

Sustainability of Livelihood Strategies of Riparian Communities in Murang'a County, Kenya.

Isaiah Ochieng Abillah¹ Dr. Benson Mwangi², Prof. Richard Juma³, Prof. Clifford Machogu⁴

¹Doctor of Philosophy in Department of Development Studies, School of Humanities and Social Sciences, Murang'a University of Technology, Kenya

^{2,3,4}Senior Lecturers Murang'a University of Technology.

Corresponding Author: Isaiah Ochieng Abillah

Abstract: Wetlands have played a key role in support of the riparian community's livelihoods and development and have been the source of forest, wildlife, minerals, agriculture, recreation, water and energy. Murang'a County in Kenya, is endowed with many such wetlands that provide water to nearby towns of Thika and Nairobi city. Despite these important roles, wetlands conservation and management in the county continue to attract little attention from scientists and policy makers. This study aims at investigating the livelihood strategies of riparian communities in Murang'a County, Kenya. This study aimed at investigating how sustainable the livelihoods strategies are of the riparian communities are in Murang'a County. The study was conducted in four purposively selected sub-counties, due to their richness in wetlands: Kiharu, Kangema, Mathioya, and Maragua. Data was collected using household's survey questionnaires, key informant interviews, and focus group discussion. Questionnaire were administered to a randomly selected sample of 404 respondents from the riparian community in the four sub-counties. Data was analyzed using SPSS software version 26.0. Chi-squared test was used to test for association between livelihood strategies and effects of encroachment into wetlands. Rejection value for statistical tests was set at $P < 0.05$. Results showed an encroachment rate into the wetlands by the riparian communities of 60.4%. It is concluded that livelihood strategies of riparian communities were not sustainable due to a high rate of encroachment, inadequate enforcement of laws and policies, On the other hand, over exploitation of wetlands resources, lack of knowledge on wise use of wetlands and conflict of interest among different environmental conservation institutions among other factors, were impacting negatively on wetlands conservation in Murang'a County. The study recommends enhanced sustainability of livelihood strategies of riparian communities through empowerment, capacity building and well-coordinated livelihood strategies by all stakeholders in wetlands management that will lead to the wise use of wetlands ecosystems in Kenya and in other parts of the world.

Key Words: Wetlands, Riparian, Conservation, Ecosystem, Livelihoods, Sustainability

Date of Submission: 03-06-2021

Date of Acceptance: 17-06-2021

I. INTRODUCTION

Globally, wise use of wetlands varies in relation to the riparian community's welfare versus poverty and as such, wetland conservation and wise use may have both positive and negative results (Angelsen et al. 2014). The household livelihoods and survival techniques depend on regional, national and local natural resources (Fisher et al. 2009). As people try to exploit wetlands to meet their livelihood needs, conflict normally occur between biodiversity and natural resource conservation initiatives (Kothari et al. 2004).

In the Sub-Saharan region, there is a strong link between food security and ecosystem sustainability. The fundamental human requirements such as food, water and other important natural resources extractions, which supports livelihood and improve human well-being has a diverse impact on environmental management. Poverty has been viewed by different environmentalists and practitioners as a contributory factor for negative livelihood strategies such as over-exploitation of natural resources, waste disposal, extreme building materials extraction, encroachment and degrading agricultural activities leading to change of water catchment sedimentation which is contrary to Ramsar convention secretariat 2005 resolutions of sustainable wise use of wetlands (Ramsar, 2016).

In Kenya, and especially Murang'a County, access to food and water resource are sustained by wetlands and despite the many wetland ecosystems benefits to humanity and environment, there is satellite imagery evidence in the Kenya Wetlands Atlas (2012) showing changes taking place in wetlands and these changes are caused by human activities, encroachment, hydrological alteration, urban growth, coastal degradation and climate change, lack of awareness on benefits of wetlands and bad government policies which

encourages draining and filling or occupation of wetlands. The comparison of wetlands conditions “before and after” shows a serious problem that calls for urgent scientific research action (Kenya wetlands atlas, 2012). It is for this reason that the study was carried out to evaluate whether livelihood strategies of riparian communities in Kenya was sustainable or not.

II. METHODOLOGY

This study used a descriptive survey design and adopted mixed method approach, to determine sustainability of livelihood strategies of riparian communities in Murang'a County, Kenya. According to Leavy (2017), descriptive survey design is appropriate because it provides a clear picture of a phenomenon the way it naturally occurs and the way they are related. Further, Creswell (2014), observes that descriptive survey design is more important as it helps in cross-sectional studies of interviews and questionnaires in field data collection among the respondents. The study targeted 144,376 riparian households which were living and drawing their livelihoods from wetlands in Murang'a County. Records obtained from County Natural Environmental Office showed that Four Sub-Counties: Kiharu, Kangema, Mathioya and Maragua, had the highest number of wetlands and were therefore purposely selected for the study. Simple random sampling was used to arrive at household sample of 143 (35.4%) in Kiharu, 64 (15.9%) in Kangema, 69 (17%) in Mathioya and 127 (31.5%) in Maragua respectively. Thus, a total of 404 households participated in the study.

Primary data was collected using several methods: structured and semi structured questionnaires, key informants' interviews, observation check list and focus group discussion. Household survey was carried on 404 households in the County to determine household size, history of settlement, nature of households, wetlands resource utilization and socioeconomic status. Structured and unstructured questionnaires were administered to each household. The oldest member of the family was given adequate time to fill the questionnaires. Those who did not know how to read and write were assisted by appropriately trained research assistants. Positive statements in Likert scale was used to determine their level of either agreeing or disagreeing with statement in questions that seeks their individual's perceptions, knowledge, and attitudes.

Key informants including NEMA, WARUA'S WARMA, TARDA, County Assistant Commissioners, KWS officers, Sub-County agricultural officers, Head teachers, Chiefs, Assistant Chiefs and Nyumba Kumi leaders were visited in their offices for one to one interview with prior appointments. During the visit, an interview guide was used to determine their awareness on the benefits of wetlands in the area, major livelihood of riparian communities, impacts of livelihood strategies on wetlands, sources of information about wetlands and their views on sustainability of wetlands conservation efforts. Additionally, key informants also gave their views on the challenges facing wetlands and livelihood sustainability in the County. Further, some of the key informants such as NEMA and TARDA also provided secondary data in form of office records on wetlands management, public awareness, campaign and collaboration with other stakeholders on livelihood sustainability.

Field visit was conducted to observe wetlands utilization, resource problems water pollution conflicting issues on riparian zones, their cause and effects on livelihood sustainability. Focus group discussion was conducted to discuss livelihood issues affecting wetland conservation and management. Data was analyzed using SPSS software version 26.0. for the accuracy of the results.

III. LITERATURE REVIEW

Globally, the fundamental human requirements such as food, water and other important natural resources which supports livelihood and improve human wellbeing impacted on environmental management. Chambers (1995), who studied the effectiveness of alternative livelihoods projects on reduction of local threats to specified biodiversity concluded that poverty is characterized by physical weakness, inferiority, seasonal deprivation and powerlessness which breeds ill-being. He further noted that sustainable development is the well-being nexus among the professionals and the poor as they struggle to combine a wide range of resources and activities to meet their daily basic requirements (Chambers, 1995). This notion is supported by Brundtland report of the World Commission on Environment Development (WCED), which observes that there is a strong link between poverty and ecosystem sustainability (WCED, 1987). However, Wise use of wetlands and sustainable wetland management system comprised of sustainable technology option, adequate institutions for the conservation of natural resource, and sustainable economic resource base option (Vishnudas et al. 2008). According to Angelsen et al. (2014), poverty leads to resource degradation and wise use of wetlands vary in relation to the riparian community's welfare versus poverty. The notion is supported by Fisher et al. (2005), who argue that household livelihoods and survival techniques depend on provisioning, regulating, supporting and cultural wetlands services. However, as people try to exploit wetlands to meet their livelihood needs, conflict normally occur between biodiversity and natural resource conservation initiatives.

The wellbeing of the riparian community depends on their livelihood strategies such as fishing, grazing, sand harvesting, logging, and charcoal burning, land cultivation, trade, tourism, water collection, and irrigation, cash crops cultivation such as tea coffee, pyrethrum, and also cultural services (Fisher 2009). They also combine a wide range of assets to achieve their livelihood which includes collection, cultivation, rural trade, rural manufacturing and remittance. Ellis (2000), studied rural livelihood determinants diversification in developing counties, found that a diversified livelihood is more resilient compared to undiversified livelihood strategies.

This notion is supported by Chambers (1995) who initiated sustainable livelihood framework to aid in the understanding of the benefits the local communities derive from a diversified livelihood asset. He observes that assets are in form of tangible and intangible resources and can be possessed through ownership, claim or control (Chambers 1995).

The World Commission on Environment and Development of the United Nations (WCED 1987), published a paper titled "Our Common Future" and this document was the basis of sustainability in the global development arena (Arce 2003). In 1950-1970s, the focus of livelihood strategy thinking was on rural village with a focus in agriculture and household-based studies. The view was focusing on poverty reduction and participatory development approach (WCED 1987).

Despite all efforts geared towards poverty reduction through sustainable approach framework, World Bank study (2015), shows that in the Sub-Saharan region, poverty level is still severe as 61% of the county's population have no adequate data to monitor poverty trend (World Bank 2015).

However, reflecting on the way forward, Millennium Development Goals report (2015), is advocating on the use of information and technology use for sustainable livelihood strategies in the 21st Century (MDGs report 2015). Technological use proved opportunities for adequate data collection and analysis as 95% of the World's population are currently by cellular networks. The notion is supported by Kinaru (2008), who observes that technological use and sustainable livelihood is deeply linked as chicken and eggs. However, he further observes that effective technology should be cost-effective, affordable, appropriate, simple, ecologically acceptable and sustainable.

In addition to technological use, the riparian community's livelihood sustainable, depends on expansion of the market base. Market involves not only trade, but other aspects such as entrepreneurship, financial resource mobilization, leadership. It also involves project proposal writing, value addition to products produced in packaging and branding. Display of agricultural products in occasions such as annual agricultural shows, world wetland days and advertisement. Further, it calls for advertisement of agricultural products in platforms such as internet websites and other electronically formed M-Agricultural markets that cuts across all gender (Aditya, 2016). Cooney and Shanks (2010), conducted a study on market-based strategies for poverty alleviation and gave a different market-based poverty alleviation strategy as they concluded that it is important to evaluate human and economic risks outcomes associated with institutions involved (Cooney et al. 2010).

Besides the expansion of market base, access to micro- finance loans with minimum collaterals, dairy and poultry farming, insurance are also important in promoting a sustained livelihood. Access to universal primary education, tertiary and higher education learning are some measure that can also help built riparian's alternative livelihood strategies and resilience through assets owned and used to earn a living (DFID, 2011).

IV. RESULTS AND DISCUSSION

Demographic Information: A total of 404 households were included in the study, out of which 198 were males and 206 were females (Table 4.1). Questionnaires were provided and returned on site, and hence, a return rate of 100% was achieved. However, despite the 100% return rate, only 350 (86.6%) questionnaires were fully responded to and included in the analysis. These included 170 (42.1%) males and 180 (44.5 %) females' participants.

Table 4.1: Response rate by gender

Respondents	Sampled Response	Response	Response Rate (%)
Male	198	170	42.1
Female	206	180	44.5
Total	404	350	86.6

In this study, a response rate of 86.6% was achieved, which was acceptable for analysis since, the whole point of conducting a survey is to obtain useful, reliable, and valid data in a format that makes it possible to analyze and draw significant conclusions about the target population. Babbie (2007), asserts that a response rate of 60% is good and 70% is very good. The dominance of women in the study is consistent with the national gender distribution in which females are approximately 51% of the national population (KNBS, 2019).

Age Distribution: Out of the 404 respondents, over 87% were aged between 31 and 80 years (Table 4.2). The majority constituting about 25% were aged between 51-60 years and 24% between 24-50 years. A very small proportion of about 11% were above 71 years and 5.1% below 24 years.

Table 4.2: Age distribution of the respondents

	Frequency	Percentage
18-24 Years	18	5.1
25-30 Years	23	6.6
31-40 Years	47	13.4
41-50 Years	84	24
51-60 Years	87	24.9
61-70 Years	48	13.7
71-80 Years	38	11.1
Others	4	1.1
Total	350	100

The inclusion of very few older people (above 70) is consistent with current demographic. The inclusion of respondents below 24 years was unintended, but was caused by having youthful members of the family heading households. According to Murang'a County HIV/AIDS Strategic Plan 2014/15-2018/19, the situation of young family members heading households is not unexpected as in many families, older members have either flown to urban centers to look for employment or have died from HIV/AIDS. The study is also consistent with KNBS (2019), which describes Kenya as a youthful country because those aged 18-35 are approximately 75% in the age structure.

Household Size: Household size in the study area was dominated by size class 1-5 (75.4%) followed by the size class 6-10 (21.4%). Very few households had more than 10 persons (Table 4.4). Households of size 1-5 constituted 37.1% males and 38.3% females. On the other hand, households of size 6-10 constituted 10% males and 11.4% females while households of size 11-15 had 1.2% males and 1.4% females. While households of size 16-20 have 0.3% males and 0.3% females. In the family set up, decisions such as childbearing, health care, education, labor, savings and consumption pattern primarily occur at the household level. Understanding of household size is important as it informs the basis of livelihood strategies choices of any given community.

Table 4.3: Household Size,

Household Size	Male		Female		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1-5	130	37.1	134	38.3	264	75.4
6-10	35	10	40	11.4	75	21.4
11-15	4	1.2	5	1.4	9	2.6
16-20	1	0.3	1	0.3	2	0.6
Total	170	48.6	180	51.4	350	100

The study findings were corroborated by that conducted by United Nations Department of economics on household size composition around the world in 2017, which observes that in the global context, average household size ranges from fewer than three persons per household to less than six. However, large household size has an average of six or more persons per household. The notion is further supported by Danie (2016), who conducted a study on the impact of household size and poverty in South Africa, the findings indicated that there most households were composed of less than five members. The study further observed that was a correlation ship in the household size and poverty level, as fewer children in the household level contributes to high development rate and hence a reduction in poverty at household and macro-economic level. The findings were further corroborated with that of key informants who indicated that the reason for smaller household size was as a result of access to basic health care reproductive services to women, high literacy level and improved infrastructure in the study area.

Economic Status of the Respondents: The fundamental pathway to socio-economic resourcefulness and resilience of households depends on its member's stable income. The respondents were asked to indicate how many members of their household had a stable salary and the findings (Figure 4.1), shows that 43.1% indicated none of their household members have a stable salary, 34.6% indicated 1-2 members, 19.4% indicated 3-10 members, 2% indicated 10-15 members while 0.9% indicated 16-20 members have a stable salary.

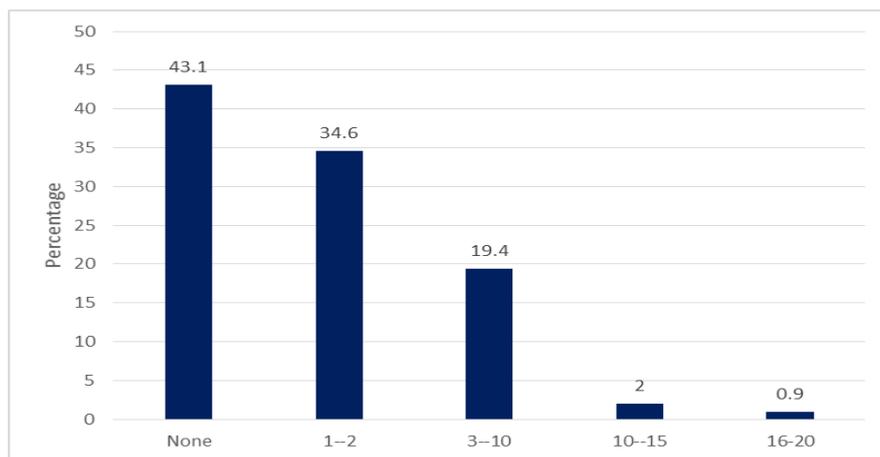


Figure 4.1: Members of Family with Stable Salary, n = 350.

The findings imply majority 43.1% of the household members do not have a stable salary. The findings were further corroborated by SPII, (2007), which hold that in South Africa, high level of poverty is due to lack of access to economic opportunities and high level of unemployment.

Livelihood Benefits Accrued from Wetlands in Murang'a County: Wetlands offer wide variety of benefits to man and both domesticated and wild animals, and gain insight to benefits of wetlands and biodiversity to riparian community was significant to the study. The benefits from wetlands was assessed based on the livelihood strategies and the multiple response findings (Table 4.8), shows that 98.3% use the wetlands for cultivation, 75.1% for livestock rearing, 58% for firewood collection, 57.4% for employment, 54% water collection and irrigation, 54% as casual laborer, 50% sand harvesting, 49.1% brick making, 28.3% fishing, 28% commercial purposes, 24.6% industrial, 21.4% recreation and 18.9% logging.

Table 4.4: Benefits from Wetlands, n = 350

	Frequency	Percentage
Cultivation	344	98.3
Livestock Rearing	263	75.1
Firewood Collection	203	58
Employment	201	57.4
Water Collection/Irrigation	189	54
Casual Labourer	189	54
Sand Harvesting	175	50
Brick Making	172	49.1
Fishing	99	28.3
Commercial	98	28
Industrial	86	24.6
Recreation	75	21.4
Logging	66	18.9

The study findings imply that majority of the respondents benefit from the wetland through cultivation, livestock rearing, and firewood collection among other benefits. The findings was further corroborated with that International Water Management Institute (IWMI, 2014), where wetlands contributes to approximately 80% of cash for poorest households and as a result, help in addressing root causes of poverty such as access to clean water, sanitation and poor nutrition. From the transect walk and observation, it was observed that wetlands rich soil enables farmers to grow major crops such as tea, avocado, macadamia and coffee. Farmers also invest in horticulture crops such as tomatoes, cabbage, French beans, spinach and kales. Food crops including maize, bananas, beans sweet potatoes, millet and cassava also dominates the area. Livestock keepers also depend on wetlands as a source of water, napiergrass, moisture for support of cattle, goats and sheep, wetlands support dairy industries in the area and source of energy in terms of hydroelectric power, firewood among other essential services.

Decline in Wetlands Benefits: The respondents were further probed to indicate if they have noticed any decline in the benefits of wetlands due to degradation (Table 4.10), 72.3% indicated there was a decline in wetlands benefits while 27.3% indicated there was no decline in wetlands benefits.

Table 4.5: Decline in Wetlands Benefits

	Frequency	Percentage
Yes	253	72.3
No	97	27.7
Total	350	100

The findings were in agreement with that of Moowaw et al. (2018), who noted that decline in wetlands benefits are as a result of change in the river channel, encroachment and land vegetation clearing.

Rate of Change in Wetlands Benefits: The respondents who had noticed a decline in the benefits of wetlands due to degradation were further asked to rate the changes (Figure 4.6), 41.1% indicated moderate, 36.4% indicated increase, and 18.2% indicated decrease while 4.3% were not sure of the change. The findings reveal that the change in the decline of wetlands benefits has been on the increase with 77.6% indicating moderate and increase.

Through transect walk, participatory observation, wetlands changes were physically visible through livelihood strategies encroachment as there was a decrease in the wetlands cover by trees and shrubs, soil management, grazing land due to increase in crop cultivation, increased soil erosion and high rate of crop failures. Oketch (2016), point that due to human activities taking place around wetlands, integral part of ecology is distorted and important biodiversity is being lost at alarming rate.

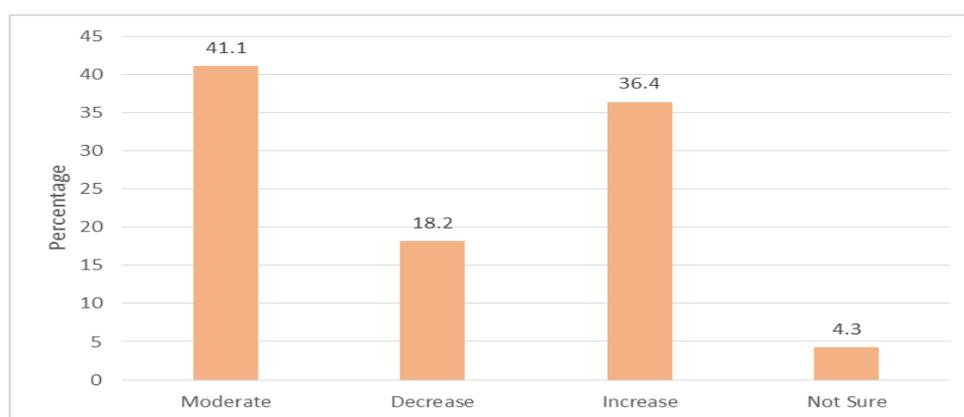


Figure 4.2: Rate of Change in Wetlands Benefits, $n = 253$.

Livelihood Strategies Encroachment on Wetlands: The respondents were asked to indicate if the livelihood strategies encroach on wetlands and the findings (Figure 4.7), shows that 61.4% indicated yes and 28.6% indicated no. the findings imply the livelihood strategies encroach on wetlands.

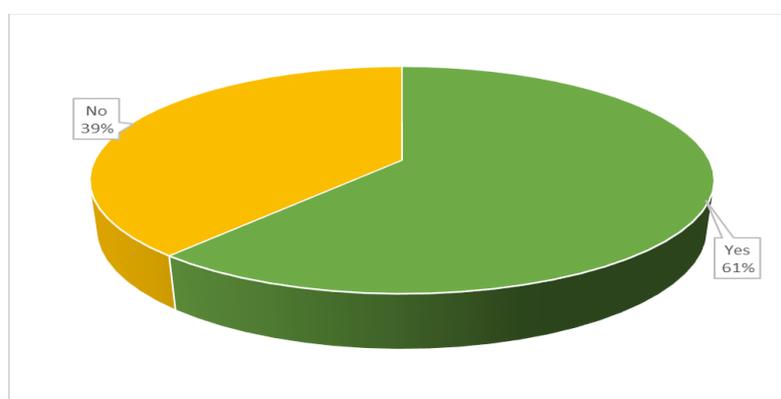


Figure 4.3: Livelihood Strategies Encroachment on Wetlands, $n = 350$

Effects of Encroachment into Wetlands: The respondents who indicated that livelihoods strategies were encroaching on wetlands were further probed on the effects of encroaching into wetlands and the findings (Table 4.11), shows that 50.2% indicated change in water level, 34% indicated reduced water quality, 7.4% indicated decline in wetlands benefits, 5.6% indicated floods and 2.8% indicated drought. The findings imply that there is change in water level and reduction in water quality due to encroachment in wetlands.

Table 4.6: Effects of Encroachment into Wetlands

	Frequency	Percentage
Reduced Water Quality	73	34
Change in Water Level	108	50.2
Flood	12	5.6
Drought	6	2.8
Decline in Wetlands Benefits	16	7.4
Total	215	100

Water is a critical resource for consumption, regulation and cultural services. According to 17 goals of Sustainable Development (SDGs), Goal number 6 advocates for universal access to clean water and sanitation. These shows strong relationship between ecological and livelihood sustainability. The findings were consistent with a study by Troyer et al. (2016), in which majority (about 319 million) people in Sub-Saharan Africa could not access clean quality water by 2015 due to climate change related issues.

Access to Basic Education and Training on Wetlands Wise use and Livelihood Strategy: The respondents were asked if they have ever accessed basic education and training concerning wetlands wise use and livelihood strategy in their areas and the findings (Figure 4.9), 62.6% indicated no, while 37.4% indicated yes.

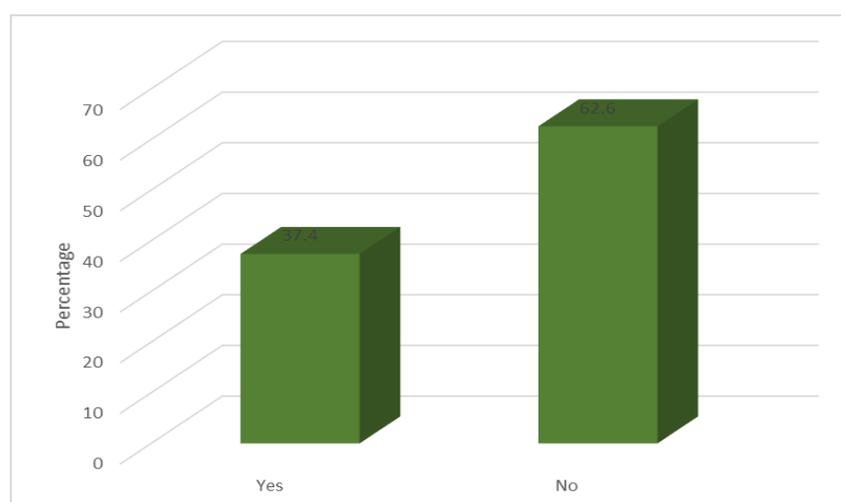


Figure 4.4: Access to Basic Education and Training on Wetlands Wise use and livelihood strategy, $n = 350$.

The findings imply majority of the respondents have not accessed any basic education and training on wise use of wetlands. Wetlands for a long time have served as learning sites about environmental biology and ecology. Findings from key informants indicated that there was a gap in the informal learning process where the older generation used to share their experiences about the benefits and conservation of wetlands with the younger generation.

Lack of Skills and Unsustainable Livelihood Strategies: The respondents who indicated they have never accessed basic education and training concerning wetlands wise use and livelihood strategies in the area were further probed to indicate if lack of life skills is a contributory factor for unsustainable livelihood strategies and the findings (Figure 4.10), shows 87% indicated yes while 13% indicated no. The findings imply lack of skills contributes to unsustainable livelihood strategies.

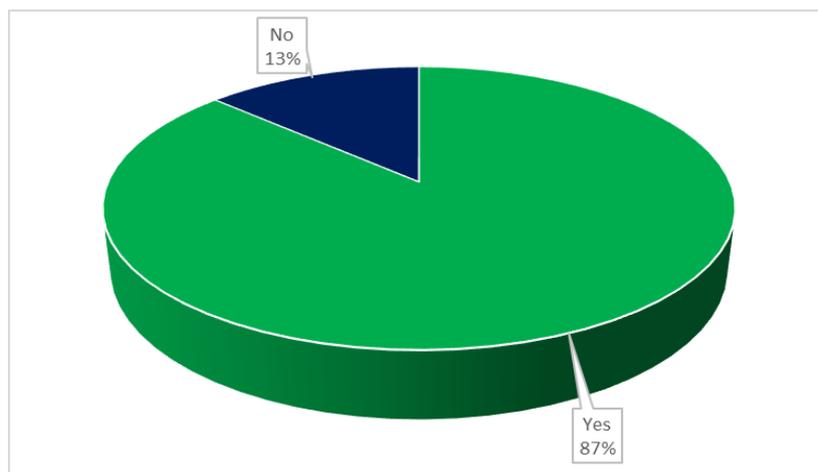


Figure 4.5: Lack of Skills and Unsustainable Livelihood Strategies, $n = 219$.

V. CONCLUSION

The study concluded that livelihood strategies of riparian communities were not sustainable in Kenya, as the wise use of wetlands regulations were not fully adhered to both at National and County level. Similarly, there is limited socio-economic benefits awareness and empowerment on wise use of wetlands that promotes sustainable use. In addition, there are livelihoods strategies encroachment into wetlands fragile zones due to rapid urbanization and industrialization, construction of dams around wetlands, conflict of interest of ownership as well as planting of eucalyptus around wetlands. Hence, the study recommends that livelihoods strategies of riparian communities be made sustainable through empowerment, capacity building, use of current information technology, controlled agricultural activities around wetlands, effective laws and policies of wetlands conservation and restoration, as well as provisioning of alternative livelihoods to reduce pressure on wetlands use and overuse.

REFERENCES

- [1]. Adtya, K. (2016). Role of women in environmental conservation: International Journal of Political Science and development vol.4 (4) pp140-145 April 2016. Doi: 1014662/IJPSD2016026ISSN:2360784X: <http://www.academicresearchjournal.org/IJPSD/Index.Html>. Retrieved on 4th July, 2018.
- [2]. Angelsen, A., Jagger, P., Rabigumira, R., Belcher, B., Hogorth, N., Bauch, S., Smith-Hall, C and Wunder, S. (2014). Environmental Income and Rural Livelihoods: A Global Comparative Analysis. <http://dx.doi.org/10.1016/j.wotl.2014.03.006>.
- [3]. Babbie, E. (2007). The Practice of Social Research, 11th Edition. Thompson Wadsworth, Belmont.
- [4]. Chambers, R. (1995). Rural development: Putting the last first, London: Longman.
- [5]. Cooney, K., and Shanks, T. (2010). New approaches to old problems; Market-Based strategies for poverty alleviation: <http://www.stor.org/stable/0.1086/652680>
- [6]. Creswell, J., (2003). Research Design Qualitative, Quantitative and Mixed Methods Approaches 2nd Edition. Lincoln Nebraska; University of Nebraska, 2003.
- [7]. Danie, M., (2016). The Impact of household size on poverty: Analysis of various low-income townships in the Northern Free State region, South Africa North West University. <http://www.researchgate.net/publication/30566205>.
- [8]. Department for International Development DFID (2011). Defining Disaster Resilience: a DFID approach paper UK: London.
- [9]. Ellis, F. (2000). Rural livelihood and Diversity in Developing Countries. New York. Oxford University Press.
- [10]. Fisher, T., and Morling, P. (2009). Defining and Classifying ecosystem. *Economics* 68:643-653.
- [11]. GoK (2018), Murang'a HIV/AIDS Strategic Plan 2014/2015-2018-2019, Government Press, Nairobi
- [12]. International Water Management Institute Annual Report (2014). Putting Water at the heart of sustainable development
- [13]. Kanaru, Z. (2008). Wetland Conservation to Large-Scale Agricultural Production, Implications on the livelihoods of the rural communities, Yala Swamp, Lake Victoria Basin, Kenya. <http://lu.dira-portal.org>.
- [14]. Kenya National Bureau of Statistics (KNBS) (2019). The 2019 Kenya Population and Housing Census. Nairobi KNBS.
- [15]. Kenya Wetlands Atlas (2012). Government Press, Nairobi
- [16]. Kothari, C. R. (2004). Research Methodology, Methods and Techniques (2nd Ed.). New Delhi: New age International Publishers.
- [17]. Leavy, P., (2017). Quantitative, Qualitative, Mixed Methods, Art-Based, and Community-Based Participatory Research Approaches. Gilford Press New York. London.
- [18]. Moowaw, W., Chinura, G., Davies, G., and Finlayson, M. (2018). Wetlands in a Changing Climate: Science Policy and Management. DCI: 10.1007/51357018-1023-8
- [20]. Millennium Development Goals Report (2015). Time for Global Action For People and Planet: United Nations New York, 2015
- [21]. OECD (2003). Environmental Indicators, Development, Measurement and Use "Measurement and Use" Reference Paper, Environmental Performance and Information Division, Organization of Economic Co-operation and Development, Paris. 2003.
- [22]. Okech, F. (2016). Land use strategies for sustainable wetland development and protection: A case study of Yala Swamp: Thesis submitted for Master's degree of University of Nairobi, Kenya.
- [23]. Ramsar Convention Secretariat (RCS). (2006). The Ramsar Convention Manual: a guide to the convention on wetlands, Ramsar Iran, (1971) 4th edition. Ramsar Convention Secretariat, Gland, Switzerland.

- [24]. Troyer, N., Murete, S., Geothals, P. (2016) Water Quality Assessment of Streams and Wetlands in a Fast-Growing East African City. DOI: 10:3390/w8040123.
- [25]. Vishnudas, S., Sarenije, H., and Zaag P. (2008). Conceptual Framework for the Analysis of Sustainable Water Shed Management Projects: 18(1): 260-263.
- [26]. World Commission on Environment and Development (1987). Our Common Future: Oxford University Press. Oxford, UK pp 18-21.
- [27]. World Bank (2015). Empowerment. Available at <http://go.worldbank.org/S9B3DNEZ00>. Retrieved 7th June, 2020.

Isaiah Ochieng Abillah, et.al. "Sustainability of Livelihood Strategies of Riparian Communities in Murang'a County, Kenya." *International Journal of Humanities and Social Science Invention (IJHSSI)*, vol. 10(06), 2021, pp 16-24. Journal DOI- 10.35629/7722