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Original Article

Sustainable Management Practices of Sio-River Wetland, Nambale Sub-County, Busia County

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Wetlands are vital resources on the earth's surface and their roles and functions cannot be underestimated. The unique nature of the wetlands is recognized both at global and local levels. The objective of this study is to examine the sustainable management of the Sio-River Wetland in Nambale Sub-County. There is scanty research done to examine and document the sustainable management of the wetlands for the residents of Nambale Sub-County hence the need for study. To underscore the objective, a mixed research approach coupled with cross-sectional research design was used. Questionnaires, observation, interview guides, Geographical Information System and Remote Sensing were used in data collection. Questionnaires were administered to 400 inhabitants through cluster, simple random and purposive sampling. Qualitative data was thematically analysed while quantitative data was analysed using the Statistical Package for Social Sciences (SPSS Ver.21). Results showed that human activities, more so, agriculture degrade the wetlands by 80%. It, therefore, concluded that there was no balance between human activities and sustainable management of Sio-River Wetland due to the irresponsibility of the local community, inadequate policies and laws and lack of integrated approach in management. In this aspect, this study recommends rehabilitation and restoration of fragile ecosystems, allocation of funds for research and development and adoption of an integrated approach in wetland management to enhance the sustainability of wetlands in Nambale Sub-County and other parts of the world. The study recommends participatory management of wetland resources and additional knowledge in the field of Sustainable Management of Rivers and Wetland Ecosystems.

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INTRODUCTION

In order for wetlands to remain valuable, sustainable wetland management practices need to be adopted. Sustainable wetland management is a concept derived from sustainable development and wise use of wetlands from the Ramsar Convention (Ramsar Convention Secretariat, 2016). According to the World Summit on Sustainable Development, (2002), sustainable management entails equitability, continuity and availability of resources for both present and future generations. Sustainable management of wetlands enhances its utilization and conservation (Kabii, 2022).

Sustainable management ensures equity, availability and continuity of resources. It is a local, national, regional and international strategy that aims at managing wetlands. This can be achieved by adopting Indigenous knowledge, land tenure systems and frameworks on sustainable wetland management as well as afforestation, land use planning, soil and water conservation (Musasa et al., 2022). Backing these sentiments, there have been some initiatives and efforts to promote sustainability though the management practices in place are outdated and scarce (Okusimba et al, 2019; Umoh & Akpabio, 2021). These included afforestation, soil conservation and water conservation initiatives.

Despite wetland benefits to the ecosystem, they are increasingly facing threats of degradation and continue to reduce in quality and quantity (Global Outlook Report, 2018). Degradation of wetland ecosystems including conversion of wetlands to other land uses would undermine the provision of ecosystem goods and services. In the past, various management approaches have been used to sustainably manage the forests but threats of wetland degradation have failed. This is a scenario experienced in both developed and developing countries (Muhimbo, 2022). In reference to (Muhimbo, 2022), poverty, rapid population, weak governance system and ignorance of the set

laws resulted in illegal cultivation, overgrazing, sand harvesting and poor sewerage disposal.

Essentially, Kenya is a signatory to United Nations agencies (Convention on Biodiversity Ramsar Convention and United Nations Framework Convention on Climate Change) all geared towards wetland protection. This is because of their immense contribution to the ecosystem. In the past, during drought and dry spells, wetlands were the only available resources that people derived their livelihood by getting water, pasture and fodder for animals though the situation has changed (Kareri, 2018).

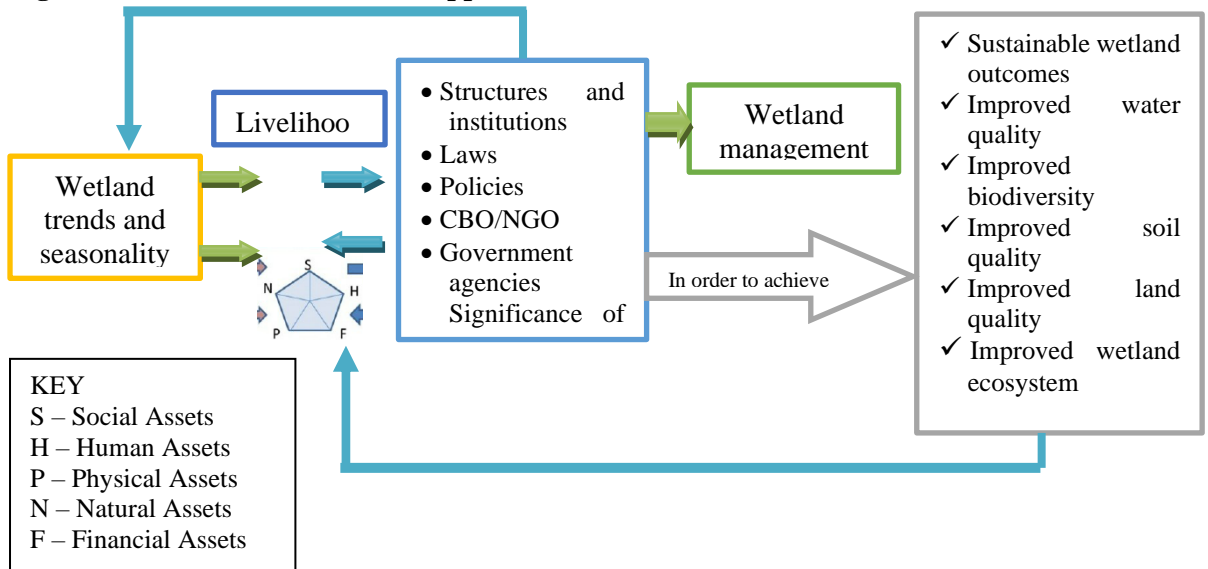
Kenya's wetlands such as Tana River Delta, Ondiri, Nyando, Kingwal, Marura, Saiwa, Great Rift Valley and the Lake Victoria have been threatened by anthropogenic activities. This has in turn resulted in the loss of riverine wetlands, loss of biodiversity and water quality changes among others (Chepkwony, 2018; Kareri, 2018). The rich biodiversity (papyrus reeds, grass and trees) has disappeared due to encroachment. Although a community management plan was developed, it seems ineffective and essentially calls for sustainable management practices to avert further destruction (Nile Basin Initiative, 2019; Raburu et al., 2022).

SUSTAINABLE LIVELIHOOD APPROACH

Sustainable Livelihood Approach (SLA) came into being in the 1990s with its origin in the UK's Department for International Development (DFID) (Chambers & Conway, 1992). Sustainable Livelihood Approach (SLA) confirms that all people have abilities and assets that can be developed with its focus on objectives, scope and priorities for development activities (Serrat, 2017). Precisely, Gichure et al, (2020) suggested the optimal availability of physical, natural, social, human and financial assets as keys to sustainability). Furthermore, Lusinga and Mutanana (2022), insist that a livelihood is sustainable if it recovers from stresses driven by

activities executed on a resource, in this case, a wetland.

Figure 1: Sustainable Livelihood Approach Framework.....



Sustainable Management of Wetlands

Sustainable management aims at meeting the needs of both present and future generations. Sustainability is paramount in achieving the Sustainable Development Goals of the 2030 Agenda (Aghmiuni et al., 2019). However, sustainability is a concept faced with challenges (Umoh & Akpabio, 2021). On this basis, to effectively carry out management, different research has been done. Mitra et al., (2022), examined wetland management for sustainable development in India using Geographical Information System and Remote Sensing. The study found out that wetlands were destructed by land use changes such as construction and pollution. Thus, the study recommended the formulation of policies in conservation, restoration and sustainability as immediate mitigation measures. This current study agrees with Mitra’s study in achieving its objective. The study used GIS to map the effect of human activities on the wetland and come up with sustainable management practices for Sio River wetland. However, there exists a geographical gap, this current research was carried out in Kenya whereas Mitra’s research was carried out in India. Chandrakar and Dhuria (2020) studied sustainable wetland management in India with an emphasis on

a sustainable future. The study asserted that anthropogenic activities were the main causes of degradation. Therefore, the study recommended adopting traditional knowledge systems and resources in attaining sustainability. The arguments raised by Chandrakar and Dhuria are very relevant to the current study that aims at assessing the human activities and coming up with sustainable management practices on Sio River Wetland. Chandrakar and Dhuria (2020) agree that sustainability was vital in wetland ecosystems and it was what this current study was up to. Mkonda (2022) study reviewed extensively on wetland management practices on wetlands in East Africa with a focus on Akagera wetland in Tanzania. Primary and secondary sources were used to collect data from the community as well as the government. This was purposively sampled. The study also established the shortfalls that affected the wetland. For example, policy gaps, political instability, financial constraints and inadequate involvement of stakeholders. The revealed gaps hindered the actualization of wetland management leading to degradation. Based on the findings, incentives, stakeholders involvement, integrated wetland management coupled with soil and water management were proposed. This current study was after adopting a sustainable wetland management that will be in

line with household needs while protecting the wetland resources for both present and future generations.

In most local communities, the lack of policies has led to the degradation of wetlands. This is a scenario in most African countries which drives degradation. Byamukama and Kiyawa (2019) worked on sustainable management and conservation of wetland resources in Uganda. Despite the efforts put in place to combat degradation, political interference, corruption and unawareness seems a setback. Therefore, capacity building, sensitization and Environmental Impact Assessment were recommended to regulate human activities, wetland resource management and land use management.

Work by Byamukama and Kiyawa (2019) was of relevance to the current study as it helped to assess the sustainable management practices on Sio River wetland and the sustainability especially in achieving the fourth objective in an attempt to see the effectiveness of sustainable management of wetland resources in Uganda. Again, we shall use this literature in assessing the good management practices on Sio River wetland. Gaps were identified in this literature, for instance periodic gap emerges since this study was conducted in 2019 while this current one would take place in 2023, hence new knowledge dynamics. There is also a geographical gap, in the sense that this study was conducted in Uganda while this current takes place in Kenya and on a riverine wetland.

Community participation is important in the management of wetlands as it also helps in pulling resources together. Odenyo (2021) gives out a sound argument towards community participation in the management of Yala wetlands using the Yala Hub Framework. The study used 410 respondents who were sampled using non-random purposive and stratified sampling methods. Structured questionnaires, focused discussions, formal interviews, content analysis and field observations were used to collect data. The results of the study revealed that effective community participation equals effective implementation of decisions on management of Yala Wetland. The

study found out that degradation within the wetland resulted to pollution and nutrient loss. In addition, it was found out that the community was not aware of the value of wetlands and ready to reclaim the land farming activities. Nevertheless, the study proposed: sensitization of the community on wetlands, working on land tenure system and formulation of a management plan as sustainable wetland management.

The ideas expounded by providing an empirical relevance to this study on sustainable management of Sio-River Wetlands. This current study agrees with Odenyo's because they both deal with riverine wetlands. Furthermore, Odenyo's study dealt with fundamental issues related to this study. Issues such as poverty levels and ignorance among the farmers are very much discussed at length. Therefore, they provide empirical data for the study. Seemingly, Odenyo's argument provides a foundation for building up a discussion on the drivers of wetland degradation and the management practices on the wetlands.

Nyaboga et al. (2022) investigated the sustainable utilization of Sironga and Nyabomite in wetlands resources in Nyamira. This study used both primary and secondary data which included scholarly work, photographs, surveys, mapping, questionnaires, observation and interview guides. The data collected was analysed by quantitative and quantitative methods using chi-square, spearman's rank's product-moment correlation, variance, totals and discussions.

Therefore, the results of the study revealed that the local community uses the wetlands for water, fuel wood and building material. Likewise, economic activities such as cane farming, maize farming, livestock keeping and eucalyptus growing are practised. Nonetheless, these economic activities are a threat to the wetlands through vegetation clearing, drainage, reduction in wildlife and soil erosion. Private-communal conflicts often occur on the wetlands. Despite the efforts put by the community to curb degradation: indigenous and formal mechanisms, wetlands lack adequate support from formal policy and legal institutions. So, the research recommended development of

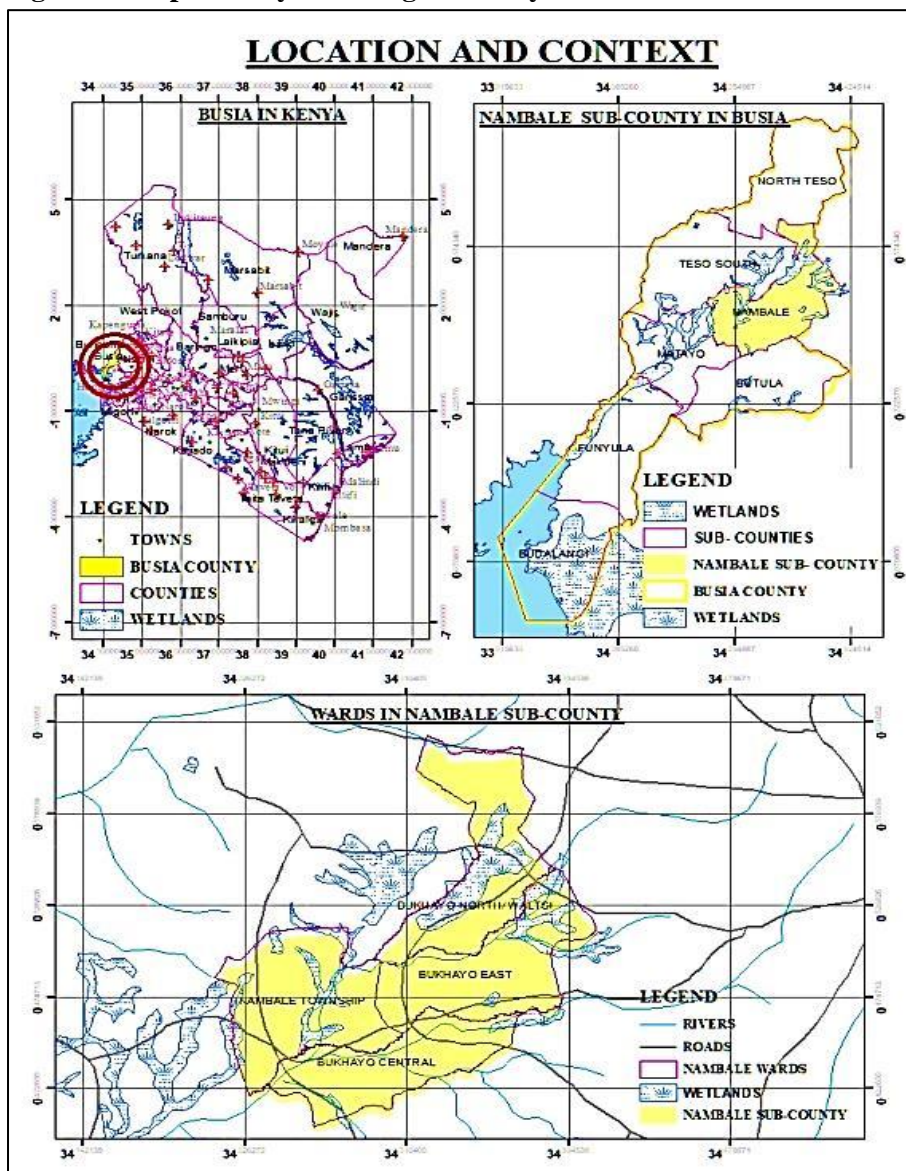
formal wetland framework for conservation of small-scale wetlands.

The ideas raised by Nyaboga are very relevant to this current study. The basic issues raised in this study were vital in addressing the main objectives of the current study. However, this current study will delimit itself in addressing sustainable management of Sio-River Wetland in Nambale Sub-County other than the general description done by Nyaboga on Sironga and Nyabomite in Nyamira County. Again, there is a periodic gap manifested in the sense that Nyaboga et al studied in 2022 but this current study was done in 2023, hence new dynamics are likely to be noted.

Ipara et al. (2022) studied on promoting development through sustainable wetland management on Marula swamp. The study used questionnaires, discussions, personal interviews and field observations to get the images of Marula swamp. The study findings revealed that inadequate involvement of local community management of the swamp was a hindrance to sustainable wetland development. The study recommended awareness creation via barazas and education. The findings of this study were important in assessing the sustainable management practices on the Sio-River Wetland in Nambale Sub County.

METHODOLOGY

Figure 2: Map of Kenya showing the Study Area.



Source: Researcher 2024

Research Design

This research employed mixed methods research approach which involved a blend of a cross-sectional research design (Leavy, 2017).

Sampling Design and Sample Size

This study used clustered sampling to select households from the five wards. Thereafter, simple random sampling was used to select the households who lived within the wetland under study (Lohr, 2019) in order to capture information on the wetland. 400 inhabitants comprised of 392 households, five local chiefs drawn from the five wards and three environmentalists from the Ministry of Water and Environment were purposively sampled to give information on the status of Sio River Wetland (Odaya et al., 2023).

Data Analysis and Presentation

The collected data was arranged and prepared for analysis. This information was coded with the assistance of Statistical Package for Social Sciences (SPSS) version 21 into manageable information. Thereafter, information was analysed using quantitative and qualitative methods. The quantitative data employed descriptive statistics where the raw data from the questionnaires were cleaned and edited.

RESULTS

Sustainable Management Practices on Sio River Wetland

The objective of the study was to recommend sustainable management practices on Sio River wetland in Nambale Sub-County. The sample respondents were asked to indicate whether they strongly agree (SA), agree (A), uncertain (U), disagree (D) or strongly disagree (SD) with the following statements as shown in *Table 1*.

Table 1: Sustainable management practices on Sio River Wetland

Sustainable management of Sio River Wetland	SA	A	U	D	SD
The Sio –river wetland is well-managed	6.4% (25)	10.8% (42)	11.1% (43)	35% (136)	36.8% (143)
Measures have been put in place to manage wetlands.	8.2% (32)	15.2% (59)	13.4% (52)	39.1% (152)	24.2% (94)
The local community, NGOS and County Government is involved in managing the wetland	14.4% (56)	11.8% (46)	26.7% (104)	26.7% (104)	20.3% (79)

Current Management of Wetland

As shown in *Table 1*, 6.4% of the respondents strongly agreed that the Sio –river wetland is well managed while 10.8% agreed on the same while 11.1% were uncertain. However, more than half had indifferent opinion of which 35% disagreed and 36.8% strongly disagreed that the Sio–river wetland is well managed. It is evident that few of the respondents confirmed that Sio–river wetland is well managed. This was evident by the quantity and quality of water, water level, pollution, loss of diversity and shrinkage in the wetland areas. This is as a result of continuous sand harvesting, deforestation and encroachment due to human settlement. The researcher observed that there were minimal gabions and bamboo trees as indicated in *Plate 1*.

The study also sought to find out the future of Sio River wetlands with reference to environment from interviews conducted with officers from Busia County Environment Department. From the response, it is evident that wetland is inadequately managed. One of the interviewees stated that if anthropogenic activities are not checked, degradation of the wetland is likely to be high causing its loss. Another interviewee revealed that the wetland is critical to the natural resources and biodiversity resources within the wetland. Finally, the wetland is critical to environmental sustainability in the region for the provision of clean and safe water to the population, the safeguard of rare animal species.

Furthermore, results from interviews revealed that Sio River wetland is a Trans-boundary wetland between Kenya and Uganda therefore concerted

efforts are required for its management. Further, River Sio Wetland is a Trans-boundary wetland that requires adherence to the management plan

and an integrated approach in enforcement of regulation governing wetlands.

Plate 1: Minimal Gabion Constructed to manage Wetland As observed by the Researcher



Source: Researcher (2023)

Measures Put in Place to Manage Wetlands

Furthermore, 8.2% of the respondents strongly agreed that measures have been put in place to manage wetlands, 15.2% agreed and 13.4% were uncertain with this assertion. It is evident that few of the respondents affirmed that measure have been put in place in the management of wetlands. This assertion is supported by researcher observation during period of study on continuous pollution of Sio-River Wetlands and reduction of wetlands. Furthermore, there is continuous sand harvesting in the wetlands. These findings were concurred with Mkonda et al., (2022) who noted that gaps in wetland management had resulted to degradation.

Via interview with official from Busia County Environmental Department, the study sought to find out if there are any measures put in place to curb environmental harm on the Sio River wetlands. The results are indicated two of the three respondents (66.7%) affirmed there is need for education and awareness to enlighten the community on wise use and education of people on the wetland suitability. Similarly, 66.7% also revealed there is need for bamboo promotion for

conservation and densification of people through tree planting projects like bamboo.

Stakeholders Involvement in Management of Wetland

Lastly, 14.4% of the sampled respondents strongly agreed that the local community, NGOS and County Government is involved in managing the wetland while 11.8% agreed on the same. The results also revealed that 26.7% of the respondents were uncertain, similarly, 26.7% disagreed and 20.3% strongly disagreed that the local community, NGOS and County Government is involved in managing the wetland. The findings reveal that there is minimal involvement into sustainable management of Sio – river wetland among various stakeholders. The findings agree with the research carried on Kingwal Wetland (Chepkwony, 2018).

Sustainable management of wetland requires integrated approach among various stakeholders. In Sio River wetland, the main actors/stakeholders are the local community who considered it as important to their livelihood and therefore, they have role to play in its management. Secondly, both county government through department of

environment and National government through NEMA have a role to play in regard to regulatory and policy framework as well as their enforcement. Lastly, private sector and non-governmental organizations have also a role to play in regard to provision of resources as well as capacity building to upscale local capabilities in the management of Sio River wetlands. Therefore, these stakeholders need to work in unison for sustainable management of Sio River wetlands.

Besides, the study sought to find out the role Busia County Government has towards the sustainable management of the Sio River wetlands via interview schedule. One of the interviewees indicated the department has the role of conserving compliance and enforcement of legislations, rehabilitation and restoration of the fragile ecosystems. Other interviewees revealed that the department has the role of reclamation of degraded lands, legal laws to monitor sand harvesting resources within the water. Lastly, working closely with the River Water Users Association (RWUAs) for management and monitoring of activities in the wetland and enforcement of EMCA is one of the roles Busia County Government.

CONCLUSION

Finally, the last objective sought to answer what are sustainable management practices on Sio River wetland in Nambale Sub-County. From the questionnaires, the results indicated that few of the respondents confirmed that the Sio –river wetland is well managed (17.2%) as compared to 72.0% who did not confirm (Disagree and strongly disagree). Similarly, 23.4% of the respondents confirmed that measures have been put in place to manage wetlands as compared to 63.0% who had contrary observation. This was complemented from observation where the researcher noted that there few gabions and minimal bamboo trees in the wetland. Interview with official from Busia County Environmental Department revealed that much has not been done in regards to sustainable management practices and therefore, if anthropogenic activities are not checked, degradation of the wetland is likely to be

high causing its loss. The interview results also revealed that Sio River wetland is a Trans-boundary wetland between Kenya and Uganda therefore concerted efforts are required for its management.

Recommendations

Basing on the conclusion of the study, the following recommendations were made in regards to policy and practice. Sio River wetland is important in the sustainability of local livelihoods; however, there is need to diversify livelihoods so as to ease pressure on the resources within the wetlands. This can be achieved through capacity building and involving in non-agricultural activities. Education and awareness-raising campaigns on the importance of wetlands are needed amongst the local community. This can be achieved by government, NGOs, CBOs and other stakeholders conducting public barazas, seminar, workshop and publicity via local radio stations.

Human activities undertaken at Sio-River Wetland are important to the sustainability of the local livelihood and therefore, the study recommends that local community have the responsibility to ensure its sustainability by engaging in activities which are not harmful to the wetlands but beneficial to them in the short run. This includes sand harvesting, using of fertilizers and pesticides as well as planting eucalyptus trees. Rather, the local community should plant bamboo trees and use manure to enhance their agricultural productivity.

There is need for National and county governments to come up with policies and laws which will regulate human activities that exploit wetland resources in a sustainable manner. Department of Environment should ensure conservancy compliance and enforcement of the same legislations. In addition, the county government should have a strong working relationship with the River Water Users Association and other stakeholders in order to regulate and monitor activities taking place in the wetland and ensure compliance with the EMCA.

There is need for integrated approach in the management of Sio River Wetland from three main stakeholders. This includes the local community including CBOs, both National and county governments and private sectors as well as NGOs. This will ensure availability of adequate resources such as finance, technical skills and policy to enhance sustainable management of wetland.

Lastly, and most important, the county government of Busia should endeavour to rehabilitate and restore fragile ecosystems within Sio-River Wetlands. Adequate funds should be allocated to research and development in such like studies to enhance sustainable management of wetlands in the county.

Recommendations for Future Research

The following area is recommended for future research.

Inadequate participatory management of the wetlands has hindered sustainable management of the Sio-River Wetland. Therefore, there is need to involve both the public- private sectors in management of Sio-River Wetland hence a future research should be carried on participatory management of Sio-River Wetland resources. There is need to carry out a similar research on other riverine wetlands in other areas and compare the findings with the Sio-River

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