Investigation of the factors that contribute to degradation of Songor Ramsar and UNESCO Man and Biosphere Reserve in Ghana

Fianko, J.R*[1] and Dodd, H. S[2]

[1] *Department of Nuclear Sciences and Application, School of Nuclear and Allied Sciences, Ghana Atomic Energy CommissionP. O. Box LG 80Legon Accra*

[2] *Natural Resource Department, Environmental Protection Agency, Accra – Ghana*

*Corresponding author: jrfianko@yahoo.com

Abstract

This study on the Songor Ramsar and UNESCO Man and Biosphere Reserve in Ghana seeks to investigate the factors that contribute to degradation of Songor Ramsar and UNESCO Man and Biosphere Reserve in Ghana through the administration of structured questionnaires using the drop-and–collect approach, face-to-face interviews and focus group discussions. The study revealed that the ranking of natural resources and occupation of the area are based on the demarcated zones within which the community is situated. Salt, fisheries and arable lands were identified as the most important natural resource in the wetland. The results on environmental degradation of the wetlands in the Songor Ramsar site in Ghana made it clear that the underlying causes of environmental degradation in the Songor Ramsar site are mainly a combination of Institutional and policy failures. It was revealed that the problem of environmental degradation is a consequence of ineffective enforcement of bye-laws. A combination of several factors such as improper waste disposal, poor attitude of residents toward environmental conservation, wildfires and shoreline recession, inadequate public education on the impact of environmental degradation, fishing and farming activities were identified during the administration of structured questionnaire, face-to-face interviews and focus group discussions. The other factors include overgrazing, over exploitation of mangroves, Predation, poaching and over fishing, uncontrolled sand and salt winning. Constraints and weaknesses to the implementation of regulations and laws with respect to conservation and protection of the wetlands identified during the study are lack of public education on the economic importance and the need to conserve the wetland, encroachment by developers, lack of enforcement of bye-laws, over-exploitation of mangroves and waste management.

Keywords: Wetland, Environmental degradation, Pollution, Songor Ramsar Site, Ghana

Introduction

Until recently, wetlands were virtually considered as "waste lands" or areas that only served as breeding grounds for dangerous aquatic reptiles and insects such as mosquitoes. Wetlands have now been found to provide multifunctional benefits relating to the ecosystem, the economy, and scenic quality. Wetlands provide millions of people with materials, products and means of livelihood. Lagoons and wetlands taken together are ecologically rich to provide food requirements for many different “feeding guilds” of shoreline birds. Ironically, these ecosystems are at the stage of environmental siege due to unsustainable use of resources (Junk et al., 2013; Ramsar Convention Secretariat, 2014). Wetland resources, such as fish, reeds, mangroves and thatch materials are harvested indiscriminately without any form of regulation regarding exploitation (Osei et al., 2011). Extensive magnitudes of the resource have been lost to both natural and anthropogenic activities. These activities include habitat modification for agriculture, proliferation of invasive aquatic weeds, predation and collection of turtle eggs, poaching of protected species, infrastructural development (port construction, expansion of industrial and recreational facilities), pollution (indiscriminate dumping of solid and liquid waste) etc. These activities contribute to regression in the quality and quantity of the

resources worldwide. (AfriMAB, 2013).

Though prolonged debates on wetlands sustainability and management have been undertaken over the years, the uncertainty of sustainability and irreversibility factors surrounding their functions have rarely been addressed especially in developing countries such as Ghana. The broader values of wetlands are gradually receiving greater attention as conservation is being increasingly considered as an integral component of sustainable use of the wetland resources. However, it is evident that the values and benefits provided by the lagoons are under increasing threat from over-exploitation and environmental degradation (Osei et al., 2011; Finlayson and Moser, 1991). The very resources that provide the values and benefits are under pressure from the expanding human population.

The Songor wetland at Ada is one of the five coastal wetlands in Ghana that have been designated as a Ramsar site under the International Ramsar Convention on Wetlands. It was recently enlisted as Man and Biosphere Reserve of international importance by UNESCO (AfriMAB, 2013). The Songor Ramsar and Biosphere Reserve act as a habitat and breeding ground for several notable species of both economic and ecological importance. It provides multifunctional benefits relating to the ecosystem, the economy and scenic quality. These benefits include nutrient recycling in bio-ecological adjustment processes, biodiversity conservation, flood conveyance and water storage, water purification, groundwater recharge, leisure and recreation (WRC, 2007).

In recent years, a growing number of studies have stressed the critical situation of several Ghanaian Wetlands (Fianko et al, 2009; WRC 2007). Various studies from wetland's environment in Ghana indicate that her environment is facing an ecological crisis. The Songor Ramsar and UNESCO Man and Biosphere Reserve struggles with many challenges. Increasing urbanization, rural-urban migration and rapid urban development associated with population growth in the Songor Ramser and UNESCO Man and Biosphere Reserve have resulted in increased environmental degradation and waste generation by industrial, domestic, and other activities. This increase has not been accompanied by an equivalent growth in the capacity to address the problem. Concerns have been raised in recent times by cross-section of the Ghanaian public about the preservation of the integrity of the Songor Ramsar site due to the level of degradation due to anthropogenic activities.

To maintain the resources of the Songor Ramsar Site, the pattern of usage must ensure that the ecological processes that support the products and functions valued by the human population are not degraded and lost forever. Whilst traditional patterns and levels of use can be sustainable in Ghana, expanding population pressures can all too quickly degrade the basic resources. The situation is more acute in Ghana where the coastal zone represents less than 7% of the total land area but holds over 25% of the nation's population (Attuquayefio and Gbogbo, 2001; Amlalo, 2006). The continued trend of the drift from rural to urban centres, the industrialization of coastal districts as well as high population growth rate place increasing stress on the coastal ecosystems

The effective management of coastal wetlands requires the development of technical information based on the status of the knowledge and socio-economic situation of the people in the catchment of the wetland

and factors that contribute to the degradation of the wetland. To ensure sustainability of the wetland, it is necessary that an investigation of the factors that contribute to degradation of Songor Ramsar and UNESCO Man and Biosphere Reserve in Ghana is carried out to identify the root cause of environmental degradation and propose mitigation measures to ensure sustainable management of wetlands.

The Songor Lagoon produces a chunk of salt consumed in Ghana and neighbouring countries like Togo and Nigeria, but current developments in and around the lagoon have affected the level of production. The Ada Songor lagoon is under serious threat following activities of some businessmen who are wreaking havoc on the salt winning site. The level of devastation at the site could have dire consequences on the environment. From afar, the Ada Songor Lagoon is seen to be dry, parched and degraded. The once vibrant salt mining field has been deserted leaving just a few residents in the salt winning business.

The study is to investigate the factors that contribute to the degradation of the Songor Ramsar and UNESCO Man and Biosphere Reserve through the administration of questionnaires, face-to-face interviews and focus group discussions. This is to ascertain the perception and knowledge of communities within the Songor Ramsar and UNESCO Man and biosphere Reserve catchment of the economic importance of the Ramsar site. The study is to also explore the various ways by which the environment of the Songor Ramsar and UNESCO Man and Biosphere Reserve in Ghana could be managed to maintain and preserve the ecological integrity of the ecosystem to ensure sustainability of the biological, aesthetic and production values that the wetlands represents.

Materials and methods

Study area

The Songor Ramsar Site is located in the Ada East District of the Greater Accra Region of Ghana between Latitudes 06°00' 25" N – 05° 45' 30" N and 00°19' E – 00°41' E (Fig. 1). It is one of Ghana's coastal wetlands and falls on the boundary of two flyways of water birds, the East Atlantic Flyway and the Mediterranean Flyway. It is 75 m above sea

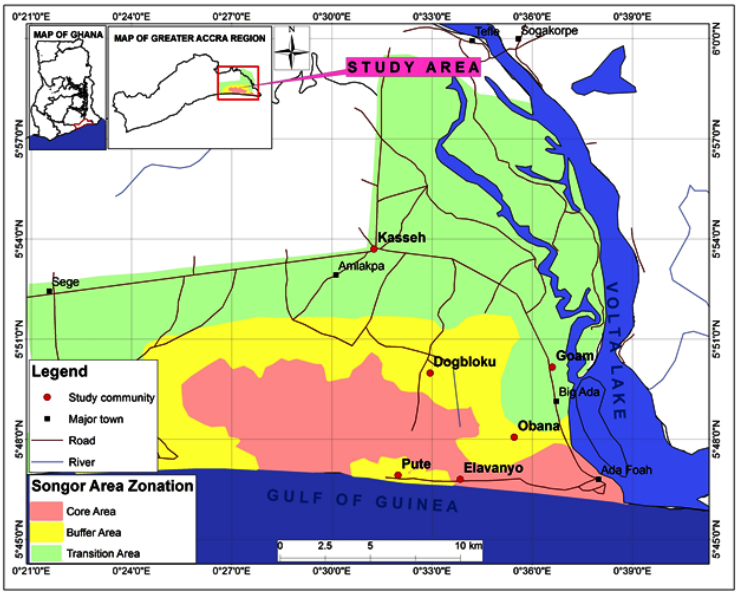

Fig. 1: Map of study area showing various communities in Songor Ramsar site

level in the north, and 15m near the Gulf of Guinea. The study area comprises extensive mudflats and low lands covered with reeds and *Sesuvium portulacostrum*, a broad sandy beach in the south and flood plains with degraded mangroves and coastal savannah vegetation to the east and north. It is important for migratory birds' and other animal species listed in the IUCN Red Data List (Armah and Amlalo, 1998). The study area has the highest total tern count on the Ghanaian coast naturally important bird populations (over 10% of the total coastal count) of at least 23 species of water birds (Pierson and Ntiamoah, 1995). The study area falls within two distinct climatic zones; the dry equatorial climate of the south-east coastal plains and the wet semi-equatorial climate further north from the coast with an average rainfall of 750mm, humidity 60 % high and temperature ranging between 23 – 28^{0}C (Benneh and Dickson, 1998).

Sampling sites

The Songor Ramsar site has been demarcated into three (3) ecological zones. These are the buffer zone, core zone and transitional zone (Armah & Amlalo, 1998; AfriMAB, 2013). Sampling sites were selected to cover all the three ecological zones within the Ramsar site. The choice of sampling sites depended on the location of the community within the three ecological zones and bulk of human activities within the wetland. Obane, Togbloku, Pute, Elavanyo, Kase and Gorm are the major communities within the Ramsar site where main human activities such as salt mining, fishing, farming and tourism take place. Obane and Togbloku are in the Buffer Zone which is located in the northern sector of the open lagoon and is surrounded by floodplain and coastal lands. It is an ecosystem suitable for the breeding of birds, nesting turtles and a vital coastline for fish breeding and fishing. The buffer zone is characterised by farming, controlled salt mining, tourism and aquaculture.

The major communities in the Core Zone are Pute and Elavanyo. This zone is located in the south and is regarded as the most important feeding and roosting sites for water birds, nesting sites for marine turtles and fish species. It has two ecosystem types, marine and brackish (lagoon) which is the aggregation point and core area for birds. The ecosystem diversity of the area is ecotourism, and Sacred Grooves. In the Transition zone, Kase and Gorm are in the major communities. This area is mainly composed of settlements with a thin coastal stretch on both ends which is fast developing into an urban community. The current land uses include aquaculture, markets, schools, mechanized shops and tourism. The ecosystem diversity of this area falls completely within the coastal zone and can be considered as a marine reserve.

Sampling

Multiple-stage sampling technique was used for the study and these were simple random and purposive sampling. The sampling technique employed was to ensure easy access to specific sections of the population and give equal opportunity for households to be selected. The target population was households from the six selected communities who were randomly selected using the lottery method and 20 key Institutions involved in the management of the wetland in the District. A total of eighty households were randomly selected by virtue of their living in any of the three ecological zones of the Ramsar site [Buffer Zone - Obane and Togbloku (salt mining, fishing); Core

Zone - Pute and Elavanyo (fishing, tourism, turtles, and sacred groves) and Transitional Zone - Gorm and Kase (trading, farming, settlements)]. Twenty-five household each were selected from the core and transition zones whiles 30 households were selected from the buffer zone all based on livelihood and socioeconomic standing of the household. This was done by given households numbers written on pieces of paper, folded and shuffled very well in a container. If the household number was picked, then that household was earmarked for the study and provided with a questionnaire to answer. Officers from key institutions (Wildlife Division of Forestry Commission, NADMO, Volta River Authority (VRA), Judicial Service (Court), The Police Service, Traditional Council, Dream Land Resort, Ezime Guesthouse and Ada East District Assembly) involved in the management of the wetland were purposively selected.

Data Collection

Both quantitative and qualitative data were collected. Quantitative data were collected through the administration of structured questionnaire using the drop-and–collect approach. Qualitative data were collected through Face-to-face interviews and focus group discussions with respondents. Interviews sessions were also held for purposively selected key stakeholders (Officers from Wildlife Division of Forestry Commission, NADMO, Volta River Authority (VRA), Judicial Service (Court), The Police Service, Traditional Council, Dream Land Resort, Ezime Guesthouse and Ada East District Assembly. Through the interviews, information such as; the current state of the Ramsar site, the underlying causes of environmental degradation in the Songor Ramsar site, the governance structure and role played by various stakeholders in management of the wetland were sought. The researcher sought to find out the causes of environmental degradation in the wetland. All the respondents from the households involved in the study were therefore asked to identify the indicators that contribute to problem of degradation of the Ramsar site. An observation schedule was used to guide the researcher to observe incidences such as degradation of the wetland, poaching, predation, habitat modification and salt winning. Secondary data was obtained from the Wildlife Division of Forestry Commission, Ada East District Assembly, articles, journals, internet, books and newspapers. To ensure validity and reliability of the instruments, there was pre-testing of the questionnaire and interviews.

Data Analysis

The data collected were statistically analysed using the Statistical Package for Social Studies (SPSS) Software (version 20.0). Responses in the questionnaire collected from the respondents were coded and scored. The data were subjected to descriptive analysis where frequencies and cross-tabulation analysis were employed and processed into statistical tables and figures for easy interpretation and discussion

Results and discussions

The fundamental target of environmental management is to protect the health of the population, promote environmental quality, develop sustainability and provide support to economic productivity. Results of the study

indicate that the study area is cosmopolitan comprising a heterogeneous population in terms of tribes, socioeconomic status, level of education, and occupation. The Ada East District is made of vast rural communities with numerous natural resources which attract people from different localities to work. The survey revealed that 71.25% of the respondents were natives while 28.75 % were non – natives who lives and work in the communities with their families.

Though the Songor wetlands provide multifunctional benefits relating to the ecosystem, the economy and scenic quality, only 18 % of the households involved in the study were aware of the socioeconomic importance of the Ramsar site to the community and the nation as a whole and were emphatic that the Songor Ramsar site provides them their source of employment and food as well as promoting tourism and research. As much as 78% of respondents involved in the study were not aware of the immense benefits of the Ramsar Site. They stated categorically that they derive only fish, crabs, lobsters, shrimps and salt from the wetland.

The study revealed an interesting trend relative to activities and sex in the different ecological zones. In the transitional zone (Kase and Gorm) more female were involved in economic activities whiles in the Buffer and Core Zones the male dominates (Fig. 2). The Kase and Gorm communities fall within the transitional zone of the wetland where salt winning is the predominant occupation. More women in these communities are involved in salt related activities while the male engage in farming.

Farming requires a lot of physical energy and is dominated by males in the study area. Majority of the females usually engage in activities at the post-farm level such as marketing, wholesale and retail as they are more inclined to less energy demanding activities than high energy draining ventures (Breen et al., 1997). Only few of the females interviewed engage in farming. Vegetables such as cabbage, carrot, green pepper, tomatoes, okro etc were the preferred choice of crops for majority of the female farmers. They asserted that vegetables are early yielding and have ready market.

The Songor Ramsar site falls completely within the coastal zone and can be considered as a marine reserve with numerous economic benefits but despite these benefits, extensive magnitude of the resources have been lost due

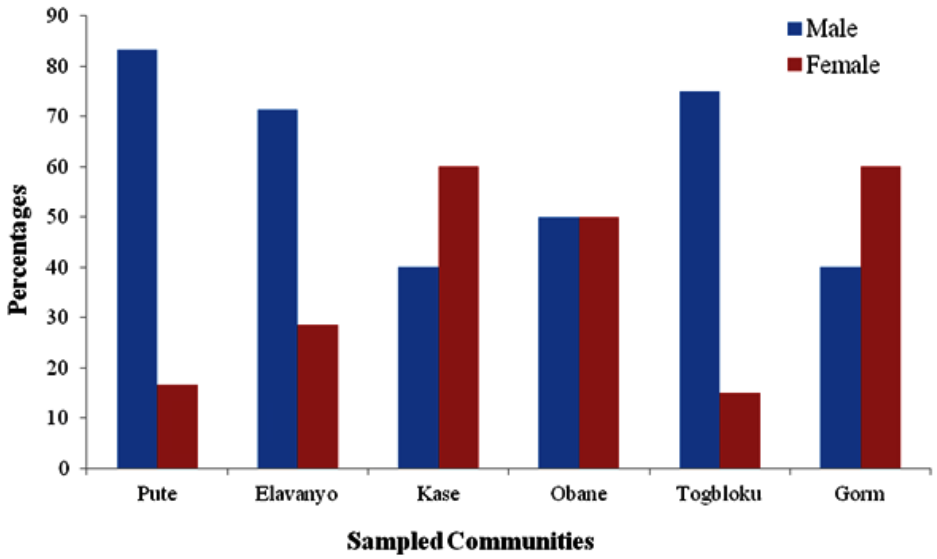

Fig. 2: Gender of Respondents based on economic activities

to both natural and anthropogenic activities. Many reasons have been assigned to the current state of the Ramsar site and these include habitat modification for agriculture, proliferation of invasive weeds, predation on turtle eggs by dogs, poaching, infrastructural development, industrial and recreational expansions, pollution, waste dumping and port constructions etc. (Ghana National MAB Committee, 2009). On the causes of environmental degradation in the wetland. All the respondents from the households involved in the study were able to identify the indicators that contribute to problem of degradation of the Ramsar site. The following indicators of degradation were identified in the Songor Ramsar site: changes in natural varieties and quantities of vegetation; emergence of invasion weeds; poor drainage and reduced flow of water bodies, siltation as well as poor water quality; Changes in biodiversity (species abundance) and changes in the land use patterns as well as soil erosion especially along the coast.

Five main factors were identified by respondents to be contributing to the degradation of the Songor Ramsar site (Table 1). Improper waste disposal in the communities was considered by 83% of the respondents as the main factor contributing to the degradation, while 80% believed that poor attitude of residents toward environmental conservation is a key factor. Wildfires and shoreline recession as well as small scale industries, fishing and farming activities were considered by 78% of the respondents to be the prime impact and 70% considered that lack of public education on the impact of environmental degradation on Ramsar sites is the key cause of environmental degradation in the Songor Ramsar Site. Other factors in order of seriousness include overgrazing and over exploitation of mangroves; predation, poaching and over fishing; uncontrolled sand and salt winning. Poaching and predation of marine turtles and their eggs were identified as a major drawback to tourism development in the wetland. The sand winning has led to the intrusion of seawater into the few fresh water bodies in the communities and serious erosion that has affected houses within the communities.

TABLE 1
Factors that contribute to degradation of Songor Ramsar and UNESCO Man and Biosphere Reserve (%)

Factor that degrade the Ramsar site	**Strongly Disagree**	**Disagree**	**Not sure**	**Agree**	**Strongly Agree**
	%	%	%	%	%
Small scale industries, fishing and farming activities	1.89	9.43	0	18.87	69.81
Improper waste disposal in the communities	0	3.13	0	14.06	82.81
Predation, poaching and over fishing	0	0	4.76	33.33	61.90
Uncontrolled sand and salt winning	1.72	1.72	1.72	37.93	56.90
Overgrazing and over exploitation of mangroves	1.67	1.67	1.67	30	65
Wildfires and shoreline recession	1.75	0	1.75	19.30	77.19
Poor attitude of residents toward environmental conservation	1.70	0	1.70	16.95	79.66
Lack of public education on the impact of environmental degradation on Ramsar sites	1.59	0	3.17	25.40	69.84

During the focus group discussions, it was revealed that the Songor Ramsar and Biosphere Reserve is faced with many challenges which are mainly anthropogenic even though there are institutions that manage wetlands. The Songor Wetland in Ada is grappling with increasing piles of waste, lack of disposal technologies and methodologies, overflowing dumping sites and indiscriminate sand winning. The main challenges in Songor Ramser and UNESCO Man and Biosphere Reserve identified in during the focus group discussions were induced by human activities such as pollution, habitat modification, agriculture, proliferation of invasive weeds, predation poaching of turtle and their eggs, waste management especially plastics and unsustainable resource utilization. Changing land use pattern, disposal of liquid effluent and sludge spreading in the wetlands are relatively widespread. Coastal erosion also threatens the shoreline stability with an increasing trend due to climate change while water pollution and hydrological regulation becomes the major threats to the sustainable use of products harvested from the wetlands.

Analysis of the research data from the study area revealed a clear relationship between human density, wetland density and wetland degradation. As human settlement pattern shifted from rural to urban, wetland mosaic in the study area shifted from consisting of many clustered wetlands to fewer isolated wetlands which is an indication of degradation. In poor neighbourhoods within all the ecological zones, residents only had access to an erratic communal skip services, frequently located at great distances from some residential units. Moreover, many peripheral and rural communities in the Songor Ramsar site had no such services, compelling households to dump their waste indiscriminately in any available space. Lack of garbage bins induces people to litter the communities and throw their garbage anywhere for convenience. At Kase, located in the Transitional Zone where there is a major market in the District, litter bins have been placed at vehicular terminals to receive waste from the public. Majority of these bins, however, are uncovered and open which attracts flies, insects and pests posing a human health risk. This result confirmed the well-established research findings that the underlying causes of environmental degradation of wetlands in many countries are mainly a combination of institutional, market, and policy failures (WRC, 2007; USGS, 2002; Wang et al., 2001). Uncontrolled dumping of waste and open burning as a means of waste disposal are common and in most developing countries pose adverse impacts on the surrounding environment (Yankson, 1998; Schertenleib, and Meyer, 1996).

The impact of solid waste on wetland environment ranges from the release of harmful greenhouse gases to contamination of ground water (Lambin et al, 2003; Gibbs, 2000). During field investigations, it was observed that majority of docks and bins were overflowing with wastes while refuse dumps in the study area are managed by indiscriminate burning. According to officers from the Ada East District Assembly, the current waste management methods employed in the wetland include, burning, burying underground, incineration, dumping in refuse dumps and recycling by scavengers. Open burning and dumping of waste among others are unhealthy and are associated with social, ecological, political and economic problems. Burning emits greenhouse gases (GHGs) into the atmosphere that greatly contribute to

global warming while burying underground chokes the soil since most plastics are non-biodegradable (Medina, 2002). Burning may also cause heavy metals like lead, toxic gases and smoke to spread over residential areas. Air pollution due to burning of waste and spreading of toxic fumes may cause damage to both the environment and human health (Lambin et al., 2003).

The general principle of good intent and wetland protection is to ensure conservation and wise use of wetlands through local and management cooperation as a contribution towards achieving sustainable development. Wise use of wetlands is the maintenance of their ecological character achieved through the implementation of ecosystem approaches within the context of sustainable development. During the focus group discussions and the interviews, all the key stakeholders involved in the management of the wetland asserted that the Songor Ramsar and UNESCO Man and Biosphere Reserve is governed by conventions and bye laws.

The Wildlife Division of the Forestry Commission of Ghana was found to be the main body in charge of management of the wetland but traditional authorities, District Assembly and opinion leaders in the communities plays significant role. According to the bye-laws, anthropogenic activities in selected reserved areas in the wetland (poaching, sand wining and game) are illegal while salt wining, settlements and crop farming are restricted to specific areas. According to the study, the traditional authorities have enacted traditional rites in the District which are strictly enforced. The marine turtle which is totemic to five clans provide traditional regulatory support for their protection (Amlalo et al 1998). Sacred groves and indigenous beliefs of the natives collectively help to increase the tourist potential of the area.

Though households involved in the study agrees that the existing regulation and laws are sufficient enough to ensure sustainability of the wetland, they accuse management of the wetland of not implementing the full regulations and laws with respect to conservation and protection of the wetlands and said current supervision is not sufficient enough to ensure sustainability. The main weaknesses identified are waste management, lack of public education on the economic

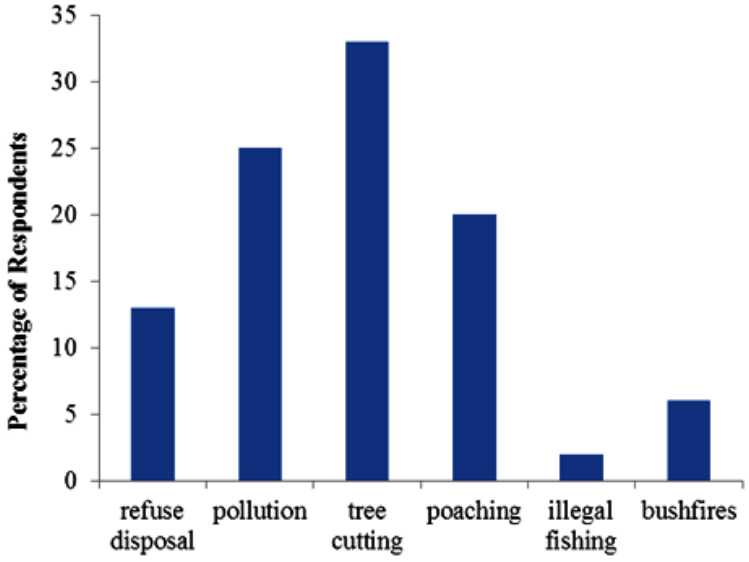

Fig. 3: Challenges identified at Ramsar Songor Area

importance and the need to conserve the wetland, encroachment by developers, lack of enforcement of bye-laws and over-exploitation of mangroves.

Wetlands are dynamic areas open to influence from natural and human factors. In order to maintain their biological diversity and productivity and to allow wise use of their resources by human beings, some kind of agreement is needed between the various owners, occupiers and

interested parties (Ramsar Convention, 1998). All the major stakeholders involved in the management of the Songor Ramsar Site acknowledged that they have noticed environmental challenges in the Ramsar site. The challenges include pollution of the beach with municipal solid waste especially plastics, tree cutting, illegal fishing and improper disposal of waste (fig. 3). According to the District Assembly their main challenge is solid waste management due to inadequate infrastructure, financial constraints and poor attitude of inhabitants with regard to waste disposal.

Conclusion

Studies on Environmental degradation of wetlands in Songor Ramsar site in Ghana made it clear that the underlying causes of environmental degradation in the Songor Ramsar site are mainly a combination of Institutional and policy failures. A combination of several factors such as improper waste disposal, poor attitude of residents toward environmental conservation, wildfires and shoreline recession, inadequate public education on the impact of environmental degradation, fishing and farming activities were identified. The other factors include overgrazing, over exploitation of mangroves, Predation, poaching and over fishing, uncontrolled sand and salt winning. Constraints and weaknesses to the implementation of regulations and laws with respect to conservation and protection of the wetlands identified during the study are lack of public education on the economic importance and the need to conserve the wetland, encroachment by developers, lack of enforcement of bye-laws, over-exploitation of mangroves and waste management.

References

AfriMAB, (2013). Biosphere Reserves in Sub-Saharan Africa: Showcasing Sustainable Development. pp 125-139.

Amlalo, D. S. (2006). The protection, management and development of the marine and coastal environment of Ghana. *Administering Marine Spaces*: International Issues, 148.

Amlalo D. S., Atsiatorme L. D. and Fiati C (1998). Biodiversity Conservation, Traditional Knowledge and Modern Concepts. Proceedings of the Third UNESCO MAB Regional Seminar on Biosphere Reserves for Biodiversity Conservation and Sustainable Development in Anglophone Africa (BRAAF) Cape Coast, 9 – 12th March, 1997. EPA. 2, 48, 80-81.

Armah A. K. & Amlalo. D. S. (1998); Coastal Zone Profile of Ghana Gulf of Guinea Large Marine Ecosystem Project. Ministry of Environment, Science, Technology and Innovation, Accra, Ghana, PP. 10 – 16.

Attuquayefio, D. K., & Gbogbo, F. (2001). Prospects of conserving wetlands along the Mukwe Lagoon at Nungua in the Greater Accra Region of Ghana. *West African*

Journal of Applied Ecology, **2(1)**, 65–75.

Benneh, G, and Dickson, K. B. (1998). A New Geography of Ghana. Longman Group UK Limited. Longman House Burnt Mill, Harlow, Essex, England. pp. 27-52.

Breen, C.M., Quinn, N.W., and Mander, J.J., (eds)., (1997). Wetland conservation and management in South Africa: Challenges and opportunities. IUCN 1997.

Fianko, J. R. Osae, S.and Achel D.G. (2009). The impact of anthropogenic activities on the Densu River in Ghana. *Water and Environment Journal.* **Vol.23**, 229-234.

Finlayson, M., and Moser, M., 1991 (eds). Wetlands Facts on Filer, Oxford, UK.

Gibbs, James P (2000). Wetland loss and biodiversity conservation. *Conservation Biology,* **Vol. 14, No. 1**, 314-317.

Ghana National MAB Committee. (2009). Ecological Mapping of the Songor Ramsar Site, Final Report. Pp. 1 – 92.

Junk, W. J., An, S., Finlayson, C. M., Gopal, B., Květ, J., Mitchell, S. A., Mitsch, W. J., & Robarts, R. D. (2013). Current state of knowledge regarding the world's wetlands and their future under global climate change: a synthesis. *Aquatic sciences*, **75(1),** 151–167.

Lambin, E.F., Geist, H.J., and Lepers, E., (2003). Dynamics of land use and land cover change in Tropical regions. *Annual Review of Environmental Resources* **28**: 205-241.

Medina M. (2002). Globalization, development and municipal solid waste management in a third World cities el colegio de la frontera norte (College of the Northern Border), Tijuana Mexico.

Osei, J., Osae, S. K., Fianko, J., Adomako, D., Laar, C., Anim, A. K., Ganyaglo, S. Y., Nyarku, M., & Nyarko, E. S. (2011). The impact of Oblogo landfill site in Accra-Ghana on the surrounding environment. *Research Journal of Environmental and Earth Sciences*, **3(6)**, 633–636.

Pierson T., and Ntiamoah Baidu Y., (1995). Water bird Ecology and the Management of Coastal Wetlands in Ghana. Ghana Coastal Wetlands Management Project. Netherlands Institute for Sea Research (NIOZ) Ghana Wildlife Society Report 1995, No.6.

Ramsar Convention Secretariat. (2014). Country Profile: Ghana. Retrieved from http://www.ramsar.org/wetland/ghana

Ramsar Convention., (1998). Monitoring conservation values of a Ramsar wetland vase-wonnerup wetland system. Convention on Wetlands (Ramsar, Iran, 1971), 1998.

Schertenleib, R. and Meyer, W. (1996). Municipal Solid Waste Management in Developing Countries: Problems and Issues; Need for Future research. International Reference Centre for Waste Disposal WHO collaborating Centre. Duebendorf, Switzerland: pp2-8.

USGS, (2002). United States Geological Survey: Wetlands and water quality change detection in San Fransis der vco Bay Ecosystem using remotely sensed images. Retrieved, 8th March, 2015.

Wang, L., Lyons, J., and Kanehl, P., (2001). Impacts of urbanisation on stream habitat and fish across multiple spatial scales. *Environmental Management* **28**:255-266.

Water Resources Commission (WRC). (2007). Integrated Water Resources Management Plan – Densu River Basin, WRC, 2007, Accra.

Yankson P. W. K. (1998). The Urban Informal Economy Accommodation, Growth, Linkages, Health and Environmental Impact. The Case of Greater Accra Metropolitan Area (GAMA). Ghana: University Press, Accra. p.36