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Contribution of Integrated Water Resource Management Strategies on Conservation of Lower River Yala Basin, Siaya County, Kenya

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Abstract: ***Water shortages, water quality retrogression, and flood effects entail some of the problems which require attention. These challenges can be solved by adequate management of water resources. In Kenya, the government introduced integrated water resource management strategies in major river basins with low uptake of the approach. In Lower River Yala (LRY) Basin, the Kenyan Government introduced Integrated Water Resource Management (IWRM) as a conservation tool with little evidence to validate its effects on the basin. This study assessed the role played by stakeholders in implementing IWRM as a strategy for conserving the LRY Basin. This study adopted a descriptive cross-sectional research design. Quantitative data were analyzed using Spearman's rank-order correlation analysis, while qualitative data were organized into themes and categories, which were analyzed to answer research questions. The results showed that there was a moderately strong statistically significant correlation between the role of stakeholder participation and the conservation of river basins (rs (298) =0.5193, P= 0.000, P<0.01). This implied that stakeholders' roles in implementing IWRM strategies were insufficient, thus, low conservation efforts in the LRY Basin. In conclusion, there was an association between the role of stakeholder participation in the implementation of IWRM strategies and LRY basin conservation.***

Keywords: Stakeholder, Conservation, IWRM, River Basin

1.Introduction

International laws and the participation of stakeholders are vital factors in the management of transboundary river basins (Mianabadi et al., 2015). Over the previous few decades, almost 80 percent of the countries have changed their water legislation. However, adopting these modifications has yet to result in the implementation of real-world consequences (Zhu et al., 2016). The delays in the application and actual implications are attributed to the various traditions, customs, and hysteresis (Bielsa & Cazcarro, 2015). As a consequence, a common understanding of the meaning of the best policies, as well as a precise method of quantifying their outcomes, is needed. Further, stakeholders' participation has yet to be achieved in basin management due to their disjointed interests in various river basins. For this, there is a need to explore the role of stakeholders in the conservation of the River Basin. In particular, Africa has 64 percent of its land surface overlapping across River Basins compared to 47 percent globally (Lautze & Giordano, 2005). Studies in Kenya established that water basin degradation is a persistent challenge to all river basins in Kenya, including the large scale dessertification of the Maasai Mau (Obare & Wangwe, 2008). Substantial land changes in the Mara River basin and other river basins, with consequent adverse effects on water and land resources, are critical for ecosystem health, livelihoods, and socio-economic growth in Tanzania and Kenya (Mutie et al., 2006). In the past, development and management for conservation interventions have concerned themselves with solutions to technical problems and little attention to social processes related to equity in participation, application of relevant water regulations, and access to resources (Jaspers, 2003).

Despite the above challenges, the government of Kenya developed Sessional Paper No. 1 of 1999 on National Water Resources Management and Development. This Sessional paper sets out the framework that brings about a culture that promotes comprehensive Water Resource Management and Development with the private sector and community participation as prime movers in river basin conservation to guarantee sustainability.

Presently, the close connection of communities with the elements of nature from which they derive their support from river basins for survival in Kenya is increasingly dwindling (The Republic of Kenya, 2016). As a result of this tendency, community management activities for river basins have become necessary, as the supply of people's fundamental necessities is clouded by uncertainty (Ngesa, 2019). Therefore, communal or social organizations with an eco-cultural approach to resource management and utilization continue to form the basis for conserving water basins (Petit, 2016). This is because the fora recognize that communities or groups of people, directly and indirectly, derive their livelihood from the ecosystem and cultural resources within a particular geographical zone (Yamamoto, 2013).

Yıldız (2015) indicated that riverine forest removal, bad agricultural methods, sedimentation, river bank encroachment, and planting of high-water-demand tree species such as Eucalyptus are the primary degradation processes within a basin, and these processes were displayed in the Lower River Yala Basin. Further, the lack of proper coordination of stakeholders' involvement and participation in IWRM activities taking the forefront has not been achieved in the Lower River Yala Basin. These

factors formed the vital implementation process of IWRM in Kenya's six hydrological regions (Water Act 2002), including the Lower River Yala Basin. Nonetheless, there were no monitoring and evaluation mechanisms to monitor the contribution of IWRM on the Kenyan river basins. Hence, there was a need for a research study to help us understand the contribution of IWRM to the conservation of the Lower River Yala Basin after the government of Kenya introduced it to be a tool used to conserve key river basins in Kenya. In addition, along Lower River Yala Basin, IWRM was implemented with the help of various non-governmental organizations and community-based organizations with a limited focus on barriers. This could impede IWRM implementation on a lack of proper coordination among all stakeholders directly or indirectly involved in the Lower River Yala Basin conservation.

2.Literature Survey

Stakeholder participation in river basin management has been hailed as a potential method for enhancing water resource management and encouraging the democratic participation of stakeholders in decision-making about issues that impact them (Richard & Syallow, 2018). According to Warner, J. (2016), participation refers to including people, groups, or communities in matters that affect their well-being. It aims at creating opportunities for building consensus and healthy deliberations to improve decision-making Warner, J. (2016). Also, stakeholder participation in river basin management seeks to enhance social networks and human resources for efficient decision-making Warner, J. (2016). Besides, stakeholder participation gives the decision-making processes and actors the legitimacy to engage participants at all levels. All these aspects of participation work in harmony to improve the management of river basins. Further, studies indicate that the involvement of stakeholders is multi-faceted; first, the process contributes to knowledge transfer from numerous sources, including the informal ones gained over a wide period compared to research-based knowledge, especially those encompassing individualsin close association to the resource in question (Ngile, 2015). Secondly, participation ensures contextualization of the prevailing problem amid the fluctuating perspectives. As a result, the stakeholders' capacity to create and adopt sound water management policies and practices gets enhanced. Therefore, stakeholders endorse, appreciate, and implement the policies and activities they initiate. Moreover, participation has been underscored by various studies to help generate better decisions, considering the critical analysis of all aspects of responses, including scientific information by multiple stakeholders through the principles of "discursive rationality" (De Marchi & Ravetz, 2001). Significantly, participatory processes play a role in the mobilization of the support of the different stakeholders and are not limited to political stakeholders and the community, which is essential for the success of consolidated watershed administration. Although participation includes other means to improve capacity to address complex water resources challenges, numerous drawbacks undermine the process and render it inefficient. Notably, various actors are interested in managing water and land resources in the river basins. Under the Water Act, 2016 actors in water resources management include the WRA, Water Resources Committee (WRC), Water Resource Users Association, National Water Harvesting Authority (NWHA), Water Works Development Agencies (WWDA), Government officials and representatives (The Republic of Kenya, 2016; Muketha, 2020). The stakeholders mentioned above have salient roles in conserving river basins at various levels. Generally, their roles include land allocation, planning, surveying, development control, monitoring and evaluation, and environmental and resource management. Importantly, Water Resources Authority (WRA) and WRUAs are involved as grassroots managers in river basin management. WRA's roles in managing river basins include planning, management, protection, and conservation of water resources (Richard & Syallow, 2018). It is also responsible for allocating, apportioning, assessing, and monitoring water resources. Other roles include issuing water permits, water rights and enforcement of permit conditions, regulation of conservation and abstraction structures, catchment and water quality management, regulation and control of water use, and coordinating the IWRM Plan. On the other hand, the WRUA's roles include the decision-making process to identify and register water users, collaboration in water allocation and catchment management, assisting in water monitoring and information gathering, resolving conflicts, and cooperative management of water resources.

3.Problem Definition

Integrated Water Resource Management (IWRM) was introduced in 2002 as water sector reform in Kenya. IWRM has largely been accepted and viewed as an ideal way of the management ofwater resources worldwide. The execution was realized through the creation of awareness on its principles to the local communities, organizing fora for all stakeholders working on the LRY basin, and sensitizing the communities on their roles in water resource management conservation in the Lower River Yala basin. Nevertheless, the implementation, methodology, and practice of IWRM continue to pose a significant challenge, given the disjointed and differing responses from management quarters and the scientific community. Moreover, IWRM principles on the Lower River Yala Basin management must be fully conceptualized among the community members, leading to uncertainty in IWRM implementation and contribution to LRY basin conservation. Further, the Lower Basin of River Yala has several water resource management challenges where the role of stakeholders in the implementation of IWRM on the conservation of LRY Basin has not been well defined, making it very difficult to identify who is contributing to water resources management in the Lower River Yala Basin. Within the Lower River Yala Basin, many water resource management institutions exist whose contributions to its conservation still need to be made clearer. This has made determining their effects on the Lower River Yala Basin conservation difficult. Therefore, this study examined the contribution of stakeholders in implementing integrated

water resources management on the Lower River Yala Basin conservation.

4.Methods / Approach

A descriptive cross-sectional research design was employed. In a cross-sectional study, data were collected at a single point in time, that is, for one week. The units of analysis were household heads, subchiefs, Water Service Providers, and Water Resources Authority.

4.1Study population and Sampling

Ten sublocations from 34 sublocations of the Gem sub-county were sampled using a simple random sampling technique where respondents were picked. Thirty percent (30%) of the sublocations were adopted for the study. According to Mugenda and Mugenda (2003), 30% of the total population qualifies as a good representative sample, and the elements in the sample are greater than 30. This way, it is possible to compute statistical operations, especially for a descriptive study efficiently. For Random selection, each 34 sublocation was given random numbers whose placement corresponded or matched particular-colored balls. The ball was then placed in a box, and one ball at a time was drawn without replacement until the 10th ball was recorded. Random numbers were used to select the sub-locations. They include Onyinyore, Kamabare, Uriri, Dienya East, Dienya West, Wagai West, Wagai East, Kanyadet, Ndori, and Gombe. The household numbers for each sub-location were computed from IEBC reports and produced 7,947 households, as shown in Table 4.1 below.

Table 4.1: Total Population and Sample Population of Lower Yala Basin

Sublocations	Male	Female	Total Population	Number of H/H	Sample Population	Percentage %
Onyinyore	1523	1599	3122	719	33	9
Kambare	2157	2670	4827	1069	49	13
Uriri	1158	1172	2330	525	24	7
Dienya East	1433	1558	2991	674	31	10
Dienya West	1140	1256	2396	608	28	8
Wagai West	904	966	1870	465	21	6
Wagai East	991	1174	2165	510	24	7
Kanyadet	1953	2212	4165	986	46	13
Ndori	2606	2857	5463	1322	61	17
Gombe	1771	1964	3735	861	40	11
TOTAL	16,022	18,134	34,156	7,947	367	100.0

Source: Adapted from Population and Housing Census Report (KNBS, 20019)

The sample size for the households for the study was estimated using the Krejcie and Morgan (1970) table for determining sample size for research, educational and psychological measurements, as shown in Appendix C.

The above table was developed using the following formula for determining sample size.

$$n = \frac{(\chi 2)(N)(P)(1-P)}{[(d^2)(N-1)+(\chi 2)(P)(1-P)]}$$

n = the required sample size
$\chi 2$ = table value of chi square for 1 df at desired confidence level (generally 95%) (3.841)
N = the population size
P = the population proportion (generally assumed to be .50 to maximize sample size)
d = the level of accuracy of the estimate expressed as a proportion (0.05)

Using the table, the calculation produced a sample size of 367 households.

This is because 7947 is greater than 7000, which yielded 364, and closer to 8000, which gives a sample size of 367. Therefore 367 was picked to represent the sample HH size for the study. The number of selected households was distributed proportionately in the ten sampled sub-locations based on household density.

4.2 Household questionnaire interview

A structured questionnaire was administered to the household heads sampled for the study. The structured household questionnaire was designed, finalized, and pretested on ten percent (10%) of the total sample population of the households as per recommendations of Gayet et al. (2014). The households used in pretesting were age groups between 18-30 years to ensure that they were not considered during the administration of the final questionnaire. Further, the questionnaires were marked to ensure exclusion in the actual data collection.

4.3 Key informant interview

Key informant interviews included a conversations of face to face among the water service providers, local administrators (assistant chiefs), and other WRA staff. Key Informants selected in the study were not used again in the household survey. A pre-designed Key informant interview guide was employed to ensure information is obtained from a wide range of people, including community leaders, professionals, or residents who have firsthand knowledge about the community and conservation of Lower River Yala Basin.

4.4 Focus Group Discussion

Eleven focus group discussants (FGD) were used to gather individuals from similar backgrounds or experiences on IWRM to discuss the conservation of Lower River Yala in the ten sublocations. Information saturation was reached at the 11th focus group discussion since this study saturation started at the 9th and 10th focus group discussion. It was at the 11th FGD that no new information was coming out from the discussants. Information saturation was reached when no new information was discovered in the data analyses, and data collection ceased.

4.5 Data analysis

Quantitative data were analyzed using descriptive statistics, including frequencies and percentages, and inferential statistics (Spearman's rank correlation). Qualitative data obtained from the discussants were analyzed by assigning codes to the questionnaires and organizing data into themes and sub-themes to enable quick interpretation of the answers from these categories and results presented in the form of charts, tables, and figures. On the other hand, qualitative data from KIIs and FGDs transcriptions were analyzed as per the specific objectives to establish patterns, trends, and relationships.

5.Results and Discussions

5.1Role played by stakeholders in the implementation of IWRM on conservation of Lower River Yala basin

5.1.1 Organizations doing conservation activities which households belong to in conserving Lower Basin of River Yala

The findings reveal that a significant 53% of the households indicated to belong to water resources user's association in the basin. However, other organizations also existed, with 9.8% of the respondents stating they were from water service providers and 8.9% indicating they came from Water sector trust funds, as shown in Table 5.1.

Table 5.1: Organizations doing conservation activities which members belong

Organizations which members belong	Responses N=300	
	Frequency (f)	Percentage (%)
WRA	18	6.0%
WTF	27	8.9%
WRUAs	159	53%
WSP	29	9.8 %
No	67	22.3%

Most household members belonged to WRUAs, found at the lowest level of river basin management. Further, twenty-two point three percent (22.3%) of the respondents indicated that several households did not have a membership in any organization, limiting their contribution to the conservation efforts. This finding aligns with GWP (2017) and Richard and Syallow (2018), reinforcing the need for processes that encourage participation. The involvement of locals in participatory processes contributes to the mobilization of the support of the various stakeholders, not limited to the political groups and society, crucial for successful integrated watershed management.

5.1.2 Households role in the implementation of IWRM on conservation of Lower River Yala Basin

All the stakeholders participating in the conservation of the LRY Basin were involved in this research, and their divergent views were considered during the fieldwork and data analysis. In the household study, it was established that 13.7 % were involved in the planning of river basin conservation projects. Another 14% were engaged in the financial mobilization of conservation activities of the LRY basin. The study further found that 25.3% were involved in decision-making on conservation activities by various stakeholders in the basin. Twenty-point-seven percent (20.7%) were engaged in volunteer conservation activities along the LRY basin. Finally, 26.3% did sensitization of various basin conservation activities, as shown in Table 5.2 below.

Table 5.2: Household's role in the implementation of IWRM activities on conservation of LRY Basin

Households' role in the implementation of IWRM on conservation of River Yala Basin	Responses n=300 Frequency (f)	Percentage (%)
Involved planning of river basin conservation project	41	13.7%
Involved in the financial mobilization of conservation activities	42	14.0%
Involved in decision making on conservation activities and programs	76	25.3%
Volunteer for maintenance of water conservation structures and tree planting	62	20.7%
Involved in sensitization of river conservation strategies	79	26.3%

From Table 3.3, households were involved in different activities to conserve the LRY basin. The findings further reveal that the households are majorly involved in sensitization and decision-making on conservation activities. This finding is in line with Kurian (2004), which stated that the involvement of all stakeholders and cross-sector coordination in implementing IWRM strategies is key to conserving river basins. More participation of key stakeholders (households, WRA, WRUAs, and WTF) in project identification, financing, and planning of IWRM activities may positively affect the conservation efforts in the LRY basin

5.1.3 The Spearman's rank-order correlation result for stakeholder role in the implementation of IWRM activities on conservation of LRY Basin.

A Spearman's rank-order correlation was run to establish the relationship between the role of stakeholders' implementation of IWRM activities and the conservation

of the LRY basin, which was statistically significant (rs (298) =0.5193, P=0.000; P<0.01). Spearman's rank correlation coefficient of 0.5193 indicates that the moderate extent of stakeholders' role tends to coincide with the moderate extent of implementation of IWRM activities on the conservation of LRY Basin. Stakeholders' role in implementing IWRM activities influences the river basin conservation, though to a moderate extent from Spearman's rank correlation coefficient. While the Stakeholders' role is critical in the conservation efforts, their participation ought to have been established at the onset of identification and reinforced planning and implementation of IWRM strategies of any project. Stakeholder involvement has been cited as a vital ingredient in conserving river basins. This includes specifying roles and involvement in planning, financing, and evaluating conservation strategies (the Republic of Kenya, 2016; Muketha, 2020). Therefore, identifying the potential risks and challenges in stakeholder engagement would assist in improving the conservation within the LRY basin. Further, there is a need for cross-sector collaborations and partnerships to encourage information and resource sharing, given that conservation organizations have common interests in protecting and conserving the environment and river basins. Inferentially, the findings of this study show that stakeholders' roles in implementing IWRM strategies could have been at the optimum level, as indicated by Spearman's rank correlation coefficient of 0.5193, consequently leading to low conservation efforts in Lower River Yala. Stakeholder participation is essential to choice-making leaning on the perspectives of individuals affected by the matter. Similarly, the results confirm the findings of Agwata (2006) at the Bwathonaro water basin of the Tana River catchment, the need to evaluate the roles of various government agencies and other stakeholders to ensure full benefits and responsibilities of the IWRM tool in the river basin.

5.1.4 Organization working to reduce water pollution

Various players indicated an agreement to collaborate with others to obtain a clarification to the challenges of the Lower River Yala basin. The study also established that 1.4% of respondents stated that WSPs conducted activities to reduce water pollution in the LRY basin. Another 5.8% noted that WSTF sponsored activities that reduce water pollution in the basin, while 37% needed to know which organizations worked to reduce water pollution. Throughout the interviews, the respondents identified various organizations working in the basin to reduce water pollution. 125 (42.5%) respondents indicated that Water Resource Users Association (WRUA) was the foremost organization working to reduce pollution along the Lower River Yala Basin, as indicated in Table 5.3.

Table 5.3: Organizations working to reduce water pollution on Lower River Yala Basin

Organizations working to reduce water pollution	Responses	
	N= 294	
	Responses (f)	Percentage (%)
WRA	32	10.9%
WTF	17	5.8%
Water Resources Users Association	125	42.5%
Water Service Provider	4	1.4%
MoWI	7	2.4%
Don’t Know	107	37%

From the results (Table 3.5), about 42.5 % of respondents indicated that WRUA, which manages water resources at the lowest level of basin management, contributed significantly to reducing the LRY basin's pollution. However, 37% of the respondents were unaware that organizations in the basin were not involved in pollution reduction. According to Richards and Syallow (2018), a lack of participatory approaches and organizations involved in managing river basins and resources would hamper coordinating conservation activities. When all stakeholders are brought together, they identify the roles, challenges, and opportunities for collaboration in knowledge and finances, partnerships, and networking. Hence, the stakeholders learn what organizations are involved in pollution reduction in the basin and strengthen one another.

5.1.5 Activities carried out by organizations working in the Lower Basin of River Yala to reduce water pollution

During the survey, forty-five-point nine percent (45.9%) of the respondents stated that most organizations promoted tree plantation along the riverbank, with the Water Resource User Association at the forefront of championing this. Other respondents (12.4%) further indicated that WRA ensured that most water resource management regulations that governed basin management were implemented. Also, forty-point-eight percent (40.8%) of the respondents stated that some organizations promoted conservation agriculture practices to farmers along the Lower River Yala Basin. However, a smaller percentage (0.9%) of respondents believed zero-grazing contributed to reduced water pollution along the Lower Yala basin, as shown in Figure 5.1.

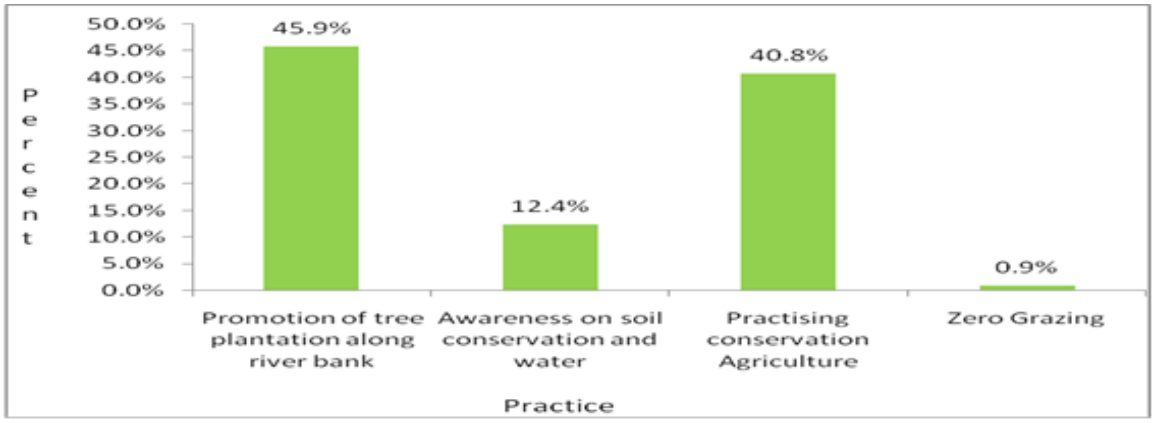

Figure 5.1: Practices reducing water pollution

Inferentially, the promotion of tree planting along the river bank and conservation agriculture has the highest scores, followed by an awareness of conservation of soil and water practices. Implementing these activities seeks to address the pollution problem in the Lower River Yala basin. Finding an effective solution to water pollution from soil erosion and agricultural activities is key to controlling the challenge. According to Isabirye et al. (2009), the nature of the field parcels and farming methods overall protects soil structure against raindrop impact and encourages soil erosion. Moreover, implementing and enforcing water regulations are critical for protecting and conserving riparian areas and the entire basin from human activities and degradation (Akivaga et al., 2012; Mehta & Movik, 2014). However, low implementation of water regulations may encourage water and resource users in the basin to encroach on the riparian areas, resulting in the river basin's overall degradation.

6.Conclusion

The study findings reveal that the role of stakeholders has an immense influence on the conservation of river basins. Stakeholder participation assisted in identifying priority areas and areas of collaboration, implementing basin conservation activities, and enforcing water regulations such as water allocation and permitting. Specifying these roles was vital since it was possible to know who, where, and when to accomplish responsibilities and establish partnerships in conserving the river basins. A quantitative analysis using Spearman's rank-order correlation was run to establish the relationship between the role of stakeholders' implementation of IWRM activities and the conservation of the LRY basin, which was statistically significant (rs (298) =0.5193, P=0.000; P<0.01). Spearman's rank correlation coefficient of 0.5193 indicated a correlation between the extent of stakeholders' role in implementing IWRM activities on the conservation of the LRY Basin.

7.Future Scope

The study was restricted to Lower River Yala due to the expansiveness of the entire river basin, which may require more time and resources. Therefore if there are enough resources in the future, the research should cover the entire basin of River Yala. This would ensure we have full data on the interaction of the basin with its environment and conservation actors. Notably, the Lower River Yala is located downstream, where most degradation impacts are experienced.

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