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Original Article

Important Functions of Wetlands in Local Communities in Kenya: A Case Study of Sio-River Wetland in Nambale Sub-County, Busia County

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Wetlands are crucial ecosystems that provide a myriad of economic, social and ecological benefits. They have invaluable goods ranging from provisioning, regulating, cultural and supporting while key services are climate change mitigation, shoreline mitigation, flood control, groundwater recharge, water purification, carbon sequestration and biodiversity protection. However, these wetland services remain unmeasured and undervalued. Consequently, the benefits they provide are sometimes ignored in most wetland management decisions. The study aimed to examine the important functions of the wetlands with a focus on the Sio-River Wetland in Nambale Sub-County. The study employed a cross-sectional research design that involved both qualitative and quantitative methods. A total of 400 inhabitants participated in the study using simple random sampling and purposive sampling approaches. In this study, data was collected from the field using pictorials, photographs, observation, questionnaires and interview schedules. Majority of the respondents affirmed that there are goods and services that the local community gets from the Sio-River Wetland as shown by 81% of the respondents against 19.0% of the respondents. To enhance the sustainability of the wetlands, 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 baraza, seminars, workshops and publicity via local radio stations.

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INTRODUCTION

Globally, wetlands are estimated to occupy 1.21 billion hectares of the earth's surface as indicated in the world wetlands (Xu et al., 2019; Nayak & Bhushan, 2022). Wetlands are important and valuable resources throughout the world due to their varied goods and services (Ahmad et al., 2019). The researcher opines that the situation is not different in world, because wetlands have been the main source of livelihood for most of the residents

Europe's wetlands range from bogs, fens and riverine that occurs on the streams and rivers. They are valued for their biodiversity and ecosystem services (Bhowmik 2020; Dang, 2022). Similarly, in China, wetlands occupy 53.42 M hectares of land mass which accounts for 5.58% of China's land. Wetlands in China are important sources of food, reeds, medicine, fuel and construction materials (Siyuan et al., 2022). However, these wetlands are threatened by climate change, pollution, biological resources exploitation and reclamation amounting to 1% loss (Meng & Dong 2019).

Equally, India is well endowed with wetlands accounting for 4.7% country's geographical area India's wetlands play hydrological, economic and ecological roles but unfortunately under serious threat. Anthropogenic activities, resulting from land use changes and lack of proper regulatory framework for conservation has contributed to wetland's loss. (Meena & Sharma, 2019). This is the same scenario seen on the Sio River wetland where human activities have immensely degraded the wetlands.

Africa as a continent is endowed with wetlands ranging from riverine, saline, brackish coastal and marine areas along the coastline and occupies

4.7% of Africa's continental area (Rebelo & McCartney 2019). Riverine wetlands are found in the riverine systems of Nile, Zaire, Zambezi and Nile providing a lot of benefits. Despite their benefits, about 35% of African country's wetlands are exposed to human encroachment (Kabii, 2022).

Additionally, in East Africa, wetlands are widely distributed all over the land covering about 18 million hectares which is approximately 7% of the region (Muhimbo, 2022). They provide a lot of benefits to the ecosystem not only fish but also herbal medicine, fuel wood and papyrus wood among others. According to Omolo, et al., (2018), in Tanzania, besides the values of Lake Manyara, Mara Bay and Masirori wetlands anthropogenic activities are threats. Additionally, Uganda well surrounded with wetlands such as Katehe, Nakivumbo, Kagera and Nakivale with multitude of benefits but lot of threats (Omagor, et al., 2018).

Mugumya (2018) highlighted that Kenya's wetlands occupy about 3 to 4 per cent of the land's surface which is equivalent to 14000km² (Kareri, 2018). Kenya's wetlands provide ecological and socio-economic goods to the ecosystem (Ministry of Environment and Natural resource (MEMRI), 2012; Chepkwony, 2018). Initially, these wetlands were sources of food, clean water, and fish, building materials, fuel wood, handicraft material, recreational sites and flood control sites (Ministry of Environment and Natural Resources, 2012). Cultural ceremonies such as circumcision still take place in special places in wetlands where the initiates are smeared with mud and Kenya continues to recognize the values of its wetlands (Kenya Constitution, 2010, Kenya Vision 2030; Kenya County Development plans).

The Sio-River wetland has been valuable in its provision of water, medicine and building materials (County Biodiversity Policy, 2016; Busia County CIDP, 2018-2022). Notable wetlands in the county are Yala, and Sio plus other small wetlands on tributaries of the above rivers such as Malakisi, M'nambale, Walatsi, Musokoto (Naburi, 2018). These are rich sources of fish, recreation, water, food, medicine, wildlife habitats, firewood and grazing sites (Dindi, 2018) though this is not the case as at now. The land has gradually changed in the entire Busia County where Nambale Sub-County. Busia County is also endowed with resources: forests, valleys, lakes, rivers streams and wetlands (Busia County is included (Okusimba et al., 2019). The rich wetland resources have diminished due to degradation (Naburi, 2018 & Busia County Biodiversity Policy, 2016-2023).

Literature Review

Importance of Wetlands

Wetland resources are valued for their immense services to people's livelihoods (Xu et al., 2018). According to MEA (2005), wetland services depend on the type; size and location hence ranging from maintaining hydrology, protecting the ecosystem and safeguarding human welfare. Therefore, wetlands provide both direct and indirect services to human beings (Xu et al., 2019). Equally, wetlands are important in achieving sustainable development, if well utilized, they can serve the needs of the future generation (Global Outlook, 2018).

Ahmad et al., (2019) using secondary sources analysed the economic values of wetlands in Pakistan. Basically, this research was based on the economic values of World's wetlands and the Ramsar standard of wetlands. Findings revealed that Pakistan wetlands play a role in carbon sequestration, atmospheric maintenance and climate change mitigation. In addition, wetlands in Pakistan are sites for recreation, education and research. However, inadequate laws, regulations and management agencies have exposed these wetlands to degradation. These findings were important to this current research in filling the gap

on sustainability of Sio-River wetland in Nambale Sub-County.

In India, Meena and Sharma (2019) found out in their study that wetlands played the role of kidneys' on earth by being in ground water recharge, flood control, pollution control and carbonation qualifies this. On the other hand, Kumar (2019) found that Bangalore's wetlands were vital in ecological balance as well as climate change mitigation. Furthermore, wetlands in America have been known for religious, cultural and historical importance; they are important places for worship and pilgrimages (Verschuuren, 2018). On the same note, Sio River wetland was important for its resources.

Arya et al., (2020) carried out research on a review and economic values of wetlands in the perceptive of India world. The study revealed that wetlands support households both within and outside the wetland ecosystem. Above all, they are important sources of biodiversity, hence providing food and water. The wetlands provide ecosystem services in water treatment and erosion control. Likewise, the study established that wetlands have both use and non-use values. Arya's research was vital for this current research in establishing the importance of Sio River wetland in Busia County. Though this research studied numerous wetlands, this current study entirely dwelt on Sio-River Wetland, a riverine wetland.

Kumari et al., (2020), studied on the importance of wetlands in India with a focus on the ecosystem and conservation. The study revealed that wetlands cater for varied biodiversity despite being threatened globally. This research recommends institution of management practices for conservation of wetlands. Similarly, management based on traditional knowledge were advocated for their cost effectiveness. In this aspect, further studies were recommended on appropriate measurement and ecosystem modelling to establish their contribution on socio-economic development. The findings of this study were very relevant in this current study to determine the economic importance of Sio-River Wetlands.

Duku et al., (2022) assessed ecosystem services and human wellbeing in Sub-Saharan Africa based in Ghana. This study used semi-structured questionnaire randomly administered to 794 households. The study discovered that larger wetlands occupied 40% of the land mass with a lot of goods and services to the rural poor. Besides, agriculture and fishing were highly carried out in wetlands due to their productivity. However, many wetlands had been destroyed and modified to meet man's needs. This possesses both direct and indirect threats to the wetlands that eventually deplete the wetlands. As a result, this research recommended government involvement in wetland management. Therefore, this study is important in examining the objectives of this current study, especially in recommending government involvement in wetland management.

Musasa and Marambanyika (2020) investigated the economic values of wetlands in Zimbabwe using Lake Chiuta wetland using the Total Economic Valuation Approach. Both direct and indirect values were measured. The study found out that Lake Chiuta wetland provided several services that promoted socio-economic development. However, lack of community and government institutions in resource use threatened wetland's resources. Therefore, the study recommended setting up of government institutions to manage Lake Chiuta wetland. This research was vital for this current study in achieving its objective one. It was relevant in identifying the important functions of Sio River Wetland. However, there are methodological and geographical gaps that have been identified that this current study filled. Whereas Musasa and Marambanyika's study used Total Economic Valuation Approach in Malawi, this current study used the Sustainable Livelihood Approach in Kenya.

Rebelo and McCartney (2019) examined the socio-economic values of Palmiet wetlands in South Africa using the rapid WET- Eco services tool on three wetland ecosystems. The study findings revealed that South African Wetlands provide fish, magadi soda, water, food and

pastures. Nonetheless, the wetland was found to be faced with threats such as overpopulation and weak laws that lead to degradation. Thus, the study proposed the adoption of sustainable land management practices as a mitigation measure. This study was vital to the current study in achieving its objectives one and four, especially in identifying the importance of wetlands and the sustainable management practices along the wetlands. Three gaps were identified from this study, while Rebelo's study was based in South Africa, while this study delimited itself in Kenya. In addition, a periodic gap was established since their study was done in 2019, and this current study would be done in 2023. Hence, many changes have taken place necessitating new knowledge dynamics.

Chepkwony et al., (2018), studied the socioeconomic benefits of Kingwal Wetland to the local people using 240 respondents. The study also employed a descriptive research design. This study revealed that Kingwal Wetland provided commercial, nutritional, recreational and socio-cultural benefits. Therefore, the study recommended the adoption of sustainability and conservation-based educational program. The arguments given by Chepkwony are important in finding the economic benefits of the wetland. This current research employed mixed research design to establish wetlands benefits.

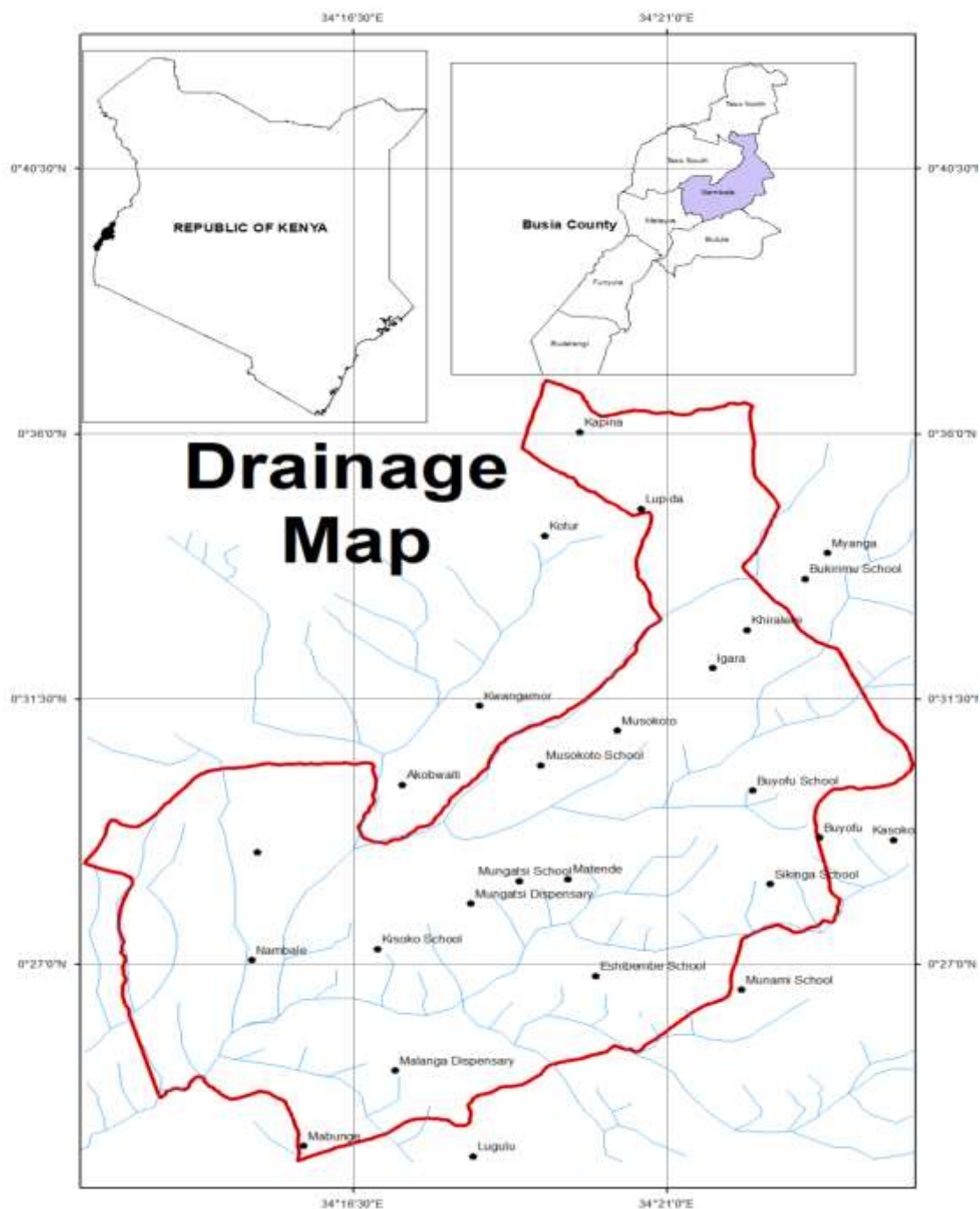
Maithya et al., (2020), studied on ecosystem services in the Nyando wetland using surveys, participant observation, and interviews. The study findings revealed a lot of economic benefits for Nyando wetland. They range from fisheries, agriculture, mats, medicine and wildlife habitats. It also noted that the continuous conversion of wetlands affects economic values of wetlands. Therefore, the research proposed the wise use of wetlands and the promotion of sustainable development. This study was an eye-opener to the current study in identifying the values of Sio River wetland and sustainable management practices.

STUDY AREA

Sio River is a permanent river with its source on the slopes of Mount Elgon in Bungoma County

and drains its water into Lake Victoria (mouth). This study takes place in Busia County on the western part of Kenya. It borders Bungoma to the north, Kakamega to the east, Lake Victoria and Siaya to the south and Uganda to the west. Busia County is made up of Teso North, Teso South, Matayos, Butula, Samia, Bunyala and Nambale sub-counties. It is approximately 1700 square kilometres.

This study was carried out in Nambale sub-county, with emphasis on Sio River wetland. The sub-county is divided into five wards namely Bukhaya North, Walatsi, Bukhaya East, Bukhaya Central, and Nambale Township occupying 237.8 Km². The Sio River wetland occupies latitude 0° 31' N and 0° 27' N and longitude 34° 16' 30" and 34° 21' E. Consequently, it contains varied soil types essential for economic activities.

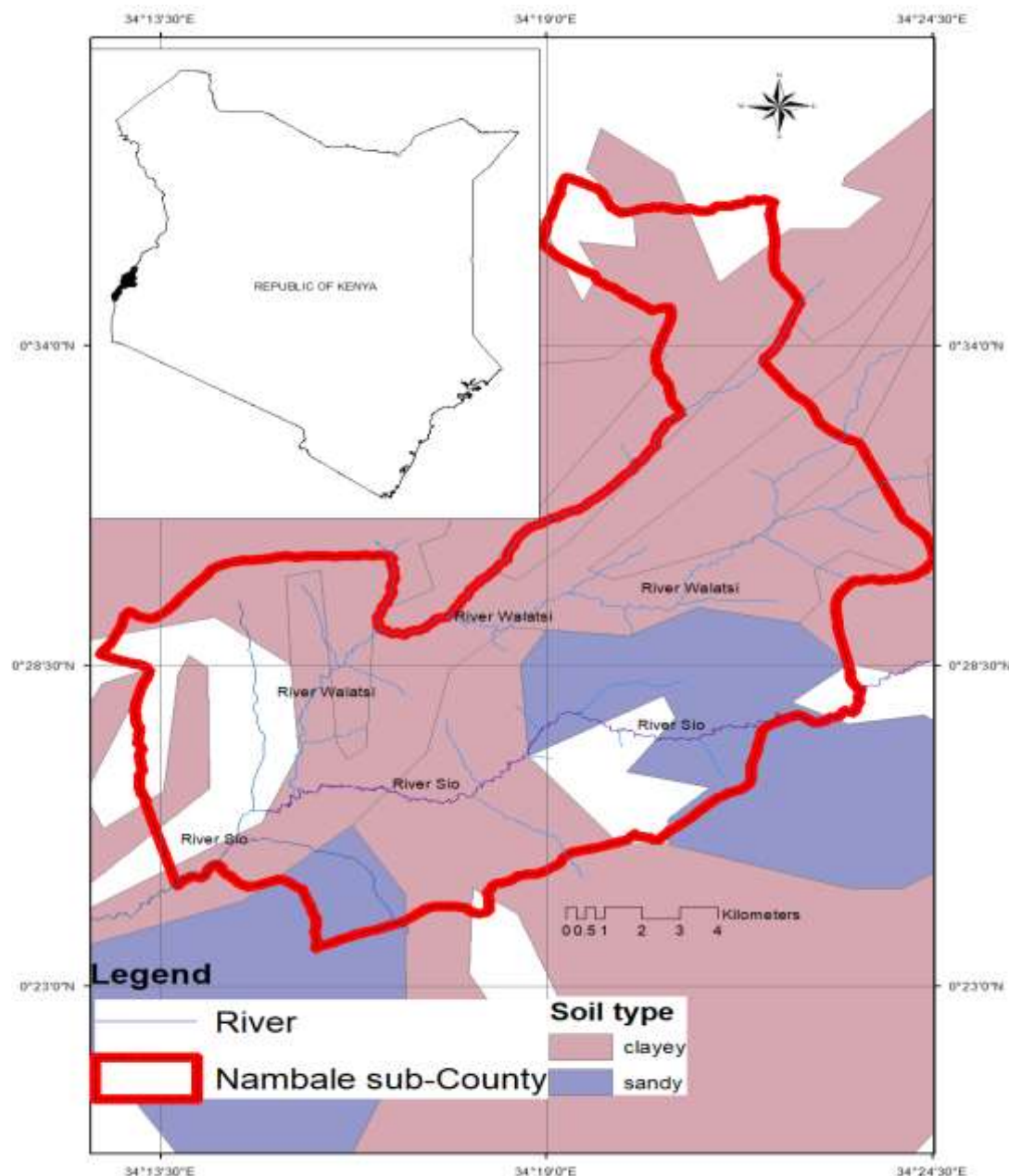


Source: Researcher 2024

SOIL

Busia County is mostly dominated by sandy loamy soils except Nambale Sub-County which is mostly dominated by well-drained, deep and dark clay soil and sandy soil with moderate water holding capacity (Naburi, 2018). This is very fertile soil and suitable for agricultural production. According to NBI, (2019), the sandy soil in the area has promoted sand harvesting whereas traces of clay soil have promoted. The

rich fertile soil in the region attracts agriculture as a major economic activity. Sugarcane is one of the cash crops that is grown along the Sio River watershed (Naburi, 2018). Continued agriculture along River Sio is likely to reduce water quality and quantity. Negative effects such as soil erosion, siltation and water logging reduce the depth and size of the Sio-River Wetland (Okusimba et al, 2019). The quest for high food production results in cultivation into the wetland ecosystem at the expense of their roles and functions.



Source: Researcher 2024

Sampling Design

According to (Kombo and Tromp 2018), a sampling design is a research plan showing how cases are selected for observation. This study used simple stratified sampling to group respondents into wards. Thereafter, simple random sampling will be used to select the local inhabitants who live within the wetland under study. To get the required feedback from the respondents, purposive sampling will be used to get information especially those living within the Sio River wetland. Thereafter, local chiefs, and representatives from the County Government were sampled purposively to give information on the status of Sio River Wetland.

Sample frame

This research used the households as the major unit of analysis because of the role they play

towards the wetlands and the human activities they are involved in. Agriculture being the main economic activity, the households will have enough to share. Respondents were selected by stratified sampling according to the wards (Table 1). Thereafter, simple random sampling was used to select 384 respondents. The local authority will also be involved in how they are managing the wetland. The County government officials from the Ministry of Environment will also give an overview of the Sio River wetland.

Below is a list of the sample frame:

- Households
- Local authority
- County government officials.

Table 1: Number of respondents to be randomly selected per ward

Wards	No. of Respondents	Population per ward
Nambale Township	134	38918
Bukhayo East	86	25076
Bukhayo Central	73	21351
Walatsi	46	13289
Bukhayo North	45	13002
Total	384	111636

Source: KNBS, 2019

METHODOLOGY

The research instruments will be designed to gather informant from the households with preference given to the head of the household. In the absence of the head of the household, available adults within gave the information. The local authority (village elders, sub-chiefs and chiefs) were be used. County officials from the Ministry of Environment gave information on the strategies of wetland management.

Sample size

Nambale Sub-County where Sio-River wetland is located had 111636 people (KNBS, 2019). This research considered the respondents who lived at the river banks of the wetland and those affected

by the wetland threats. Sample is part of a statistical population. In descriptive research 10-50% sample size is accepted (Mugenda & Mugenda, 2019). The sample size for this study was calculated using Mugenda and Mugenda (2019) formulae using the following equation.

$$n = (z^2pq) / d^2$$

Sample size formulae.

n=Sample size

z=confidence level of 95% thus 1.96

p= marginal error i.e 50%

q= 1.0-p

1-0.5=0.5

d = level of statistical significance at 0.05

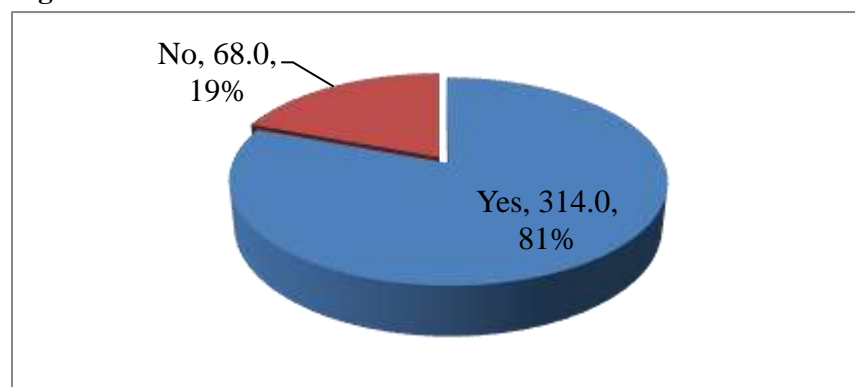
E=Tolerance of the desired level of confidence, take 0.05% at 95% confidence level since Nambale Sub-County has a household of 111636 as per 2019 population census (KNBS, 2019).

$$1.96^2 \times 0.5 \times 0.5 / 0.05^2 = 384$$

RESULTS

The respondents were initially asked if there are goods and services that the local community get from the Sio-River Wetland. The results are shown in Figure 1

Figure 1: Goods and Services Derived from Sio-River Wetlands



Economic Importance of Sio River Wetlands

Further, the respondents were asked to state goods and services that the local community gets from Sio River wetland. The results were analyzed using content analysis and thereafter grouped according to economic and social importance. The

study further conducted Chi-Square Pearson correlation analysis to establish the link between the demographic characteristics of the respondents and economic importance of Sio River wetlands. Table 2 shows the economic importance of Sio River wetlands to the local community.

Table 2: Economic Importance of Sio River Wetland to the Residents

N=314	Frequency	Percent
Food production	233	74.2
Sand for construction	163	51.9
Cash Crop Production	136	43.3
Pasture and fodder for Livestock	125	39.8
Fish	82	26.1
Water for Industrial use	55	17.5
Water for Irrigation	51	16.2
Timber and wood	49	15.6
Soil for Brick-making	44	14
Papyrus for basketry	24	7.6
Wild fruits and meat	2	0.6

From Table 2, 51.9% of the respondents affirmed the community obtained sand from the River Sio wetland. Sand is an important component used for construction and building both commercially and residentially. Basically, the presence of sedimentation at the wetland makes it prime product to exploit for the purpose of earning

income. There was a significant difference among respondents' income per month and sand harvesting.

Social Importance of Sio River Wetlands

The study also presented the social importance of Sio River wetland as indicated in Table 2

Table 3: Social Importance of Sio River Wetlands

N=314	Frequency	Percent
Water for domestic use	279	88.9
Soil for Mud houses	178	56.7
Firewood	162	51.6
Transport via boats	22	7
Recreational services (Swimming & Conducive environment)	20	6.4
Home for wildlife (animals and native tree species)	14	4.5
Herbal medicine	5	1.6

The results also revealed that 88.9% of the respondents obtained water for domestic use from Sio-River Wetland. Water obtained from the Sio-River Wetland was mainly used for cooking, hygiene and sanitation among other functions. Livestock also used water from Sio-River wetlands. There was a significant difference

among respondents' marital status as well as number of children and Sio-River Wetland as source of water for domestic use. Respondents who were married and have more than children considered Sio-River Wetland as important source of water.

Table 4: Benefits of Sio River

	Community		Individual	
	Frequency	Percentage	Frequency	Percentage
Food	1	20.0	1	20.0
Grass For Build	1	20.0		
Grazing	2	40.0	2	40.0
Sand	4	80.0	4	80.0
Water	4	80.0	5	100.0
Trees for Construction			1	20.0
Medicine			1	20.0

As indicated in Table 3, one of the five chiefs (20%) who participated in the interview indicated that Sio-River Wetland is beneficial as a source of food both at the individual and community level. Similarly, 20% of the sampled chiefs indicated Sio-River Wetland is beneficial since it afforded grass for building at community level and trees for construction as well as medicine at individual levels. The Sio-River Wetland was also used for grazing as indicated by 2 of the 5 sampled chiefs (40%) both at the community and individual levels. The results further revealed that sand harvesting was one of the key benefits of Sio-River Wetland as indicated by 4 out of 5 sampled chiefs (80%) both at individual and community level. Lastly, the wetlands of Sio River were the major source of water as indicated by 4 out of 5 (80%) at individual level and 5 out of 5 (100%) at the community level.

DISCUSSION

In regards to first objective which sought to answer which are the important functions of Sio River wetland in Nambale Sub-County, the study established that there are goods and services that the local community obtained from the Sio- River Wetland. Sio River Wetlands have socio and economic importance to the local community. Economically, they obtained sand and bricks for building, food such as fish and food crops, cash crop such as sugar cane, water for irrigation, pasture for livestock and timber and wood for furniture and construction. The wetland has also social importance since the local community derived herbal medicine, water for domestic use, firewood for food preparation, transport via boats and recreational purposes by swimming and a conducive environment. Similar results were also identified during interviews with four local

administrators where Sio River Wetlands were the main source of water, sand, food and grazing. These results corroborated with researcher's observation that Sio River Wetland has socio-economic importance to the local community.

CONCLUSION

The importance of the Sio River Wetland to the local community's socioeconomic well-being has been amply proven by the study and therefore, it cannot be overlooked. Just like other wetlands, local community have benefitted from wetland economically and socially. Moreover, human activities are being undertaken in Sio River wetland which underlies its socio-economic importance to the local community. Anthropogenic activities such as sand harvesting has reduced water level and pollution, farming coupled with excessive use of fertilizer has interfered with wetland biodiversity and soil fertility.

RECOMMENDATION

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 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 baraza, seminar, workshop and publicity via local radio stations.

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