administrative districts, including two of Ghana's most bustling and economically significant cities, Accra and Tema.
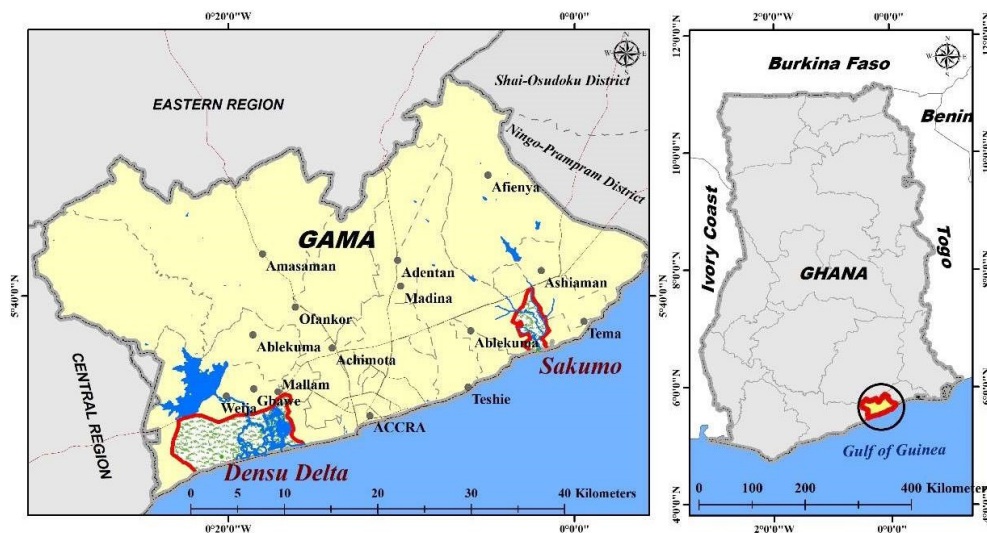
Figure 2: Location of Densu Delta and Sakumo Ramsar Sites

The topography of the GAMA is generally low-lying with 1,162 square kilometres (78%) of the total land area having an elevation of between -5 and 69 metres above sea level. However, the otherwise-flat plain is interrupted by a few hills that rise between 70 and 360 metres above sea level (see Figure 3). One of the features that characterise the low-lying plain is the presence of numerous wetlands, the most prominent of which are the Densu Delta and Sakumo Ramsar sites. The landscape is also characterised by several small lakes, ponds and lagoons most of which form part of the wetlands, as well as several rivers and streams that either feed the wetlands or flow directly into the Gulf of Guinea.

GAMA has experienced rapid population growth during that last six decades. Data compiled by the authors from the last six population censuses show that the area had a population of only 405,136 in 1960, which increased to 1,495,255 in 1984 and 4,992,911 in 2021 (see Figure 4). Growth rate analysis shows that, on the average, the population doubled every 17 years during the last 61 years. The period 1960-1970, which roughly coincided with the first decade after Ghana's independence, recorded the highest annual growth rate of 6.5%. However, the growth rate declined steadily to 4.7%, 3.7% and 3.2% in 1970-1984, 1984-2000 and 2000-2010, respectively. By 2010-2021, it had dropped to 2.6%.

Growth in population and volume of socio-economic activities has resulted in a rapid expansion of the built-up area (comprising mainly of residential, commercial and infrastructural developments). This physical growth, which has been largely uncontrolled, has created several adverse effects on the natural environment, including the destruction of wetlands and water bodies. For instance, according to Yankson *et al*. (2004), the built-up area increased from 216 sq. km in 1985 to 555 sq. km in 2002 while landcover/land use analysis of recent satellite images show that the built-up area currently covers 971.5 sq. km, representing over 65% of the total land mass; vegetation, croplands, wetlands and water bodies account for the remaining 35%.
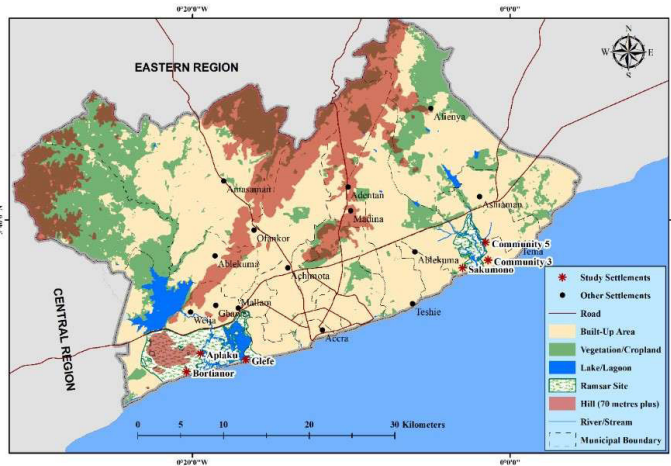
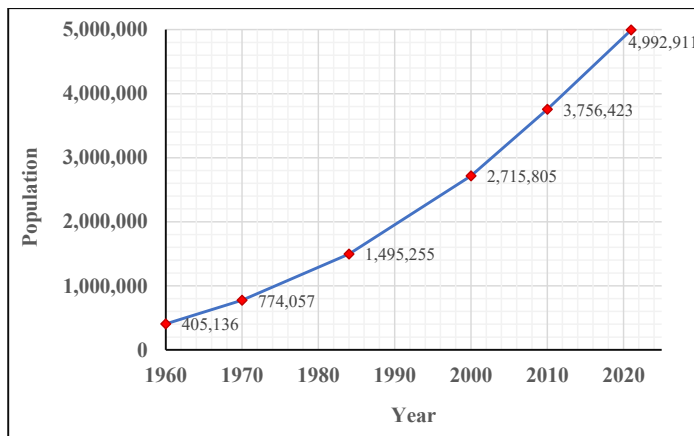**Figure 3: Map of GAMA Showing Study Settlements and Physical Features**

Figure 4: Population Growth Trend of GAMA, 1960-2021

(Source: Authors' construct based on data compiled by from the last six population censuses, 1960-2021)

Densu Delta Ramsar Site

The Densu Delta Ramsar site, a 5,893-hectare protected area, was designated as a Ramsar site in 1992 (Addo, 2017). The site straddles three administrative districts, namely Ga South, Weija-Gbawe and Ablekuma West Municipalities. The site includes a delta formed by River Densu, lagoons fed by the same river, salt pans, sand dunes, freshwater marshes and scrubs, and a few streams (Oteng-Yeboah, 1999). During the dry season, water inflow from the river is interrupted by the Weija Dam, which is located approximately 11 km upstream and supplies drinking water to Accra. However, during the rainy season, excess water from the dam is released into the delta and the lagoons. The discharge, together with increased volume of water from surrounding streams, causes the delta

and the lagoons to overflow their banks. This in turn impedes the flow of surface run-off when there is heavy rainfall and causes flooding in nearby communities such as Gbegbeyise, Glefe, Mpoase and Tetegu. The vegetation of the site includes about 136 plant species made up of 50 flowering plant families, including mangroves, reeds and sedges (Oteng-Yeboah, 1999). The site is also noted for its faunal diversity, which includes about 35,000 birds belonging to 57 species; reptiles such as snakes, lizards and turtles; various mammalian species; marine and freshwater fish and shellfish species; and other invertebrates (Oteng-Yeboah, 1999; Tyroller, 2016). The main economic activities at the protected area before its Ramsar site designation included fishing, crop farming and salt winning (Oteng-Yeboah, 1999). However, due to rapid urbanisation and land use conversion, crop farming is now on a limited scale while industrial and commercial activities have become predominant.

Sakumo Ramsar site

The Sakumo Ramsar site is located in the Tema West Municipality and covers an area of 1,365 hectares. The wetland includes the Sakumo Lagoon, which receives water from the Dzorwulu and Mamahuma rivers, a narrow sand dune that separates the lagoon from the sea, a 700-hectare flood plain surrounding the lagoon and freshwater marshes. Both rivers have been dammed upstream for irrigation, thus limiting the flow of water into the lagoon, especially during the dry season. However, during the rainy season, the flood plain occasionally gets flooded due to excess water from the dams and surface run-off. The site, which is home to over 60 bird species, 13 finfish species and crabs, has a vegetation that consists mainly of coastal savanna grasslands, thickets of trees and shrubs, and floating water plants (Agyepong, 1999). The immediate surroundings of the Sakumo Ramsar site are highly urbanised, with Tema, Ashaiman, Lashibi and Sakumono being among the notable communities that abut the protected site. Expansion of these communities has resulted in significant encroachments on the site. Other human activities at the site include fishing in the lagoon and crop farming in the flood plain.

METHODS

The research began with preliminary visits to the Ramsar sites. These visits provided an opportunity to observe the state of the wetlands as well as human activities that have impacted the sites. Through these visits, six (6) communities that are located either within or on the fringes of the two Ramsar sites were selected for study (see Table 1)

Table 1: Brief Description of Study Communities

Ramsar Site	Communities	Description
Densu Delta	Bortianor	Located within the Densu Delta protected area. An old indigenous community, originally a fishing/farming village. Has grown rapidly over the last few decades attaining a population of 32,485 as of 2010.
	Aplaku	Located within the Densu Delta protected area. Originally a farming village. Has grown rapidly in recent years, reaching a population of 16,816 as of 2010.
	Glefe	Located within the Densu Delta protected area. A crowded, frequently-flooded slum community made up of settlers from various parts of the country. Had a population of 3,313 as of 2010.
Sakumo	Sakumono	Located on the fringe of the Sakumo protected area. Originally an indigenous, fishing/farming village. Had a population of 22,713 as of 2010 with its physical expansion spilling into the protected area..
	Community 3	Located on the fringe of the Sakumo protected area. Forms part of the port city of Tema, originally planned and constructed by government. However, its physical expansion has spilled into the protected area due to poor development control. Had a population of 5,691 as of 2010.
	Community 5	Located on the fringe of the Sakumo protected area. Forms part of the port city of Tema, originally planned and constructed by government. However, its physical expansion has spilled into the protected area due to poor development control. Had a population of 13,043 as of 2010.

Field data were collected in June/July 2021 through a survey, key informant interviews and direct observation in the six selected communities. The survey targeted household heads living at the two study sites. Since the main purpose of the study was to analyse respondents' awareness and attitude, the key variables considered were categorical in nature and, therefore, the parameters of interest took the form of proportion. Besides, the size of the study population was unknown. Given these two conditions, we computed a suitable sample size using the following formula, which does not require prior knowledge of population size and is designed for making inferences about unknown population proportions (see Agresti & Finlay, 2014):

$$n = \pi(1-\pi)\left(\frac{Z}{e}\right)^2$$

where

n = sample size;

Z = 1.96 = the standard normal variate (z-score) based on a 95% confidence level;

π = unknown population proportion, taken as 0.5 to maximize π(1- π); and

e = 5% = margin of error.

The calculated sample size was 384, which was approximated to 390 and distributed between the two sites as 210 for Densu Delta and 180 for Sakumo. However, the number of respondents who agreed to participate in the survey was 163 at Densu Delta and 145 at Sakumo, giving a total of 308 respondents (household heads) and a response rate of 79%. Respondents (household heads) were randomly selected based on the houses they lived in. The sampling process began with the creation of an inventory of houses in the study communities that were located within, or abutted, the two protected sites using satellite images and ground truthing. The simple random sampling technique was then used to select the appropriate number of houses in each community based on the number of respondents allocated to that community. Where there were more than one household in a house, the available household heads were assigned numbers and the simple random sampling technique was again used to select one of them.

Although the focus of this study was not about testing the various theories that have been stated in the previous sections, the survey was conducted using a questionnaire based on insights from the conceptual and theoretical framework. Primarily, the questionnaire captured data on respondents' (household heads') socio-economic characteristics, their awareness and attitude towards the coastal wetlands under study. Awareness was operationalised by asking respondents to indicate whether they knew about the benefits of the coastal wetlands, human activities that destroy the wetlands, and existing government policies and regulations protecting wetlands. Also, as pointed out in the theoretical discussion, environmental attitude describes a person's mindset and opinions in respect of their favourable or unfavourable evaluations about the environment. This was operationalised in the survey instrument by asking questions designed to gauge the respondents' views on why the wetlands had been poorly managed, their opinions about wetland protection, reasons for their opinions, and what they thought should be done to better protect the wetlands. These awareness and attitude questions were mostly designed to elicit multiple open-ended responses, which were later classified into various categories based on their similarities.

The survey data, which were collected electronically using the KoboCollect app, were analysed and presented using various descriptive statistics (such as tables, graphs/charts, proportions and averages) and Chi-square tests (to examine possible association between awareness and support for wetland protection a 5% alpha level). The analysis was conducted with the aid of *STATA 17* and *MS Excel 2019.*

Following the survey, interviews were conducted with 10 purposively selected key informants. Criteria for their selection included: 1) officials of state institutions responsible for wetland management who were knowledgeable about the two sites; 2) researchers at a research institution with a focus on wetlands; and 3) traditional or formal leaders of the study communities (see Table 2). In addition to the survey and key informant interviews, direct observation of the state of the wetlands and prevailing human activities formed part of the data gathering process.

Table 2: List of institutions from which key informants were selected

Institution	Status/Selection Criterion	Number of Key Informants
Environmental Protection Agency (EPA)	State institution responsible for wetland management	1
Wildlife Division of the Forestry Commission (WD)	"	1
Water Resource Commission (WRC)	"	1
Ga South and Tema East Municipal Assemblies	"	2
Centre for African Wetlands (CAW)	Research institution with focus on wetlands	1
Community Leadership at the two sites (Assembly Members/Elders)	Traditional/formal community leaders	4
Total	**-**	**10**

RESULTS

Characteristics of survey respondents

An understanding of key demographic characteristics provides the context for residents' awareness and attitudes on coastal wetlands. The survey revealed that respondents at both sites were predominantly male. However, compared to the Densu Delta Ramsar site, respondents at Sakumo were better educated, were less likely to engage in farming or fishing as their main occupation, and had resided at this site more recently (see Table 3). The spatial differences with respect to education and occupation were reflective of the fact that household heads of Tema West Municipality where the Sakumo site is located had a slightly higher socio-economic status than those of Ga South Municipality where the Densu Delta site is located. For instance, in 2010, the proportion of household heads who had attained at least secondary education was 37.0% in Ga South Municipality (Ghana Statistical Service, 2014a) and 47.1% in Tema Metropolis, which included Tema West at the time (Ghana Statistical Service, 2014b). Also, the proportion of the employed labour force that engaged in agriculture or fishing as their main occupation in the two administrative districts were 4.2% and 9.1%, respectively.

Residents' awareness of the value of coastal wetlands

During the survey, respondents were asked to indicate whether they were aware of any benefits of the coastal wetlands and, if they were, state them. Their responses to this open-ended question, which included multiple responses, were then categorised as shown in Figure 5. The results show that the most frequently mentioned benefit was the fact that wetlands were a source of livelihoods, which mainly included farming and fishing. This benefit was stated by 54.2% of the respondents while 28.6% of them stated that the wetlands were a source of water for farming and domestic use, and another 17.9% mentioned that wetlands served as habitat for wildlife (see Figure 5). Other significant benefits mentioned included wetlands possessing aesthetic and recreational values, moderating atmospheric temperature and helping to control floods each of which was mentioned by approximately one in ten

Table 3: Characteristics of respondents

| Characteristic	Densu Delta (n = 163)	Sakumo (n = 145)	Both sites (n = 308)
Sex (%):			
Female	35.0	36.6	35.7
Male	65.0	63.4	64.3
Educational level (%):			
Primary School	54.6	4.1	30.8
Middle/Junior High School	5.5	19.3	12.0
Secondary/Senior High School	23.3	42.1	32.1
Tertiary	16.6	34.5	25.0
Duration of stay (%):			
Up to 5 years	13.5	74.5	42.2
6-10 years	22.1	17.9	20.1
Over 10 years	64.4	7.6	37.7
Occupation (%):			
Trader	10.4	23.4	16.6
Farmer/Fisherman	7.4	0.0	3.9
Salaried worker	11.0	11.7	11.4
Artisan	3.1	5.5	4.2
Other	5.5	2.8	4.2
Not working	62.6	56.6	59.7
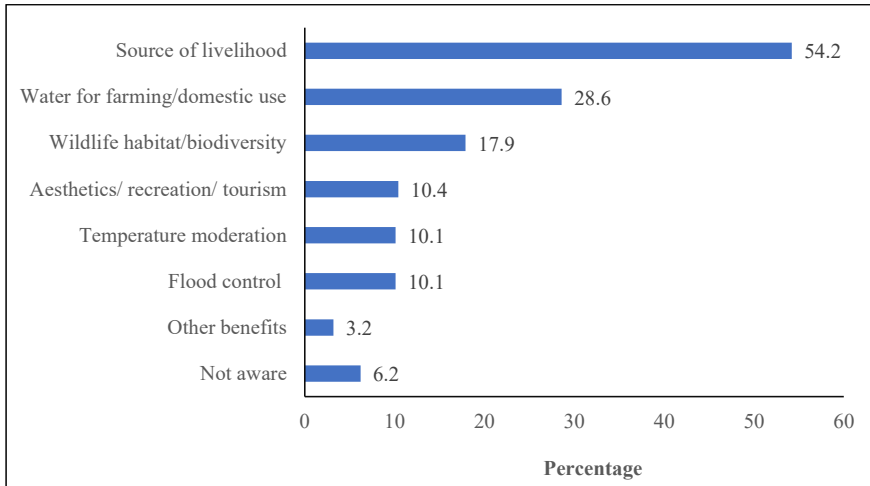
Figure 5: Coastal wetland benefits stated by respondents

respondents. The "Other benefits" (3.2%) category included spiritual (the lagoons and rivers serving as abodes for the gods) and medicinal (the wetlands being a source of medicinal herbs) benefits.

In all, a total of 93.8% of the survey respondents knew at least one benefit of coastal wetlands while the remaining 6.2% indicated they were not aware of any benefits. About 54.9% of them were aware of one benefit while 38.9% were aware of two or more benefits (see Figure 6). Thus, although none of the respondents knew about other wetland benefits such as surface water purification and groundwater recharge, over nine in ten knew about at least one benefit that was prevalent at the two Ramsar sites. This reflected their lived experiences and personal knowledge of the two Ramsar sites.

During the survey, respondents were asked whether they were aware of any human activities that destroyed the wetlands and then, if they were, state what they considered to be the most destructive activity. The data, which included multiple responses, are presented in Table 4. It shows that the most commonly mentioned activity was "building in the restricted zone", which was mentioned by 44.5% of respondents at the two study sites, with the breakdown being 63.2% at the Densu Delta site and 23.4% at the Sakumono site. The second most cited activity, "improper waste disposal", appeared to be particularly prevalent at the Densu Delta site where it was mentioned by 52.8% of the respondents, compared to only 7.6% at the Sakumo site. However, "sand winning" was a major concern at the Sakumo site where 13.1% cited it as being injurious to wetlands. "Road construction" and "farming" were also mentioned as human activities that destroyed the wetlands. Also worth noting is the fact that the proportion of respondents who said they had no idea about human activities that destroyed wetlands was as high as 50.3% at the Sakumo site but only 9.2% at the Densu Delta and 28.6% for the two sites combined.

The huge disparity is probably due to the fact that human activities that adversely impacted the wetlands were much more rampant at the Densu Delta site, which is also much more extensive than the Sakumo site.
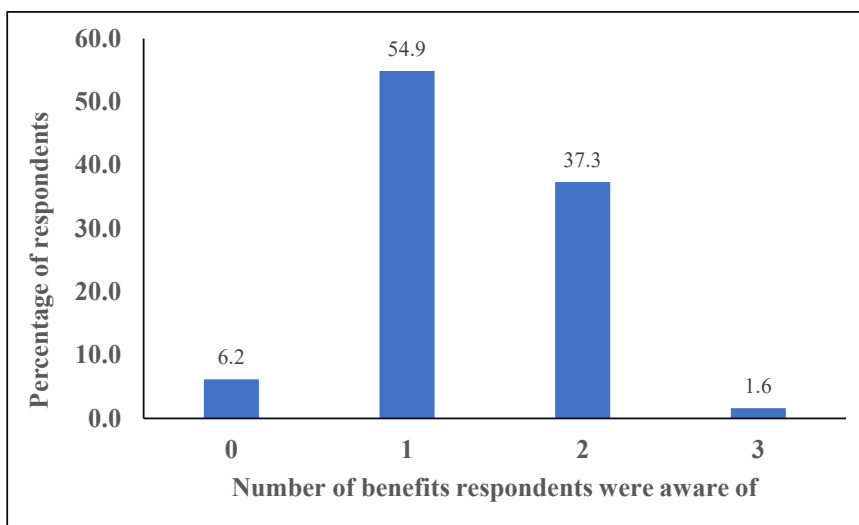
Figure 6: Number of benefits respondents were aware of

Table 4: Activities that destroy coastal wetlands

Activityy	Densu (n = 163)		Sakumo (n = 145)		Both Sites (n = 308)	
	Number	Percent	Number	Percent	Number	Percent
Building in the restricted zone	103	63.2	34	23.4	137	44.5
Improper waste disposal	86	52.8	11	7.6	97	31.5
Sand wining	4	2.5	19	13.1	23	7.5
Road Construction	10	6.1	12	8.3	22	7.1
Farming	1	0.6	1	0.7	2	0.6
No idea	15	9.2	73	50.3	88	28.6

Residents' awareness about wetland protection policies and regulations

Despite being aware of the benefits of coastal wetlands, most respondents were unaware of government's wetland protection policies and regulations. Out of the 308 household heads surveyed, as many as 282 (representing 91.6%) said they were unaware while the rest claimed to be aware of such policies and regulations. Among those who indicated awareness, the most frequently stated policy/regulation was "buffer zone restrictions" (3.2%), which included prohibition of building construction and other human activities within wetland buffer zones (see Figure 7). They also stated "prohibition of waste dumping" (2.9%), "laws to protect wildlife" (2.3%), and "ban on sand winning" at the beach or wetlands (2.3%). The generally low level of awareness about government's wetlands protection measures could be attributed to the failure of government agencies responsible for wetland

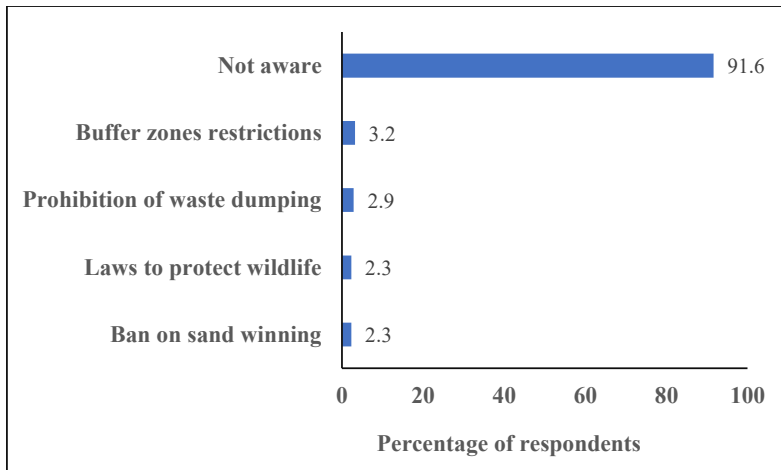management to engage wetland communities in wetland management.

Figure 7: Awareness about Wetland Protection Policies and Regulations

Residents' attitude towards wetland protection

According to the survey data, 282 out of the 308 respondents expressed opinions about factors responsible for the poor management of the two coastal wetlands while the remaining 26 expressed no opinion. The opinions of the 282 respondents, which are presented in Table 5, point to a general notion among residents about government's failure or ineffectiveness in protecting wetlands. For instance, they complained about "poor waste management system" (25%), "inaction or ineffectiveness of government in checking encroachments" on wetlands (14.9%), "lack of restrictions on building and other construction activities" (14%), "lack of public education on wetlands/wetland protection laws and regulations" (6.8%), and "poor human settlement/land use planning" (3.6%). Apart from government, a few respondents blamed community leaders for the destruction of the coastal wetlands. They cited indiscriminate sale of lands by chiefs, family heads and other customary land owners (10.7%), as well as ineffective leadership and organization at the community level (4.9%).

Table 5: Factors responsible for poor management of coastal wetlands based on household heads' perspectives

Factors opined by respondents	Number	Percent
Poor waste management system	77	25.0
Inaction/ineffectiveness of Government in checking encroachment	46	14.9
Lack of restrictions on building/other construction activities	43	14.0
Indiscriminate sale of lands by chiefs/land owners	33	10.7

Lack of public education on wetlands/ wetland protection laws & regulations	21	6.8
Lack of restrictions on sand winning	16	5.2
Lack of good drainage system	16	5.2
Ineffective community leadership/organization	15	4.9
Poor human settlement/land use planning	11	3.6
Seasonal changes in weather conditions (causing streams and lagoons to dry)	4	1.3
No opinon	26	8.4
Total	**308**	**100.0**

The survey data also showed that respondents' support for wetland protection was very high, particularly among those who had indicated awareness about the benefits of coastal wetlands. Table 6 is a cross-tabulation between the two categorical variables (i.e. support for wetland protection by awareness about wetland benefits). All the 289 respondents (representing 93.8% of the 308 respondents) who were aware of at least one benefit of coastal wetlands were in support of wetland protection while only four (4) out of the 19 respondents who said they were unaware of any wetland benefit expressed support for wetland protection (see Table 6). A Chi-square test of the association between support for coastal wetland protection and awareness about wetland benefits yielded a high Pearson's Chi-square statistic of 239.8 with a very low p-value of less than 0.001 (against an alpha level of 0.05). That means, within the study population, awareness about the benefits of coastal wetlands had a statistically significant influence on support for wetland protection. However, a similar test for possible association between support for coastal wetland protection and awareness about wetland protection policies and regulations showed no statistically significant results. Thus, respondents' support for wetland protection was not influenced by their knowledge about government's wetland protection policies and regulations.

Table 6: Support for Coastal Wetland Protection by Awareness about Wetland Benefits

		Support for Wetland Protection		
Awareness about Wetland Benefits		Support	Don't Support	Total
Aware	Number	289	0	289
	%	93.8	0.0	93.8
Not Aware	Number	4	15	19
	%	1.3	4.9	6.2
Total	Number	293	15	308
	%	95.1	4.9	100.0

Pearson chi2(1) = 239.8383; Pr = 0.000

Respondents provided reasons for supporting coastal wetland protection based on perceived benefits derived from wetlands. Over 33% of the respondents said they supported wetland protection because the wetlands were a source of livelihood for some residents (see Figure 8). The rest mentioned flood prevention (17.5%), wildlife protection (17.2%) and other wetland benefits to justify wetland protection.
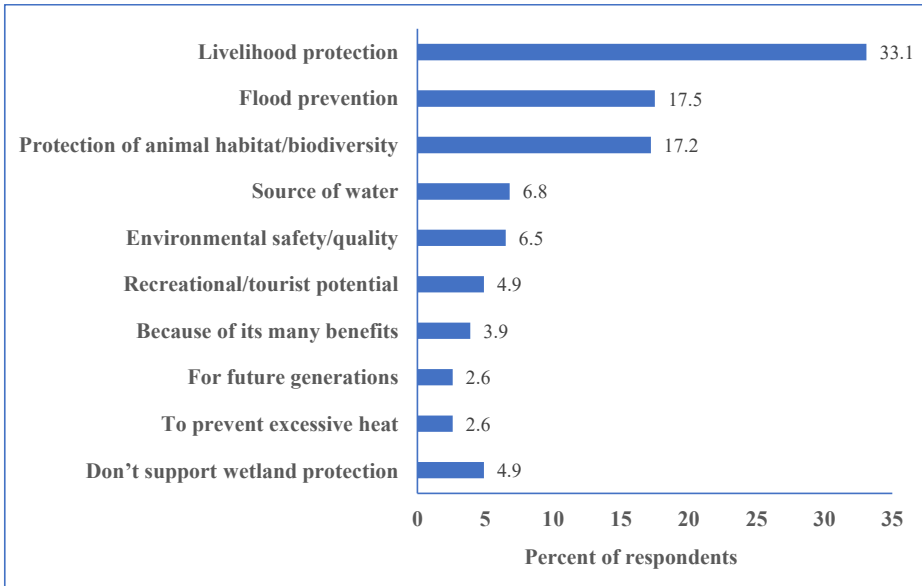

Figure 8: Reasons why coastal wetlands should be protected

Respondents who thought that coastal wetlands should be protected further demonstrated their positive attitudes by suggesting that certain measures be put in place to protect the wetlands. As Figure 9 shows, close to a third of the respondents suggested the "enactment or strict enforcement of laws" while 17.5% and 14.9% of them suggested the establishment of a "proper waste management system" and construction of "a good drainage system", respectively. Other suggestions included: effective town planning/land management; awareness creation/sensitization; clear demarcation of buffer zone; prevent sale of plots on wetlands; and dredging of lagoons/waterways.

These suggested measures largely reflected what they thought were the factors responsible for poor management of the coastal wetlands in their community.

Evidence from direct observation and perspectives of state institutions responsible for wetland protection

Most of the activities stated by the survey respondents as being responsible for the destruction of the wetlands were confirmed by direct observation. For instance, several buildings constructed in marshes or close to water bodies were observed by the research team (see Plate 1).
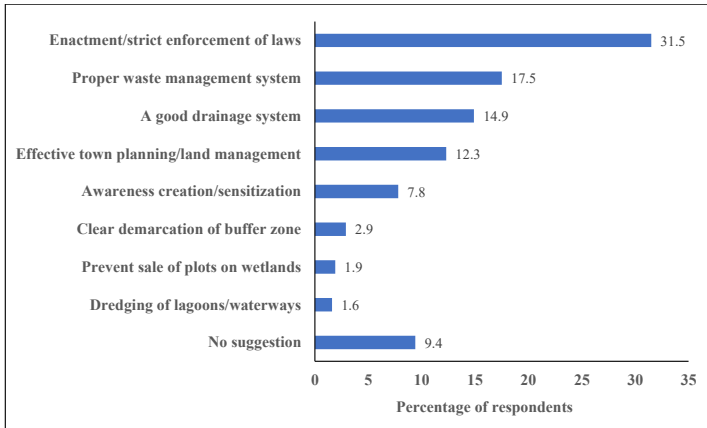
Figure 9: Wetland protection measures suggested by respondents

Plate 1: Building construction in wetlands at study sites

Direct observation and key informant interviews with government officials revealed that some of the residents of the study communities were responsible for illegal building construction, indiscriminate disposal of waste and other human activities that destroy wetlands. For instance, at Glefe, residents had adopted the practice of reclaiming land from the Glefe Lagoon for housing construction by filling the lagoon with solid waste and laterite (see Plate 2). Thus, residents' verbal expression of positive attitude towards wetlands was contradicted by their actual behaviour.

Officials from the various state institutions who were interviewed also lamented about

the activities of residents that had contributed to the continual deterioration of wetlands. For instance, an official of Ga South Municipal Assembly had this to say:

What we are currently facing is the way the [Densu Delta] wetlands are being encroached upon. It is so bad! Some of the people undertake construction [of buildings] at night and on weekends because they know at such times, we are not working.

Another official claimed that:

When we go in there to stop unauthorized developments in the wetlands, we are attacked by land guards. So, it creates that fear in us. So, inasmuch as we are protecting

government property, protecting the masses from flooding…, we also have to protect our *lives* (An official of Tema West Municipal Assembly).

Plate 2: A portion of Glefe Lagoon being filled with refuse

In describing what had accounted for the inability of the responsible institutions to effectively implement existing wetland protection measures, another official claimed that:

There is total disregard for the laws of Ghana. Sakumo has been acquired by the Government but go and see the level of encroachment there…. people are filling the wetlands and developing it. When we decide to pull the structures down, there is trouble (an official of Wildlife Division).

The officials also acknowledged the failure of the institutions they represented in playing their roles in wetland protection. They attributed this to several factors, including uncooperative attitude of chiefs and other customary landowners who allocate land within the protected areas to developers without recourse to zoning regulations, political interference in their work, lack of political will on the part of political leaders, lack of specific strategies for wetland protection, inadequate staff, and lack of resources to police the wetlands. For instance, according to one of them:

It has to do with logistics and human resource. In terms of logistics, there are no pick-ups [vehicles] for monitoring, which is key in protecting the wetlands. The bigger challenge is the political will … we all know that in order to implement plans or policies you need political will and that's a challenge in Ghana. This is because, for instance, if someone is putting up a structure in unauthorised places and as a technical person you visit the site to demolish it, a politician will intervene and prevent you from performing your duty. In this case we become handicapped (an official of Ga South Municipal Assembly).

Furthermore, interviews with community leaders suggested that the various government agencies responsible for wetland management hardly engaged with residents in connection with wetland management.

DISCUSSIONS

Key findings

The study revealed that most residents were aware of the value of coastal wetlands, which could be attributed to their lived experiences, although none of them knew about other benefits such as carbon sequestration, water purification and groundwater recharge and discharge. For instance, livelihood activities such as farming, fishing and sand winning had already been widely reported at the study sites prior to this study (e.g. Addo, 2011; Adjei *et al.*, 2019; Ekumah *et al.*, 2020). The respondents also knew that building construction in the low-lying areas of the protected sites, which serve as receptacles for large volumes of runoff water during heavy rains and water spillage from dams located upstream, caused flooding. Moreover, the majority of them were aware that building and road construction, improper waste disposal, sand winning and other anthropogenic activities at the protected sites destroyed the wetlands. These activities have also been reported by several researchers (e.g. Agbeti *et al.*, 2022; Ekumah *et al.*, 2020; Nartey *et al.*, 2011; Tyroller, 2016; Willoughby *et al*. It is also significant to note that most of the activities mentioned by the respondents as being destructive to coastal wetlands are prohibited by the country's National Land Policy and Riparian Buffer Zone Policy.

Despite being aware of the benefits of coastal wetlands and activities that destroy wetlands, most of the respondents were not aware of government's wetland protection policies and regulations due to the failure of relevant state institutions to involve local communities in wetland management. This is clearly at variance with the first objective of the country's wetland conservation strategy, which seeks "to promote the participation of local communities, traditional authorities, and other stakeholders in sound management and sustainable utilisation of Ghana's wetland

resources" (Ministry of Lands and Forestry, 1999a). This finding also gives further credence to the fact that residents' awareness of the value of wetlands is based on their lived experiences rather than a deliberate public education or sensitisation by government.

The study also reports widespread verbal expression of support for wetland protection as a measure of residents' attitudes towards wetlands. In addition, support for wetland protection was significantly influenced by respondents' awareness about wetland benefits. That means, as far as the study population was concerned, awareness about the value of wetlands was a principal determinant of positive attitude among wetland residents as suggested by the behavioural change model (see Hungerford & Volk, 1990) and the model of ecological behaviour (see Kollmuss & Agyeman, 2002). However, as the theory of planned behaviour posits, positive attitude does not necessarily lead to ERB (see Ajzen, 1991; Sawitri *et al.*, 2015)1985, 1987. At the two Ramsar sites studied, although residents verbally expressed positive attitudes towards wetlands, their actual behaviour (such as building construction and indiscriminate waste disposal in wetlands) contributed to wetland destruction.

Another key finding is that, residents' attitude towards wetlands (in terms of support for wetland protection) was not influenced by their awareness about government's wetland protection policies and regulations. This implies that, although getting residents informed about the existence of government's policies and regulations is necessary for the implementation of such policies and regulations, it is their convictions about the value of wetlands that actually influence their attitude.

The lack of residents' awareness and compliance with government's wetland protection policies and regulations can be attributed to weak urban governance. This

study has shown that state agencies lack the commitment and resources required to effectively influence residents' behaviour through civic engagement, undertake development control and enforce other wetland protection regulations. Indeed, the wetland residents' themselves attribute the deterioration of the two Ramsar sites to the failure of government to enact and strictly enforce wetland protection regulations, undertake effective land use planning, sensitise the population and provide municipal services. Thus, weak urban governance is clearly at the heart of the ineffective management of the two Ramsar sites. This is a reflection of a general governance failure in the management of Africa's urban environment, as has been reported by other researchers (e.g. Cobbinah *et al*., 2022; Materu *et al*., 2018; Mutisya & Yarime, 2014). For instance, with respect to wetlands management in Kumasi (Ghana's second largest city), Cobbinah *et al*. (2022) found several governance-related challenges, including the lack of political will, failure of institutions to enforce wetland protection regulations and laws, inadequate staffing, and lack of coordination and cooperation between government agencies, developers and traditional authorities.

Implications for sustainable urban development

Residents' awareness and positive attitude towards wetlands, together with effective urban governance, promote effective wetland management and, ultimately, sustainable urban development. However, evidence from the field shows that, although awareness and positive attitude are preconditions, they do not guarantee ERB. According to the theory of planned behaviour, the intervening variable mediating between attitude and ERB is behavioural intention (Ajzen, 1991; Sawitri *et al*., 2015)1985, 1987. Also, as Fietkau and Kessel's model of ecological behaviour points out, attitude is only one of four socio-

psychological factors that influence ERB, with the other factors being possibilities to act environmentally, incentives for pro-environmental behaviour, and perceived consequences of behaviour (Kollmuss & Agyeman, 2002).

The responsibility for creating the possibilities for residents to act environmentally, providing incentives (and sanctions) for pro-environmental behaviour and enhancing positive perceptions about the consequences of responsible behaviour lies within the domain of urban governance. In addition, effective urban governance is needed to translate residents' positive attitude to responsible behaviour and effective wetland management, both of which are ingredients of sustainable urban development. Therefore, the lack of effective urban governance, as found in this study, implies that residents will hardly have the incentive, commitment or even the opportunity to act responsibly towards wetlands since the necessary conditions for them to do so are absent. In turn, this is likely to have long-term negative consequences on the environmental, economic and social sustainability of urban development. In particular, construction and other environmentally injurious human activities in the wetlands will not only continue but may be intensified while environmental awareness and protection remain an empty rhetoric.

CONCLUSION

This study has shown that, although residents' awareness and attitudes regarding wetlands are critical, these factors do not guarantee desirable behaviour. Therefore, to ensure effective wetland management and sustainable urban development, deliberate measures need to be devised to translate awareness and positive attitude into actual ERB. This will require strengthening the governance dimension of sustainability

by enforcing existing wetland protection measures and fostering closer engagements with local communities and other stakeholders in wetland management. For instance, existing legislations on subdivision and alienation of land for physical development should be enforced. Residents should also be sensitised on the fact that pro-environmental behaviour at the personal level is required to produce desirable environmental outcomes at the community and global levels. To facilitate this, there is the need to sensitise the political class and resource the administrative setups of the MMDAs and other relevant state agencies towards pro-environmental policy making and implementation. In addition, these agencies should collaborate closely with pro-environmental civil society organisations (CSOs). We also recommend further research into the complexities, challenges and prospects of the subject of wetland governance in urban Ghana.

The study has a few limitations with respect to its scope. First, measurement and analysis of the environmental behaviour of wetland residents at the personal level, which would have allowed for a formal empirical testing of the main underlying theory (theory of planned behaviour) was not included in the scope. Secondly, the study did not go into the details of all the governance issues relating to wetland management, especially issues relating to relationships, collaboration and coordination among the various state and non-state actors, and institutional capacity of these actors to play their respective roles.

REFERENCES

Adamus, P. R., Stockwell, L. T., Clairain, E. J., Morrow, M. E., Rozas, L. P., & Smith, R. D. (1991). Wetland Evaluation Technique (WET): Volume I (Literature Review and Evaluation Rationale). Wetlands Research Program Technical Report WRP-DE-2.

Addo, A. A. (2017). Assessing Heavy Metal Load of Fish and Shorebirds in The Densu Delta Ramsar Site, Ghana [University of Ghana, Legon]. http://ugspace.ug.edu.gh/handle/123456789/24672

Addo, K. A. (2011). Changing morphology of Ghana's Accra coast. Journal of Coastal Conservation, 15(4), 433–443. https://doi.org/10.1007/s11852-010-0134-z

Adjei, F. O., Adjei, K. A., Obuobie, E., & Odai, S. N. (2019). Trends in land use/land cover changes in the Densu River basin and its impact on the Weija reservoirs and the Densu Delta (Sakumo I lagoon) in Ghana. Journal of Geography and Regional Planning, 12(4), 76–89. https://doi.org/10.5897/jgrp2019.0747

Agbeti, J. A., Mantey, S., & Zaman, Q. Z. (2022). Detecting encroachment within wetlands using UAV techniques -The case of Sakumo Ramsar site, Ghana. Journal of Environment and Earth Science, 12(2), 23–31. https://doi.org/10.7176/jees/12-2-04

Agresti, A., & Finlay, B. (2014). Statistical Methods for the Social Sciences (4th ed.). Pearson Education Limited.

Agyapong, E. B., Ashiagbor, G., Nsor, C. A., & Leeuwen, L. M. Van. (2018). Urban land transformations and its implication on tree abundance distribution and richness in Kumasi , Ghana. Journal of Urban Ecology, 4(1), 1–11. https://doi.org/10.1093/jue/juy019

Agyepong, G. T. (1999). Coastal wetlands management project: Management plan for Sakumo Ramsar Site.

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Akintunde, E. (2017). Theories and concepts for human behavior in environmental

preservation. Journal of Environmental Science and Public Health, 01(02), 120–133. https://doi.org/10.26502/jesph.96120012

Alakananda, B., Mahesh, M. K., Supriya, G., Boominathan, M., & Balachandran, C. (2011). Monitoring Tropical Urban Wetlands through Biotic Indices. 2(2), 91–106.

Amo, M., Bih, F. K., Agyemang Jr., A., Gyamfi, T. A., & Mensah, M. (2017). Investigation into the acquisition and development of wetlands in built environment industry: A case study in Kumasi Metropolis. International Journal of Civil Engineering, Construction and Estate Management, 5(4), 1–20.

Andersson, J. (2007). The recreational cost of coral bleaching—a stated and revealed preference study of international tourists. Ecological Economics, 62(3–4), 704–715.

Appiah, D. O., & Yankson, D. (2012). Anthropogenic Drivers of the Pressures on the Ramsar Site of Sakumo Lagoon in Ghana. International Journal of Technology and Management Research, 1(1), 48–56. https://doi.org/10.47127/ijtmr.v1i1.7

Asamoah, R. O., Nelson, I. D. I., Twumasi-Ampofo, K., Solomon-Ayeh, B., Offei-Nyako, K., & Ankrah, J. S. (2016). Invasion of wetlands in Kumasi by informal economic activities and consequences for urban management. Urban and Regional Planning, 1(1), 16–21. https://doi.org/10.11648/j.urp.20160101.13

Bauer, S., & Meijer, K. (2015). Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. In M. Loewe & N. Rippin (Eds.), The Sustainable Development Goals of the Post-2015 Agenda: Comments on the OWG and SDSN Proposals. German Development Institute. https://doi.org/10.2139/ssrn.2567302

Bervar, M., & Bertoncelj, A. (2016). The five pillars of sustainability: Economic, social, environmental, cultural and security aspects. Management International Conference, 243–244. https://www.hippocampus.si/ISBN/978-961-6984-26-3/151.pdf

Biermann, F., Betsill, M. M., Gupta, J., Kanie, N., Lebel, L., Liverman, D., Schroeder, H., & Siebenhüner, B. (2009). Earth system governance: people, places and the planet. In Earth System Governance Report 1, IHDP Report 20. https://doi.org/10.7551/mitpress/9780262028226.001.0001

Campion, B. B. (2012). Urban wetland ecology and floods in Kumasi, Ghana. Universität Bremen.

Campion, B. B., & Owusu-Boateng, G. (2013). The political ecology of wetlands in Kumasi , Ghana. International Journal of Environment and Bioenergy, 7(2), 108–128.

Cherono, C. G., Hellen, I., & Okelo, O. P. (2018). Socio-Economic Benefits of Kingwal Wetland to the Local People. 6(4), 41–46.

Cobbinah, P. B., Korah, P. I., Bardoe, J. B., Darkwah, R. M., & Nunbogu, A. M. (2022). Contested urban spaces in unplanned urbanization: Wetlands under siege. Cities, 121, 103489. https://doi.org/10.1016/j.cities.2021.103489

Colenbrander, S. (2016). Cities as engines of economic growth: The case for providing basic infrastructure and services in urban areas. www.iied.org@iiedwww.facebook.com/theIIEDhttp://pubs.iied.org/xxxxxIIEDwww.iied.org3

Ekumah, B., Armah, F. A., Afrifa, E. K. A., Aheto, D. W., Odoi, J. O., & Afitiri, A.-R. (2020). Assessing land use and land cover change in coastal urban wetlands of international importance in Ghana using

Intensity Analysis. Wetlands Ecology and Management, 28(2), 271–284. https://doi.org/10.1007/s11273-020-09712-5

Faulkner, S. (2004). Urbanization impacts on the structure and function of forested wetlands. Urban Ecosystems, 7, 89–106.

Geng, M. M., & He, L. Y. (2021). Environmental regulation, environmental awareness and environmental governance satisfaction. Sustainability, 13(3960), 1–17. https://doi.org/10.3390/su13073960

Ghana Statistical Service. (2014a). 2010 Population and Housing Census: District Analytical Report (Ga South Municipality). Ghana Statistical Service. www.statsghana.gov.gh.

Ghana Statistical Service. (2014b). 2010 Population and Housing Census: District Analytical Report (Tema Metropolis). Ghana Statistical Service. www.statsghana.gov.gh.

Gopal, B. (2013). Future of wetlands in tropical and subtropical Asia , especially in the face of climate change. Aquatic Sciences, 75, 39–61. https://doi.org/10.1007/s00027-011-0247-y

Gundu, T., & Flowerday, S. V. (2013). Ignorance to awareness: Towards an information security awareness process. SAIEE Africa Research Journal, 104(2), 69–79. https://doi.org/10.23919/saiee.2013.8531867

Hassan, S., Olsen, S. B., & Thorsen, B. J. (2019). Urban-rural divides in preferences for wetland conservation in Malaysia. Land Use Policy, 84, 226–237. https://doi.org/10.1016/j.landusepol.2019.03.015

Hawkes, J. (2001). The Fourth Pillar of Sustainability : Culture ' s essential role in public planning. Jon Hawkes and the Cultural Development Network.

Howard, R. J., Wells, C. J., Michot, T. C., & Johnson, D. J. (2014). Effects of disturbance associated with seismic exploration for oil and gas reserves in coastal marshes. Environmental Management, 54, 30–50. https://doi.org/10.1007/s00267-014-0274-2

Hu, C., Wright, A. L., & He, S. (2022). Public Perception and Willingness to Pay for Urban Wetland Ecosystem Services: Evidence from China. Wetlands, 42(19). https://doi.org/https://doi.org/10.1007/s13157-022-01538-6 Public

Hungerford, H. R., & Volk, T. L. (1990). Hungerford Volk - Changing learner behavior through Environmental Education.pdf. The Journal of Environmental Education, 21, 257–270.

Ibarra, A. A., Zambrano, L., Valiente, E. L., & Ramos-Bueno, A. (2013). Enhancing the potential value of environmental services in urban wetlands : An agro-ecosystem approach. Cities, 31, 438–443. https://doi.org/10.1016/j.cities.2012.08.002

Iizuka, M. (2000). Role of environmental awareness in achieving sustainable development.

Joachim, O. I., Kamarudin, N., Aliagha, G. U., & Ufere, K. J. (2015). Theoretical explanations of environmental motivations and expectations of clients on green building demand and investment. IOP Conference Series: Earth and Environmental Science, 23(1). https://doi.org/10.1088/1755-1315/23/1/012010

Kanaujia, A., & Kumar, A. (2014). Wetlands : Significance , threats and their conservation. Green, 7(3&4).

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? Environmental Education Research, 8(3), 239–260. https://doi.org/10.1080/13504620220145401

Kometa, S. S., Kimengsi, J. N., & Petiangma, D. M. (2018). Urban development and its implications on wetland ecosystem services in Ndop, Cameroon.

Environmental Management and Sustainable Development, 7(1), 21–36. https://doi.org/10.5296/emsd.v7i1.12141

Maltby, E., Hogan, D. V., & McInnes, R. J. (1996). Functional analysis of European wetland ecosystems phase 1 (FAEWE): Ecosystems Research Report No 18.

Materu, S. F., Urban, B., & Heise, S. (2018). A critical review of policies and legislation protecting Tanzanian wetlands. Ecosystem Health and Sustainability, 4(12), 310–320. https://doi.org/10.1080/20964129.2018.1549510

Merlín-uribe, Y., González-esquivel, C. E., & Contreras-, A. (2013). Environmental and socio-economic sustainability of chinampas (raised beds) in Xochimilco, Mexico City. International Journal of Agricultural Sustainability, 11(3), 1–18. https://doi.org/10.1080/14735903.2012.726128

Ministry of Lands and Forestry. (1999a). Managing Ghana's Wetlands: A National Wetlands Conservation Strategy. Ministry of Lands and Forestry.

Ministry of Lands and Forestry. (1999b). National Land Policy. Ministry of Lands and Forestry.

Ministry of Water Resources Works and Housing. (2013). Riparian Buffer Zone Policy for Managing Freshwater Bodies in Ghana.

Mitsch, W. J., Bernal, B., & Hernandez, M. E. (2015). Ecosystem services of wetlands. International Journal of Biodiversity Science, Ecosystem Services & Management, 11(1), 1–4. https://doi.org/10.1080/21513732.2015.1006250

Mutisya, E., & Yarime, M. (2014). Moving towards urban sustainability in Kenya: A framework for integration of environmental, economic, social and governance dimensions. Sustainability

Science, 9(2), 205–215. https://doi.org/10.1007/s11625-013-0223-7

Nartey, V. K., Edor, K. A., Doamekpor, L. K., & Bobobee, L. H. (2011). Nutrient load of the sakumo lagoon at the sakumo ramsar site in Tema, Ghana. West African Journal of Applied Ecology, 19(1), 93–105.

Ondiek, R. A., Vuolo, F., Kipkemboi, J., Kitaka, N., Lautsch, E., Hein, T., & Schmid, E. (2020). Socio-economic determinants of land use/cover change in wetlands in East Africa: A case study analysis of the Anyiko Wetland, Kenya. Frontiers in Environmental Science, 7. https://doi.org/10.3389/fenvs.2019.00207

Oteng-Yeboah, A. A. (1999). Development of a management plan for the Densu Delta Ramsar site. In Ghana Coastal Wetlands Management Project (GET TF 28619 GH).

Ramsar Convention Secretariat. (2016). An Introduction to the Ramsar Convention on Wetlands, 7th ed. Ramsar Convention Secretariat.

Republic of Ghana. (1994). Environmental Protection Agency Act 1994 (Act 490). Assembly Press.

Republic of Ghana. (1996). Water Resources Commission Act 1996 (Act 522). Assembly Press.

Republic of Ghana. (2016). Land Use and Spatial Planning Act, 2016 (Act 925) (pp. 1–106). Assembly Press.

Rodríguez-Labajos, B. (2013). Climate change , ecosystem services , and costs of action and inaction : scoping the interface. WIREs Climate Change. https://doi.org/10.1002/wcc.247

Sakka, S. El. (2016). Developing countries challenges in applying sustainable urban development: An application on Egypt. International Journal of Business and Economic Development, 4(2). https://doi.org/10.4172/2161-0525.1000282

Sawitri, D. R., Hadiyanto, H., & Hadi, S. P. (2015). Pro-environmental behavior from a socialcognitive theory perspective. Procedia Environmental Sciences, 23, 27–33. https://doi.org/10.1016/j.proenv.2015.01.005

Sholahuddin, A., Fitriyana, R., Sya'ban, M. F., & Sadiqin, I. K. (2021). Students' caring attitudes to wetland environment: A case of environmental education in Banjar district Indonesia. Jurnal Pendidikan IPA Indonesia, 10(1), 149–158. https://doi.org/10.15294/jpii.v10i1.27838

Sinthumule, N. I. (2021). An analysis of communities' attitudes towards wetlands and implications for sustainability. Global Ecology and Conservation, 27, e01604. https://doi.org/10.1016/j.gecco.2021.e01604

Sinthumule, N. I., & Netshisaulu, K. H. (2022). Wetland resource use and conservation attitudes of rural vs. urban dwellers: A comparative analysis in Thohoyandou, Limpopo Province, South Africa. Water, 14, 1290.

Tang, H.-T., & Lee, Y.-M. (2016). The making of sustainable urban development: A synthesis framework. Sustainability, 8(492), 1–28. https://doi.org/10.3390/su8050492

The World Bank. (2016). World Development Iindicators 2016: Highlights Featuring the Sustainable Development Goals. International Bank for Reconstruction and Development/The World Bank. http://databank.worldbank.org/data/download/site-content/wdi-2016-highlights-featuring-sdgs-booklet.pdf

Torres-Lima, P., Conway-Gómez, K., & Buentello-Sánchez, R. (2018). Socio-environmental perception of an urban wetland and sustainability scenarios: a Case study in Mexico City. Wetlands, 38(1), 169–181. https://doi.org/10.1007/s13157-017-0967-4

Truong, D. D. (2021). Villagers' Perception and Attitude Toward Wetland Values and Conservation in Vietnam: A Case Study of Xuan Thuy Ramsar National Park. Frontiers in Sociology, 6:763743, 1–11. https://doi.org/10.3389/fsoc.2021.763743

Twumasi-Ampofo, K., Decardi-Nelson, I., Asamoah, R. O., Ofori, P. A., Solomon-Ayeh, B., & Osei-Tutu, E. (2018). Urban wetland and floods: Investigating housing conditions and characteristics at Sepe-Buokrom and Dichemso in Kumasi. Journal of Emerging Trends in Engineering and Applied Sciences, 9(4), 186–194.

Tyroller, A. L. C. (2016). Changing socio-ecological dynamics in an African peri-urban wetland: The case of the fisheries in the Densu Delta Ramsar site (No. 7; Governance and Sustainability Lab, Trier University, WaterPower Working Paper).

Umuhire, M. L., & Fang, Q. (2016). Method and application of ocean environmental awareness measurement: Lessons learnt from university students of China. Marine Pollution Bulletin, 102(2), 289–294. https://doi.org/10.1016/j.marpolbul.2015.07.067

UN-HABITAT. (2011). The Economic Role of Cities: United Nations Human Settlements Programme. UN-HABITAT.

United Nations. (1987). Our Common Future: Report of the World Commission on Environment and Development. United Nations. https://digitallibrary.un.org/record/139811/files/A_42_427-EN.pdf?ln=en

United Nations. (2014). Prototype Global Sustainable Development Report. United Nations Department of Economic and Social Affairs, Division for Sustainable Development. http://sustainabledevelopment.un.org/globalsdreport/

United Nations. (2015). The Millennium Development Goals Report 2015. United Nations.

Wathuge, A., & Sedera, D. (2021). An awareness-based model to minimize the environmental damage of the internet usage: A Longitudinal Study. Twenty-Fifth Pacific Asia Conference on Information Systems, 1–14.

Wheeler, S. (1996). Sustainable urban development: A literature review and analysis. In Monograph 51, IURD Monograph Series, University of California at Berkeley. University of California at Berkeley.

Willoughby, N., Grimble, R., Ellenbroek, W., Danso, E., & Amatekpor, J. (2001). The wise use of wetlands: Identifying development options for Ghana's coastal Ramsar sites. Hydrobiologia, 458, 221–234. https://doi.org/10.1023/A:1013158329107

Wright, T., Tomlinson, J., Schueler, T., Cappiella, K., Kitchell, A., & Hirschman, D. (2006). Article 1: Direct and indirect impacts of urbanization on wetland quality. Wetlands & Watersheds Article Series #1.

WWT Consulting. (2018). Good Practices Handbook for Integrating Urban Development and Wetland Conservation. WWT Consulting.

Yankson, P. W. K., Kofie, R. Y., & Moller-Jensen, L. (2004). Monitoring urban growth: Urbanization of the fringe areas of Accra (Working paper, 2004). www.geogr.ku.dk/lmj/rsal/docs/monitoring urban growth 10.pdf

Yepsen, M., Baldwin, A. H., Whigham, D. F., Mcfarland, E., Laforgia, M., & Lang, M. (2014). Agricultural wetland restorations on the USA Atlantic Coastal Plain achieve diverse native wetland plant communities but differ from natural wetlands. Agriculture , Ecosystems and Environment, 197, 11–20. https://doi.org/http://dx.doi.org/10.1016/j.agee.2014.07.007

Zhu, H., Guan, Z., & Wei, X. (2016). Factors influencing farmers' willingness to participate in wetland restoration: Evidence from China. Sustainability, 8(1325), 1–12. https://doi.org/10.3390/su8121325