

Influence of Agricultural Practices and Activities on Conservation of the Ol-Bollosat Wetland in Kenya

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ABSTRACT

Literature shows that most of the wetlands are threatened ecosystems due to increased human activities. The proper conservation and management of the wetlands is an important step to ensure that the human population continues to benefit directly and indirectly from the wetlands, and thus the need for this study that focuses on the influence of agricultural practices and activities on the conservation of the Ol-bollosat wetland. The study adopted a descriptive survey research design, targeting 1000 households and the key informants, including the Nyumba kumi representative, Area Chief, Sub chief, KWS officers, MCA's from Ndaragwa and Ol-jororok sub counties in Nyandarua County. Stratified random sampling was used to select two hundred and eighty seven (287) household heads as the respondents of the study. The data collection tools were interview schedules for key informants and guided questionnaires for household heads. A pilot study was carried out in Rwamuthambi wetland in Kirinyaga County. The researcher used Statistical Package for Social Scientists (SPSS version 26) to analyse data. Both descriptive and inferential statistics were used for data analysis, and the results were presented in form of bar graphs, pie charts and tables. The findings showed that agricultural activities and practices have an adverse effect on the conservation of Ol-bollosat wetland. The analysis showed that the community engaged in unsustainable agricultural practices and activities which were deleterious to the conservation of the wetland. Overgrazing on the riparian land, abstraction of water for irrigation are some of the unsustainable agricultural practices that the local community routinely engages in. The study recommends that inter-agency collaboration be enhanced so as to address the multiple challenges facing the Ol-bollosat wetland. The role of the County and National government in the management of the wetland should be enhanced, and local communities must be engaged. Further, agricultural practices and activities must be upgraded so that more cost-effective and environmentally friendly methods of irrigation are adopted. The study also recommends that further investigations be done to explore areas of meaningful community engagement in the management of the Ol-bollosat wetland.

Keywords: Agricultural Practices, Agricultural Activities, Conservation, Ol-Bollosat Wetland, Kenya

I. INTRODUCTION

Globally, wetlands have for long been considered as wastelands and consequently worthless (Davidson, 2014). They were regarded as wastelands and were not thought to have any significant contribution. Statistics indicate that at least half of the world's wetlands may have disappeared within the last 100 years (Kingsford, Basset, & Jackson, 2016). In the United States of America alone, a conservative estimate indicates that more than 50 per cent of its original wetlands have been lost. Similar pattern of wetland conversion is also common in third world countries (Kingsford et al., 2016). Wetlands have assumed a new attraction and value in the recent decades as their chemical, biological, hydrological, physical, and socio-economic benefits are acknowledged and as they become degraded at an alarming rate (Davidson, 2014). Wetlands are rich ecosystems, which provide essential livelihood products and services such as fish, water and moderation of climate.

At the regional level, communities living around wetlands have continued to exploit them in total disregard of whether such exploitation is sustainable in the long run or not (Gichuki, 2003). This issue is compounded further by the lack of legal instruments or their enforcement to provide adequate protection for wetlands. The communities living in settlements adjacent to the wetlands and who earn their livelihood from wetland resources have remained largely ignorant of the conservation policies and the implications of their socio-economic practices and are mostly uninformed about the new conservation trends and the benefits they could get from implementing these new environmental conservation efforts.

In East Africa, communities living adjacent to the wetlands have contributed to their conservation since they are the primary beneficiaries (Zamberletti, Zaffaroni, Accatino, Creed, & De Michele 2018). In Kenya, the Ministry of Environment Water and Natural Resources estimates Kenya's wetlands to cover 2 to 3% of the country's surface area

(Wachenheim, Roberts, Addo, & Devney, 2018). Most of these wetlands are threatened ecosystems with the main threats arising from human activities (Government of Kenya, 2019). Environmentalists stress the need of preserving the natural balance of soil and water, as well as ensuring food safety and maintaining the health and quality of life of rural people and their communities (Rockström, Williams, & Daily, 2017).

Hammer and Bastian (2020) posits that wetlands are highly vulnerable and valuable areas supporting a diversity of species and habitats and as such they require an environmentally compatible agriculture. Beuel et al. (2016) argues that wetlands are rich ecosystems, which provide essential livelihood products and services such as fish, water and moderation of climate. However, in Kenya, the local community has been involved in depleting the wetlands. The rate at which the wetland is being depleted and degraded is very alarming which begs the question; can the local community be used to protect and conserve the wetland instead of depleting, and therefore what are the issues that would influence their participation in the conservation of the wetland? Schweizer, Colloff and Pittock., (2022) states that farmers as well as land owners are aware of the benefits of the wetland since they have directly benefited from the wetland for years. Conserving the ecological balance, structure and functions of wetlands while simultaneously maintaining the agricultural resource base by practicing environmentally compatible agriculture should therefore go hand in hand (Rockström, Williams, & Daily, 2017). The role of the local people in management and control of environmental degradation should be enhanced (Davidson, 2018).

As shown by the preceding discourse, wetlands play very important roles in maintaining biodiversity, clean water, food security among others; they have also indicated that local communities have a role in either maintaining or depleting the wetland. Communities living around Ol-bollosat wetland have over the years subjected the wetland to severe anthropogenic disturbances. These include pollution from agrochemicals, over use of water for agricultural purposes, drainage of swamp for settlement as well as overgrazing. This clearly shows that the local community has been involved in depleting the wetlands although literature has shown that the wetland is of significant value if it is well maintained, protected and sustained. The rate at which the wetland is being depleted and degraded is very alarming which begs the question; can the local community be used to protect and conserve the wetland instead of depleting, and therefore what are the issues that would influence their participation in the conservation of the wetland? This study seeks to assess the influence of community participation in the conservation of the Ol-bollosat wetland in Nyandarua County.

II. LITERATURE REVIEW

2.1. Theoretical Framework

This study is guided by the theory of Deep Ecology developed by Arne Naess (Hewer, Scott, & Gough, 2015). The theory is basically anchored on the following central tenets; one is that all living things- whether plants or animals- have an intrinsic/inherent value within themselves. Secondly, the full variegation of life forms contributes to the realization of these values. The third tenet is that human beings through their activities have no right to reduce this richness and diversity whatsoever, unless they are satisfying some very vital human needs. The theory's final tenet is that the prosperity of human life and civilizations is consistent with a significant reduction in the human population, while the flourishing of non-human life necessitates such a reduction (Burns, 2015).

This theory guided the study in investigating the role of the local community in sustainability of the Ol-bollosat wetland in Nyandarua County, Kenya. The theory advocates for appreciation of biodiversity and the need to realize that all living things have a positive intrinsic contribution to the beauty of the planet. Wetlands by their very nature have intrinsic values and form part of the most important ecosystems, owing to the array of benefits that human beings derive from them. When applied against this background, the Deep Ecology theory helps to refocus attention from capitalistic consumerism to the realization that all species are interrelated, and that destruction and degradation of the environment and more so the wetlands will have lasting dire consequences on the quality of human life as we know it today. The rallying call underlying the Deep Ecology theory is that there must be a shift from human-centred anthropocentrism to eco-centrism, an idea in which all living things are regarded as having an intrinsic inherent value. Within this background, conservation and therefore ultimately the sustainability of the wetlands can be achieved.

2.2 Empirical Review

Agriculture is the biggest land use in terms of area globally and also the most significant in terms of impacts (Deichmann, Goyal, & Mishra, 2016). Any use of land has some impacts on it, with effects varying in terms of intensity of use and the type of use. However, Kurtener, Torbert & Krueger (2008), notes that low intensities of land use do not necessarily imply that there were no effects, or that they are negligible.

While environmental degradation may occur naturally, human activities accelerate these processes. This may be through introduction of foreign materials (chemicals, plants, animals) that may not occur naturally at the same levels in that environment or through creating an environment that allow natural processes to be accelerated. For example cultivation may open up land to the natural elements hence accelerating soil erosion.

Sadler et al (2016) posits that in Kenya agricultural policies have focused on agro-chemical use as an important focal point in the effort to increase production. Efforts in promoting fertilizer use in Kenya have included fertilizer trials, demonstrations and extension programs and provision of subsidies on fertilizers. However, use of fertilizers is already impacting on water resources. Studies in Lake Victoria show that agricultural land runoff may contribute up to 22% of the nitrogen and up to 55% of the phosphates (Kumar *et al*, 2017)

Nyangi (2015) states that, the use of agro-chemicals has deleterious effects on the environment. Studies worldwide indicate that the use of fertilizers in a watershed affects the concentrations of nutrients in the water systems within the catchments. Fertilizers increase the concentration of nutrient in the surface soil and consequently in the runoff. The amount of fertilizer applied in a given watershed has been found to relate to the amount of nutrients in the river served by the watershed (Mburu *et al.*, 2015).

According to OECD, the concern about environmental degradation by agriculture has gained currency, as its associated cost to society has become better known. These include degradation and depletion in the form of soil loss and forests loss, desertification, overgrazing, deterioration of quality surface and ground water, reduction in genetic diversity of fish stocks, water-logging, salination, accumulation of toxic metals and organic compounds, siltation and eutrophication caused by improper use of pesticides and fertilizers (Tsuji, 2001).

Thenya et al., (2011) points out that, globally, wetlands have provided an easy and cheap source of water for irrigation, as well as water for domestic use. This water is provided by the streams and springs that drain into the lake. As a result of increased horticultural activities by the nearby commercial horticulture farms, there has been increased abstraction of water from the wetland. Consequently, there has been a marked decreased in water levels over the last decade. Most of the riparian lands surrounding the wetland have been converted into arable agricultural land, with farmers relying heavily on the wetland for irrigation water. Therefore, the farming practices adopted by the neighboring community will ultimately affect the conservation efforts of the wetland.

Challinor, Watson, and Lobell (2014), on the other hand, claims that local communities can spearhead efforts to sustain the wetlands, particularly through conservation practices. In most cases, the local people have a deeper understanding of the changes taking place in the wetlands, and can therefore provide important information necessary for making wetland inventory as well as data regarding socioeconomic conditions of a particular named resource. When properly engaged, the local people can volunteer their knowledge, information and skills that can prove vital in the all-round sustainable management of wetlands in general. The active inclusion of the local communities during the planning phase of an intervention is important since it helps to develop a sense of ownership of the process. This is important since they are the direct beneficiaries of the wetlands and therefore are directly affected (Brown et al., 2020).

III. RESEARCH METHODOLOGY

3.1 Research methodology

This was a descriptive survey study that aimed at determining the influence of agricultural practices and activities on conservation of the Ol-bollosat wetland. The study was done in Nyandarua County, Kenya. The study used stratified random sampling to sample the households as the respondents of the study. Data collection tools used for the study were interview schedules for the household heads and guided questionnaires for the Key informants. The study gathered both qualitative and quantitative data which was analyzed using descriptive and inferential statistics. Ethical considerations and requirements were adhered to.

3.2 Research Design

The study adopted a descriptive survey design. Mugenda and Mugenda (2003) describe descriptive survey as design in which data is collected in order to answer questions concerning the current status of the subject under study. Descriptive study also engages an assessment of the situation of affairs describing, analyzing and reporting conditions that exist or that existed (Kothari, 2019). The descriptive design was preferable for this study since it ensured a broad description of the influence of agricultural practices and activities on conservation of the Ol-bollosat wetland.

3.3 Location of the study.

The study area was the sub-counties surrounding Lake Ol'Bolossat wetland, that is Ndaragwa and Ol-jororok sub-counties. It is a freshwater body which is about 4km², and lies at a longitude of 36⁰, 26'E and a latitude of 0⁰,

09°S. The lake is located at the northern foots of the Aberdare ranges, and to the West of Satima escarpment which is very conducive for agricultural activities both subsistence and commercial agriculture (WEF, 2018). Ndaragwa sub-county borders the lake generally on the Eastern side, while the Ol-jororok Sub-County borders the lake on the western side. The types of soil found in Nyandarua County are mainly of volcanic origin, and are suitable for agricultural purposes (Arora, 2019). Consequently, residents living in these two sub counties are mainly involved in agricultural production, and therefore they hold important information regarding their interaction with the wetland.

3.4 Target population

The target population of the study was 1000 household heads living adjacent to the wetland i.e. Ol-jororok Sub-county and Ndaragwa Sub-county. Additionally, the study also targeted the local community leaders including the KWS officials, representative of *Nyumba Kumi* initiative, M.C.A, chiefs and sub chiefs as the key informants. The wetland lies between the two sub counties and the respondents were likely to have had first- hand interaction with the wetland as opposed to people who are further away from the wetland.

3.5 Sampling procedures and techniques

The study used multistage sampling techniques. First, the study used purposive sampling to sample the two sub counties (Ndaragwa Sub county and Ol-jororok sub county) which border the wetland. The community members neighboring the wetland hold important information about its use, conservation and depletion status. Secondly, the study used cluster sampling to sample one constituency from each Sub County; i.e. (Ndaragwa constituency and Ol-jororok Constituency). Thirdly, from the selected constituencies simple random sampling was used to select two hundred and eighty seven (287) households as the sample of the study as explained in 3.6.1. Care was taken to ensure representation of all types of households in the selection of the respondents.

3.5.1 Sample size

Mugenda and Mugenda (2019) pointed out that where time and resources allow, a researcher should take a sample as big as possible. Therefore, the study will adopt a formula from Israel (1992) below to select the sample size;

$$n = N / (1 + N (e)^2)$$

Where n = sample size

N = Target population

e = Acceptable error (5% for this study)

When substituted in the formula above, the sample for household will be:

$$n = \frac{1000}{1 + 1000 \times (0.05)^2}$$

The sample size for the study will be 287 household heads and 25 key informants totaling to 312 respondents.

3.6 Data collection instruments.

The study used guided questionnaires for the household heads (Appendix V) and interview schedules for the key informants (Appendix IV).

3.6.1 Guided Questionnaires for household heads

Guided questionnaires consisting of unstructured questions were administered to the household heads, as the respondents of this study. Guided questionnaire was important for this study because it yielded important information regarding the influence of community participation on the conservation of Ol-bollosat wetland. Guided questionnaire helped to collect data from all the households even those with low or no education at all. They were used to collect information on how land ownership influences conservation of the wetland, information on how agricultural practices and activities influence the conservation of the wetland and also to establish the ways through which the stakeholder intervention can influence community members to participate in the conservation of the Ol-bollosat wetland in Nyandarua County.

3.6.2 Interview schedules for key informants.

The researcher used interview schedules to elicit responses from the key informants. Through the use of interview guide, the researcher was able to collect first-hand information regarding the influence of community participation on the conservation of the Ol-bollosat wetland in Nyandarua County. Interview schedules are important for this study since they helped in getting in-depth data which is impossible to get using the questionnaires. Further, interview schedules were suitable for this study since the researcher was able to clarify on the purposes of the study as well answer any questions that the respondents had, and this resulted in more accurate data for the study which helped

to address the objectives of the study.

3.7 Validity and Reliability of Data Collection Tools

Before carrying out data collection exercise, the researcher carried out a pilot study in Rwamuthambi wetland, which is located in Kirinyaga County so as to test the reliability of the data collection instruments. The researcher used the test-retest method, which involved issuing the same questionnaire to the same respondents after a pre-determined period of time, and then checking the responses for consistency. This helped the researcher to point out the weaknesses and establish whether the respondents found clarity in the questionnaires. The researcher also carried out interviews with a few randomly selected key informants to test the reliability of the tool.

In order to test the validity of the data collection instruments, the researcher analyzed the results of the pilot study so as to identify any modification that needed to be done on the questionnaire and interview schedules. In order to test the validity of the data collection tools, the researcher used inter-rater reliability, which shows the degree of agreement among independent observers of an occurrence or phenomenon.

3.7.3 Data Collection Procedures

Data collection methods are either primary or secondary depending on the research objectives. The researcher used both primary and secondary data collection methods. The researcher delivered the guided questionnaire to the household heads and requested them not to disclose their identity so as to cultivate more honest responses, especially on contentious issues as shown by Leedy and Ormrod (2013). The interview procedure started by booking appointments with the key informants (chiefs, sub chiefs, MCAs, KWS officers, village headman/Nyumba kumi representative), and the questions were guided by the interview guide. The researcher carried out data collection in the month of August 2022.

3.8 Data Analysis Techniques and Procedures

The study used descriptive statistics to analyse the quantitative data. This involved the use of standard deviations, means, frequencies and percentages. The process of data analysis required the use of Statistical Package for Social sciences (SPSS) version 26. The data was coded, assigned labels to identify categories of variables and fed to the computer program to be run. Qualitative data was analysed through the use of thematic content analysis whereby the data was coded, similar relationships, themes and patterns were identified for analysis. The results are presented in form of figures, tables, graphs and charts.

IV. FINDINGS & DISCUSSIONS

4.1 Response Rate for guided questionnaires and interview schedules

The respondents for this study were household heads in the Ol-bollsat region of Nyandarua County. The table below shows the response rate for guided questionnaires and for interview schedules.

Table 1

Response Rate for Guided Questionnaires

Response rate	Frequency	Percent
Response	260	90.6
Non- response	27	9.4
Total	287	100

Table 1 above shows that out of the total number of guided questionnaires administered, at least 260 were properly filled representing 90.6%. There was a non-response rate of 9.4%, indicating that 27 respondents failed to participate in the study. This finding indicates that a majority of the intended respondents for the study participated, while only 27 failed to fill the questionnaires properly.

Table 2

Response Rate for Interview Schedules

Response rate	Frequency	Percent
Response	20	80
Non- response	5	20
Total	25	100

Table 2 above shows that there was a response rate of 80%, indicating that 20 respondents participated in the interviews while 5 participants failed to participate in the study representing 20%. This finding shows majority of the respondents were willing to participate in the study. This response rate agrees with Jafari et al (2015) who posited that researchers should strive to achieve a return rate of at least 60% of the research instruments. The data gathered can then be generalized to represent the opinions of the respondents in the target population.

4.2 Agricultural Practices and Their Influences on Wetland Conservation

The main objective of the study was to examine how agricultural practices by the community influence the conservation of the lake Ol-bollosat wetland. The study findings under this objective will be discussed under the following sub headings; Reclamation of riparian land by the community, average land sizes reclaimed by the community members, reasons for land reclamation and agricultural activities and wetland degradation.

4.2.1 Reclamation of Riparian land by the community

The table below shows the percentage of community members who had reclaimed the riparian land for various uses.

Table 3

Reclamation of Riparian Land

Have you reclaimed any riparian land in the last one year	Frequency	Percent
Yes	160	62
No	100	38
Total	260	100.0

The study found that 62% of the respondents had reclaimed land from the riparian reserve, while 38 percent had not. As shown in the table above, this indicates that the majority of the respondents had reclaimed parts of the riparian land for their use.

One of the key informants for the study, an elderly woman representing *Nyumba Kumi* stated;

“The people here have no choice but to use any available land for farming and grazing of their livestock. Because of the dwindling land sizes and the growth in population, as well as the over exploitation of the available arable land, people are ready to cultivate on any available piece of land”.

The area chief lamented:

“Despite our best efforts to sensitize the community against cultivating in the riparian reserves, or calls have gone unheeded, but mainly because people have no more farming land. As an administrator, my work is made much more difficult because of the growing population and the high levels of poverty”

Another key informant for the study who is a KWS officer stated:

“There has been a notable pattern of gradual encroachment on the riparian land over the last couple of years. This is mainly because of the unchecked population growth, failure to differentiate between government-owned land and community owned land and failure to apply the laws”

These findings agree with a study done by Yusoff, Kamari, and Aljafree (2016) in which they found that there was lack of clear understanding among the communities living adjacent to the lake as to where the boundaries of the lake were. Further, the study findings collaborate with a study by Ruiz and Vernooy (2012) who described farmers as the custodians of environmental resources that fell within their areas and therefore any successful intervention to conserve and protect the environment (and wetlands in particular) must necessarily involve them.

Moreover, the study findings are also in line with De Dreu and Gross (2019) who in their study concluded that illegal occupations of government land usually start as small harmless encroachment, and before very long slums spring up.

4.2.2 Average Land Sizes Reclaimed by Community Members

Table 4 below shows the average acreage reclaimed from the riparian reserve.

Table 4*Average Land Size Reclaimed on the Riparian Reserve*

Land size reclaimed	Frequency	Percent
Less than 2 acres	114	44
2 to 5 acres	90	35
More than 5 acres	56	21
Total	260	100.0

From the table above, majority of the respondents (40.7%) had reclaimed less than 2 acres, while 25% had reclaimed more than 5 acres. These findings indicate that majority of the community members had reclaimed an average of two and half acres; while very few had reclaimed more than five acres. The key informants for this study disclosed that riparian land reclamation posed a real and serious threat. The sub chief stated:

“Most of the people here see no issue in using the riparian land for their own use. They pay no attention to the wildlife found there, and have the misplaced notion that their farming activities are more important than the survival of the wildlife found in this area. This is quite saddening. Again, the lack of clear demarcation on the boundaries of the wetland encourages encroachment by the local community, which in turn exacerbates the human-wildlife conflict in this area”

This statement was supported by officers from the Kenya wildlife Service who quipped;

“People see no value in the wild life found in this vast wetland. They view them as an unnecessary towards carrying out their farming activities. As such, human-wildlife conflict is a routine issue which brings conflict between the residents and the KWS”.

These findings are consistent with the study done by Abong’o et al (2014) in Sri Lanka, which concluded that communities would most likely utilize riparian land in instances where regulation was weak, or the community had a cultural connection with the land in question. Further, a study done by Edwards et al (2022) concluded that communities who were disenfranchised of their lands and therefore depended on the environment for sustenance were likely to settle on any available parcel of land, regardless of whether such occupation was lawful or not. The study further surmised that the manner of occupation of such land is largely dependent on the unique socio-economic circumstances of the community in question (Edwards et al., 2022).

4.2.3 Reasons for Land Reclamation

Table 5 below shows the reasons for land reclamation.

Table 5*Reasons for Land Reclamation*

Activity	Frequency	Percent
Farming	104	37.1
Grazing	58	20.7
Settlement	94	33.6
Others	24	8.6
Total	280	100.0

Table 5 indicates that that the majority (37.1%) of the respondents had been using the riparian land for farming, mostly for cultivation of maize. These findings indicate that socio-economic activities carried out around Lake Ol-bollosat wetland inherently influence the participation of the community members in how they participate in the conservation efforts.

The area MCA when commenting on the matter of land reclamation said:

“Local community members reclaim the land for various reasons, but the key issue witnessed here is that the livestock is left loose to graze on the riparian reserve. Unchecked stocking of livestock is a serious problem. The lack of clear demarcation of the land between the settlement and the riparian land is a major issue, considering the wetland straddles 3 different wards. It’s a potential source of serious conflict”.

The Nyumba kumi representative concurred, stating:

“Local area residents will continue to use the available land for agricultural activities so long as enforcement of the laws remains weak and uncoordinated. People will always seek the easy way out. If left unchecked, this wetland will dry up eventually”.

This study finding correlates with Gyawali (2018), who noted that conservation is a complex undertaking that requires a multifaceted approach, and at the center there must be community participation since they are the major stakeholders. Further, the study also agrees with Njagi et al (2012) who found that the unregulated encroachment of the wetland by the local community posed serious threats to the community. He noted that the local community felt justified in using whatever resources in order to survive, even if such resources were protected by both local and international laws.

4.2.4 Agricultural Activities and Wetland Degradation

This section of the questionnaire sought to establish whether the respondents were aware of the effects of various agricultural practices on the wetland. The results are discussed under three subheadings; Use of pesticides and other agricultural chemicals, abstraction of water for irrigation, awareness on impacts of overgrazing on riparian zone and fishing activities on wetland.

4.2.4.1 Use of Pesticides and Other Agricultural Chemicals

The figure below represents the use of pesticides and other agricultural chemicals by the local community.

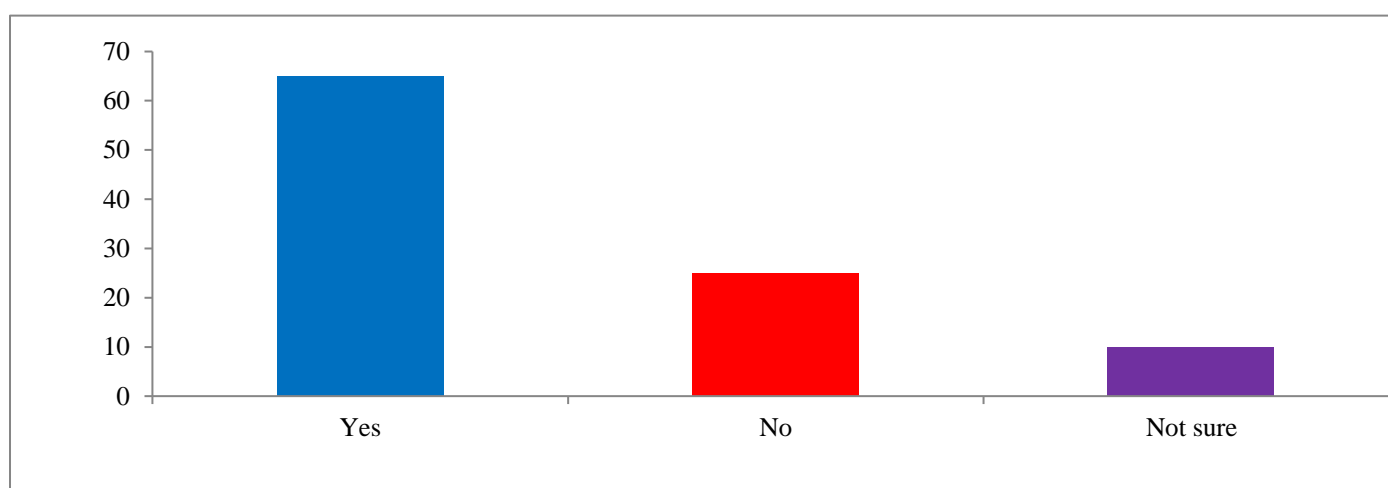


Figure 1

Awareness of Harmful Effects of Pesticides on Wetland

The Figure 1 shows that 65% of the respondents were aware that various agricultural practices did have deleterious effects on the immediate environment and the wetland, while 25% indicated that they were not aware of any negative effects. 10 % of the respondents were not sure whether agricultural pesticides and chemicals had any effect on the environment. These findings indicate that majority of the respondents are apprised of the effects of pesticides on the environment and the wetland, while only a few of the respondents were not sure.

The officers from KWS who were key informants for this study stated;

“The continued use of agricultural chemicals and pesticides has a serious impact on the wetland, especially due to surface run off from the adjacent farms. The water with chemical residues eventually ends up in the wetland, endangering different species of aquatic life. Eventually, the whole wetland will be poisoned especially because of the extensive use of these chemicals by the nearby commercial flower farms. It is a really serious situation.”

The chief reported:

“Over the last few years, there has been reported cases of fish dying in large numbers from the open waters of the wetland. It has been suspected that there is contamination of the wetland by the nearby farms, due to the various pesticides and other chemicals used in farming”

These findings agree with Maitah, Zidan, Hodrob, and Malec, (2015) who studied the perception of farmers towards the harmful effects of pesticides in Jordan and identified that in general, farmers had a higher than average awareness of the harmful effects of the use of pesticides in their farms. In their study, they identified the key role by agricultural extension officers in sensitizing farmers about sustainable agricultural practices. Further, these findings agree with the findings of a study done by Stadlinger et al (2012) which concluded that farmers were generally aware that pesticides and other chemicals had harmful effects on the immediate environment, even though they couldn't quantify the extent of the effects. This study concluded that farmers needed adequate training on the effects of pesticides and their safe usage.

This finding however contradicts with one of the basic tenets of the Deep Ecology theory, which holds that human beings have no right to reduce the richness and diversity of nature whatsoever, unless as a last resort to satisfy some very basic human needs.

4.2.4.2 Abstraction of Water for Irrigation

The study sought to find out from the respondents whether they understood the deleterious effects of unregulated water abstraction from the wetland. The results are as shown below.

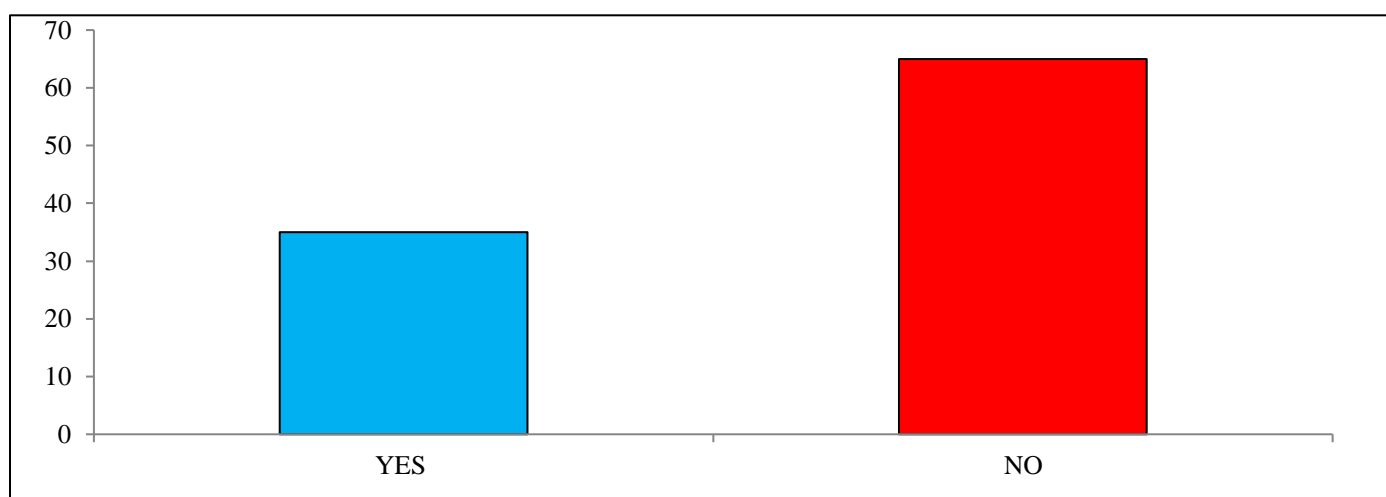


Figure 2

Abstraction of Water for Irrigation

The Figure 2 indicates that that majority of the respondents (65%) were unaware that the unregulated water abstraction had any harmful effects on the health of the wetland, while only 35% of the respondents understood the effects.

This finding indicates that majority of the respondents believed that the abstraction of water from the wetland for irrigation did not have any negative impacts on the wellbeing of the wetland.

This finding however disagrees with the view of the area chief who lamented:

“My people in this area do not understand that the use of water from both the rivers draining into the wetland, and the wetland itself does have some negative consequences. There is the mistaken belief that the open waters in the wetland cannot be depleted by human activities, especially the use of the water for irrigation. Unregulated use of the water will have long term environmental effects”.

Further, the elderly man representing Nyumba kumi stated:

“People in this region do not realize how wasteful our irrigation methods are. The more people irrigate, the more harm they cause to the wetland. Sadly, they cannot see it because they are led by the short term desire to produce food for their families and for selling”.

The study finding agree with Nabahungu (2012), who identified that most rural farmers were unaware that continued water abstraction from the wetlands did have both short terms and long term effects on the quality and health of the wetlands. This study finding is also confirmed by Taiwo (2013) who concluded that small scale farmers would continue to use the shared water resources unconcerned about its long term sustainability so long as the short term demands of food production was satisfied. The study also found out that in most regions, shared resources suffered from the ‘tragedy of the commons’, a situation in which every individual resource user tries as much as possible to get the maximum benefit out of the shared common resource.

4.2.4.3 Awareness on Impacts of Overgrazing on Riparian Zone

The study sought to find out from the respondents whether they were aware of the impacts of overgrazing on the riparian land. The results are as shown below.

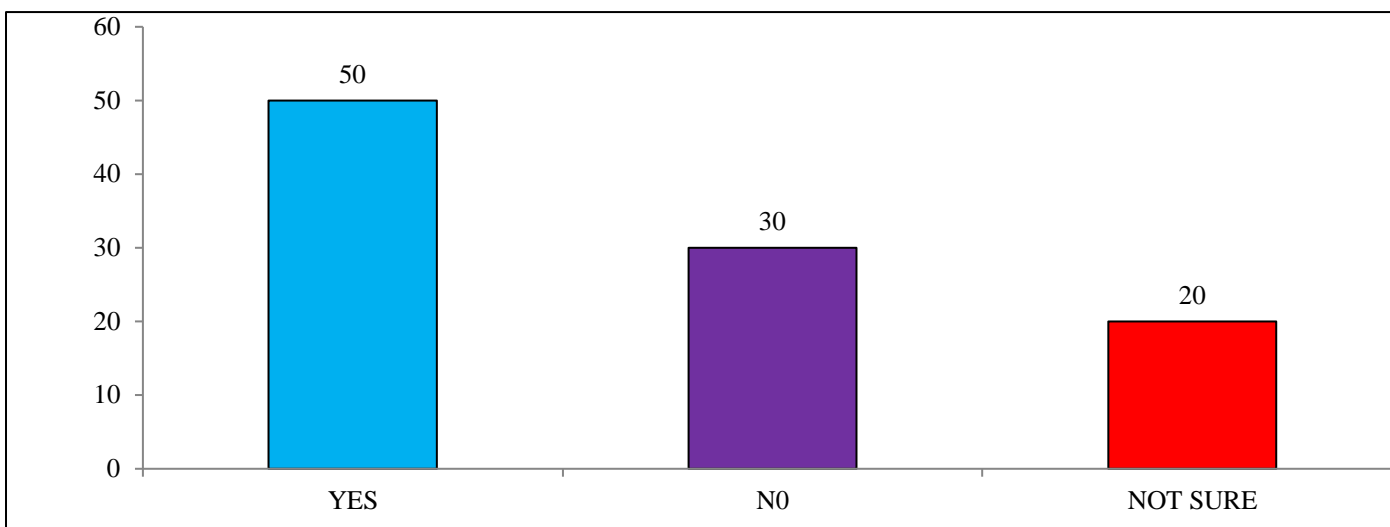


Figure 3

Awareness on Impacts of Overgrazing on Riparian Land

Figure 3 above shows 60% of the respondents were aware of the impacts of overgrazing on riparian land, while 30% reported that they were not aware and 10% reported that they were not sure. This finding indicates that majority of the study respondents knew that overgrazing had negative impacts on the riparian zone, while only a few indicated that they were not sure whether it had any impacts.

The area sub chief who was a key informant for this study reported;

“People here know that overgrazing near the lake has serious impacts, and yet they cannot be convinced to stop. This is because they have cultivated all the arable areas within their farms and therefore they have nowhere else to graze. The only freely accessible place is the wetland”

The Nyumba kumi representative revealed;

“During the dry seasons in the past, we have had an influx of Maasai cattle herders with their animals swarming this place due to water and grass. This leaves the local people dissatisfied since the herders have hundreds of animals and deplete the grass within no time. This situation if not well handled can flare up tensions and lead to clashes between the immigrant herders and the local communities”.

The KWS official lamented;

“People are aware of the imperious effects of overgrazing on the riparian land, and yet they cannot be convinced to stop. Perhaps we need to carry out more sensitizations so that the local communities can understand these things”

This finding agrees with the results of a study done by Mwangi et al (2016) who found that despite the high environmental perception among the local communities, overgrazing was still a serious problem. The study attributed this unfortunate trend to dwindling grazing land, over population and high levels of poverty.

Further, the findings also with a study done by Nyamu, Maitai, Mecca, and Mwangangi (2012) which concluded that local communities knew the impacts of certain farming practices such as overgrazing, use of chemicals for weed and pest control, importance of organic farming among others, and yet they continued with these practices because in most cases they had little or no alternatives. The study cited poverty as the biggest driving force towards lack of sustainable agricultural practices among the rural communities practicing subsistence farming.

4.2.4.4 Fishing Activities on the Wetland

The study sought to find out from the respondents whether they were engaged in fish farming. The results are as shown below.

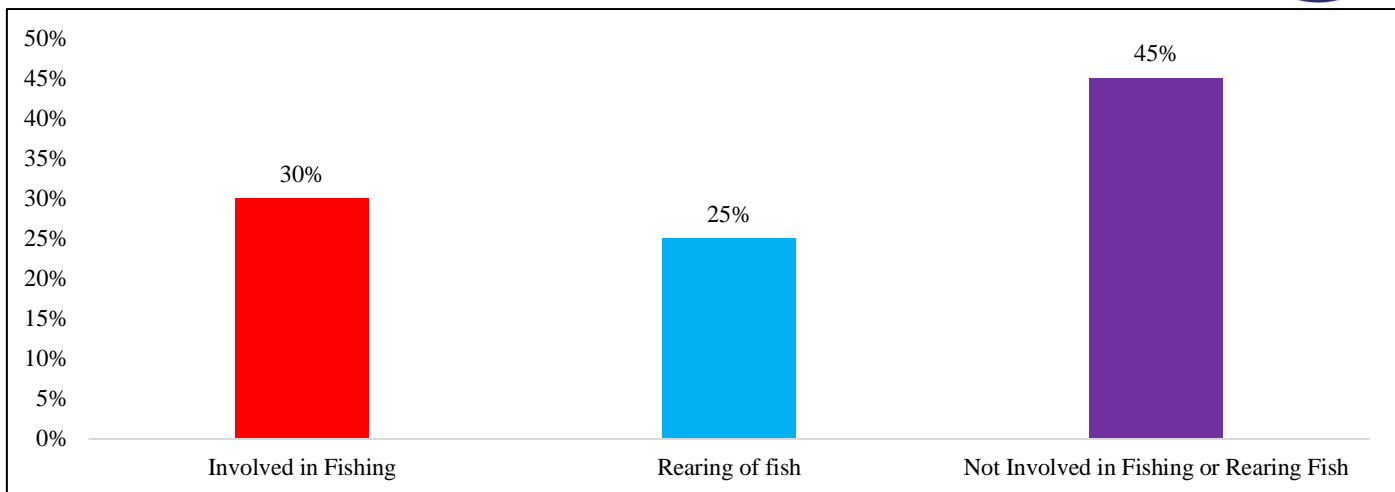


Figure 4
Fishing activities on the Wetland

Figure 4 above shows that the majority of the respondents (45%) are not into fish farming or rearing of fish in fish ponds. Only a small proportion of the respondents (30%) are involved in fishing while 25% are into rearing of fish in their farms.

This finding indicates that the local community does not attach great importance into fishing either as a source of food or as a source of income. This is because the area is primarily inhabited by the kikuyus who practice farming rather than fishing.

One of the key informants for the study, the area MCA stated;

“Most people here are not very keen on fishing as a source of livelihood. As a matter of fact, people would rather go to till their small pieces of land rather than go to the open waters of the lake to fish. This could be due to lack of capacity or the skills needed for fishing”.

An officer from the KWS who was a key informant for the study retorted;

“Unlike other regions where I have worked, people here are not receptive to fish farming as a serious enterprise. Perhaps there is a cultural angle to the whole issue regarding rearing and consumption of fish”

These findings agrees with a report by GOK (2019) on the integrated management plan of the Lake Ol-bollosat wetland, which established that aquatic weeds had infested part of the wetland and this greatly hampered the exploitation of the fisheries potential in the area. The report further maintained that the alkaline nature of the open waters made it impossible for fish to survive and breed and this made the worse. Further, the findings also agree with the findings of a study done by Njagi (2012) who reported that the consumption of fish in this region was low. The study attributed that to cultural reasons, lack of sensitization on the benefits of fish consumption, poor fishing methods among others.

V. CONCLUSION AND RECOMMENDATIONS

5.3 Conclusion

The study concludes that unsustainable agricultural practices have a negative impact on the quality of the Ol-bollosat wetland. Further, the communal grazing land especially the riparian zones were used without due consideration on the sustainability of the grazing land itself and by extension the wetland. The community members lacked proper training on the best agricultural practices, especially sustainable irrigation practices. This has led to unsustainable abstraction of water for irrigation, which when carried out at large scale becomes deleterious to the well-being of aquatic animals such as fish which depend on the same water for their own survival.

5.4 Recommendations

Based on the findings of the research study, the researcher recommends that agricultural activities particularly grazing and irrigation be improved by adopting modern technologies and practices. This in turn will help to relieve the pressure exerted on the wetland resources by the local communities especially through unsustainable grazing practices and irrigation methods and practices. The national government and the County Government must be deliberate and proactive in designing concerted efforts to address the challenges facing the communities living within the vicinity of the Ol-bollosat wetland. These challenges range from land tenure, environmental education, food insecurity, high

population growth, human-wildlife conflict among others. The import of all this multifaceted challenges is that the local communities have to engage in whichever means necessary to address them. Unfortunately, some of the methods adopted such as irrigation using water abstracted from the wetland are outright illegal and unsustainable. It is also the recommendation of this study that there is a need a for further research to determine how the community living around the Ol-bollosat wetland can be engaged in order to participate more on conservation.

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