

RESEARCH ARTICLE

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Human Wildlife Conflicts and Livelihood Diversification among Kamnarok National Reserve Adjacent Communities in Baringo County, Kenya

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Abstract

Increasing human populations and economic challenges are intensifying reliance by local communities on Wildlife Protected areas (WPAs) in marginal rangelands. Human wildlife conflicts in areas adjacent to Kamnarok National Reserve (NR) is an outcome of excessive resource extraction by adjacent household activities, declining food resources for wildlife and weak conservation governance by those in charge. The Kamnarok NR resources have supported livelihoods for adjacent communities as well as adversely affecting their lives and livelihoods through crop damages, livestock predation, property destruction and human injuries & even deaths. The adjacent communities have diversified livelihood portfolios for varied reasons including; risks aversion associated with wildlife conflicts, increased income, food security and for meeting household needs. Livelihood diversification is a positive undertaking and therefore Kamnarok NR adjacent households should be allowed and encouraged to diversify livelihoods as it enables them to co-exist harmoniously with wildlife and enhance their income portfolios

Key Words: Diversification, Households, Human Wildlife Conflicts, Livelihoods, Income Portfolios, Risks

INTRODUCTION

Most of the Worlds' poor populations rely heavily on non-cultivated natural resources for their income and household use (Roe and Elliot, 2006). In Africa, approximately two-third of 600 million people depend on natural resources for cash or for subsistence income (Timko *et al.*, 2010). Given such widespread reliance on natural resources, there is much pressure to regulate and conserve more natural areas including land used by small scale farmers and pastoralists (Kikoti, 2009). This pressure is linked to a growing recognition of the importance of protected areas (PAs) in conserving biodiversity richness, promoting ecosystem services and mitigation against climate change as well as reducing the rate of global deforestation, preventing species extinction and conserving land and water resources (Brookes *et al.*, 2009).

In the contemporary times, the number of wildlife protected areas has grown from less than 1,000 in 1940s' (Veit and Benson 2004) to over 161,000 in 2010 (Kiringe and Okello, 2011), representing 13% of the world's land surface area (UN MDG, 2010). At most all the stricter categories of Wildlife protected areas which are classified to fall under category I & II under International Union for the Conservation of Nature (IUCN) are found in the third world (Naughton – Treves *et al.*, 2005). Governments, conservation organizations and private entities have established PAs and conservancies aimed at promoting national development and public interests and adapting conventional exclusionary approaches, however, there is minimal or no consideration of the implication for the local people whose livelihoods are dependent on the resources contained in these areas (Scherl *et al.*, 2004). While there is much reliance on natural

resources by poor households living adjacent to Kenya's wildlife protected areas (WPAs), equally their lands are increasingly being converted into WPAs (CBD, 2012). WPAs have been the major focus of global conservation targets since the first IUCN World park congress in 1962. There has been a growing recognition of the importance of WPAs in terms of biodiversity richness and as a model of biodiversity conservation. However, critics of the Fortress conservation approach argue that the creation of WPAs restricts community development opportunities and increase poverty (West *et al.*, 2006). Such criticism results from the evidence that WPAs are associated with little or no compensation for the community forgone lands, changes in the land tenures and denial or restriction on access to natural resources which the community has been using and depending upon for a long time (Gillingham and Lee 2003). Furthermore, hardships suffered by local communities include human wildlife conflicts such as crop losses, property damages, livestock predation, human fears, injury and deaths, sleepless nights while guarding crops from wildlife and conflicts that arise from WPAs law enforcement activities (Brockington and Igoe, 2006, Mackenzie and Ahabyona 2012). In some cases WPAs deprive local communities of the opportunities necessary for their survival and development including basic social services (Cernea and Schmidt – Soltau, 2003). Moreover, the displacement of the local people from WPAs results in impoverishment (Nabakov and Lawrence, 2004) as they become dispossessed of their resources. As a result they are exposed to higher risks of landlessness, homelessness, joblessness, food insecurity, economic marginalization, increased mortality and morbidity rates and loss of environmental services and access to common property (Adams and Hutton, 2007). More often than not WPAs are established with little regard or consideration of their impacts on the livelihoods of the local communities. It has become clear that it is essential to understand how establishment and management of WPAs

affect local communities. Failure to do so may lead to increased rate of community non-compliance with WPA regulations and hostility both of which have led to the failure of many biodiversity objectives (Andrade and Rhodes, 2012).

A majority of Kenya's population (80%) live in rural areas where they rely heavily on natural resources for their livelihoods (Kiringe and Okello, 2011). For instance, over 90% of the rural inhabitants rely on wood and other plant resources for energy (Okello and Kioko, 2010). Nonetheless, about 40% of the Kenya's land is under conservation measures (Okello and Kioko, 2010) coupled with control and access restriction. Although many of the wildlife protected areas in Kenya generated economic benefits, much of these benefits are enjoyed by national and international elites, while most of the conservation costs are borne almost entirely by the local people, particularly the poor, vulnerable and marginalized groups (Adams and Hutton, 2007; West *et al.*, 2006). Previous studies have found that local people have been disempowered when the control of natural resources are taken over by government or private investors (Borrini – Feyerabend, *et al.*, 2004). In most cases local people are left without alternatives, which in the long run, results in squatting, encroachment and poaching of natural resources to keep them a live (Colchester, 2000). It is well known that most people in rural Kenya depend on natural resources such as fodder, firewood and bush meat for their livelihoods including the sale of such products (Roe and Elliot, 2006; Timko *et al.*, 2010). Furthermore, restricting access to the resources such as firewood is reported to be problematic (Coad *et al.*, 2008; Velded *et al.*, 2007) as wood provides about 70% of the energy consumed in rural Kenya (Coad *et al.*, 2008). Within poor communities, the dependence on natural resources increase with poverty levels (Babulo *et al.*, 2008). For example in Kamnarok NR adjacent households consume wild plants and animals more than half of the time (Kiringe *et al.*, 2012).

Literature Review

While many studies have focused on the livelihood impacts of the protected areas on local communities (Cernea *et al.*, 2006, West *et al.*, 2006), some have failed to understand that communities living adjacent to wildlife protected areas (WPAs) have adopted different strategies including livelihood diversification to reduce risks of property damages, crop losses, livestock depredation and losses brought about by wildlife and wildlife vector borne diseases.

Against the backdrop of increased human wildlife conflicts in Kamnarok National reserve adjacent areas, many households have to find more sustainable ways of surviving. Undoubtedly, one of the sustainable strategy option is diversification of livelihood portfolios. Livelihood diversification has long been used and promoted as a strategy for increasing incomes and managing risks among the poor and vulnerable groups (Bezu *et al.* 2010). According to Haggblade *et al.* (2010), diversification can be defined as the process by which rural families construct a diverse portfolio of activities and social support capabilities in order to survive and to improve their standards of living, minimize household income vulnerability, reduce the adverse impacts of risks and provide additional income. Diversification can have positive or negative consequences for rural households (Hart, 1994). For example certain types of diversification strategies may provide short term security but trap households in low return activities that make poverty persistent.

There is an extensive literature that deals with motivational factors influencing livelihood diversification in rural parts of Kenya (Lemi, 2010). According to available literature rural non-farm operational activities are gaining importance in Kenya's wildlife range lands even if pastoralism and mixed farming remain the main source of livelihoods, income and employment. With regard to households, specifically living adjacent to Kamnarok NR, they have been found to diversify livelihood sources due to variety of factors including agro-climatic, wildlife related, pull and push

and household physical asset possessions. According to Wishtemi *et al.*, (2011), although Kamnarok NR adjacent households have low capacity to manage and mitigate human wildlife conflicts, they have however, survived and coped in various ways over time. But due to increased poverty, conflicts and enhanced wildlife conservation by the reserve management authority, most of the households in the recent past have been unable to meet their basic livelihood needs because of the reserve management and damages brought by the wildlife. Non-compensation for the damaged and destroyed property coupled with unfulfilled promise of land compensation forgone for the establishment of the protected area are some of the problems Kamnarok NR adjacent households have been pestering on for so many years. Most Kamnarok NR adjacent households have been suffering from perennial poverty induced from human wildlife conflicts and therefore, maintenance of a diversified resource base is a prerequisite for improving their standards of living as diversified livelihood systems allow the affected households to draw on various sources of food and incomes. In doing so, they can diffuse the risks of vulnerability brought by human wildlife conflicts (Lemi, 2010).

Several studies on rural livelihoods in Kenya that assert that livelihoods diversifications away from dependence on farm/crop production appears to be gaining preference in the mist of falling agricultural commodity price and the liberalization of agricultural markets across East Africa (Barret and Reardon 2013, Liyama, 2006).

However, empirical information on the motivational factors influencing livelihood diversification with particular interest on households living adjacent to Wildlife Protected Areas (WPAs) is limited, especially of Kamnarok NR and its adjacent environs. In view of the foregoing, this study was carried out to; i) Determine the human wildlife conflicts status among the reserve adjacent dwellers and mitigation mechanisms applied,

ii) Determine factors influencing households livelihood diversification and its effects on wildlife conservation.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Barwesa Division of Baringo County, Kenya. In Kerio Valley, Kamnarok National Reserve is situated in an areas covering 15000 km² of mostly arid and semi-arid rangelands straddling between Keiyo/Baringo borders. Kamnaok NR is a wildlife protected area established in 1983 vide a legal notice V2091/83 and lies between 20° 4N and 00° 46N and 35° 3 and 36° 2 East (Figure 1). An overall rainfall gradient in the valley floor is 500 mm p.a with the influence of Kerio river, rugged hills and escarpments on both ends of the valley The Kamnarok NR extends into three locations which comprise of Lawan, Kabutie and Kerio Kaboske.

The Wildlife Protected Area (WPA) occupies an area of 87.7km² forming a narrow and long strip of land of approximately 80 km along the Kerio river in the great Rift Valley (Njogu, 2003). The protected area was under the defunct Baringo county council and currently under county government of Baringo. The main reason for the establishment of the PA was its strategic position to hold and conserve the endangered species of savannah elephants, Black Rhino and Rothschild giraffe (Njogu, 2003) and as part of migratory corridor for migratory wildlife between Mau forests in the south and Rimoi, Nasalot and lake Turkana South National Reserves in the north (Wesonga et al., 2011). The study area lies in semi-arid and savannah ecosystem and support a wide variety of large herbivore species including giraffe (*giraffa camelopardalis*), elephant (*Laxodonta africana*), buffalo (*Syncerus caffer*), plain Zebra (*equus quagga*) and water buck (*Kobus ellipsiprymnus*) among others. The WPA also host a variety of carnivores and primates including spotted hyena (*Crocuta crocuta*), leopard (*Panthera pardus*), Wild dog (*Lycaon pictus*) and blue monkey (*Cercopithecus mitis*) colobus monkey (*Colobus guereza*) Olive Baboon

(*Papio anubis*). Local communities living adjacent to the reserve practice a combination of subsistence farming, cash crop farming, mixed farming and livestock production (Walpole et al., 2009, Ogutu et al., 2011). The main crops include maize (*Zea mays*) grown for both subsistence utilization and commercial sale and drought resistant crops such as cassava (*Manihot esculenta*), sorghum (*Sorghum bicolor*), finger millet (*Eleusine coracana*), cow peas (*Vigna unguiculata*) and variety of vegetables including tomatoes (*Solanum lycopersicum*) kale (*Brassica oleracea var. acephala*) and Cabbage (*Brassica oleracea var. capitata*). Livestock kept includes sheep (*Ovis ories*), cattle (*Bos taurus*), goats (*Capra hircus*), Camel (*Camelus dromedarius*), donkeys (*Equus asinus*) and poultry. The study area has an estimated population of about 7427 in 2010 (KNBS, 2010). It is estimated that the population will increase to 9804 by the year 2020 based on the Kenya National Bureau of Statistics (KNBS) annual growth rate of 2.4%.

Kamnarok NR Management Systems

The reserve management is led by a steering committee, a type of multi stakeholder forum which was initiated by county government of Baringo under the department of wildlife and tourism resources which has failed to take off. In August 2016, the Kenya Wildlife services listed Lake Kamnarok and the entire protected area as a wetland of national importance, citing its rich biological diversity including the Nile crocodile, the local livelihood dependence and possible anthropogenic threats. Since then, the WPA is under the management of county government of Baringo with the support of KWS. The local people have been using the reserve resources since the ancient times to sustain their livelihoods. Ever since the establishment of the WPA, and the larger Kerio Valley Conservation Areas (KVCAs), conservation and sustainable use of the WPA has been priority actions for the county government of Baringo, KWS and other conservation organizations.

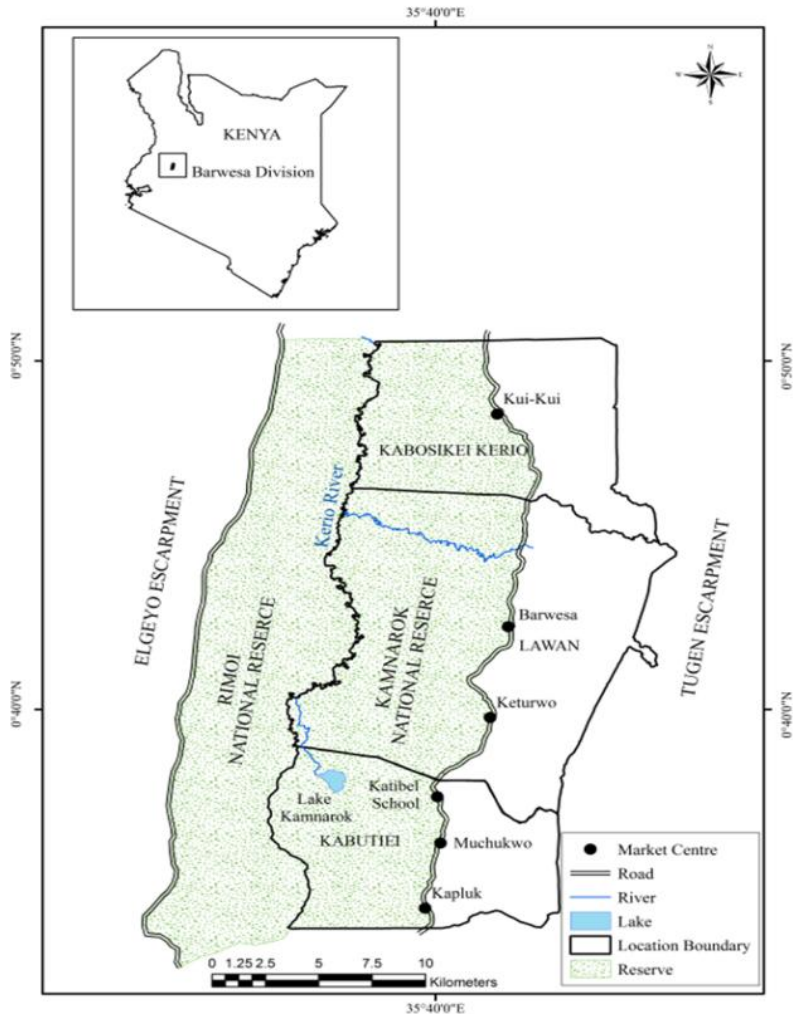


Figure 1. Map of Kamnarok National Reserve in Kenya 2018

Kamnarok NR Adjacent Household Livelihood Profile

In the Baringo County Integrated Development Plan (CIDP), Kamnarok NR adjacent households can be described as an economy of pastoralism/animal husbandry combined with subsistence climate dependent food cropping with wildlife from Kamanrok NR as the main constraint to successful livelihood outcomes. The study area has potentials for successful irrigation farming and successful cotton growing with a cotton processing ginnery near Salawa center in Baringo central

AER Journal Volume 3, Issue 1, pp. 51-64, 2018

Research Design

The study adopted a survey research design. The unit of analysis was household. Both qualitative and quantitative research methods were employed. Structured questionnaires were administered to the households. This concerned the human wildlife conflicts (HWC) and resources information on their household resource extraction status and types of HWC encounters and experiences extraction, were households heads gave.

Sampling Frame and Sample Size

A two stage sampling technique was used in the study. The first stage involved a purposive sampling of three locations out of the five locations in Barwesa division. The selected locations were Lawan, Kabutie and Kerio Kaboske since Kamnarok NR extends to the three selected locations table 1. The second stage involved purposive sampling of 114, 136, and 110 diversifying households from Lawan, Kabutie and Kerio Kaboske locations respectively giving a sample size of 360 diversified households as illustrated by Fisher

et al. (1983) formula. The use of purposive sampling techniques is justified on the basis that the study is concerned with only diversifying households and since there was no reliable data on the sample frame of diversifying households in the study area, purposive sampling technique was employed in the selection of diversifying households. Also in-depth interviews with 3 focus group discussants (FGD) with an average of 12 participants were held to gather data on HWC, changes in livelihoods and the natural resources.

Table 1. Sample Frame Distribution

Location	Male		Female		Total	%
	Male	%	Female	%		
Lawan	86	23.9	28	7.8	114	31.7
Kabutie	94	26.1	42	11.7	136	37.4
Kerio Kaboske	96	26.7	14	3.9	110	30.6
Total	276	76.7	84	23.3	360	100.0

Methods of Data Collection

Primary data was used for this study. The data was collected from the respondents with the aid of a well-structured questionnaire. The data included the socio-economic characteristics of households such as; age of the respondents, occupation, education & marital status, household size, land size & ownership status, farming experiences, experiences with human wildlife conflicts & mitigation measures applied, perceptions on wildlife Protected area and reasons for livelihood diversification. Key informant interviews involved the participation of eight community members involved in non-farm livelihoods. Two local NGOs heads representatives each from World Vision and Faulu Kenya, also two government officials (agricultural extension officers) from the department of agriculture working in the study area.

Data Analytical Technique

Analysis of data collected from the field was done by cross tabulation, chi-square and regression

RESULTS AND DISCUSSIONS

Household Characteristics and Livelihood Strategies

The study was dominated by household respondents aged 40-49 years (20%) with an average age of 43 years. The average household income ranged from Ksh. 5,000 to Ksh. 20,000 with a mean of Ksh. 8945 ± 748.44. Although education is overall low in Kamnarok NR adjacent areas, only 30% of the inhabitants have no formal education and 33.9% had any member having secondary education and differed significantly ($X^2 = 7.026$, $df=3$, $P<0.05$).

With regard to livelihood strategies, the most common form of occupations were pastoralism and mixed farming as was reported by a majority of the households (72.8%). In addition to herding livestock and cultivating their own farms, many households that have small parcels of land and surplus labour work as farm hands and casual laborers locally(26.4%). Casual and wage labour was the third most common activity practiced by 48% of the households. However, farming is a highly seasonal activity in the study area because of short bimodal rainfall occurring between March –

April and between September–November. The season therefore offers a window of opportunity for households to attempt off-farm income sources in extra local settings. Many young educated and skilled members of households migrate to nearby urban centres in search of wage labour. Some return before the beginning of the next farming season with some little money and consumable goods. About 18% of the households had involved in wage migration. Business was also another important off-farm activity among the Kamnarok adjacent households. Our survey data indicate that 12% of the households were involved in some form of business. Households which were unable to get involved in businesses could also obtain some livelihood income from the collection of Non Timber Forest Products (NTFPs) from Kamnarok NR which they could sale to other local households and traders. NTFPs

collection was reported by 78% of the survey households. Handicraft and tool making was also another source of livelihood for some households. Handicrafts sold to tourist visiting Kamnarok NR and most of the simple agricultural implements used among the adjacent households were all locally made. Also in the recent years, Kamnarok NR adjacent areas has attracted a significant number of Non-Governmental Organization (NGOs) that have created a local niche for salaried/contractual jobs adopted currently at 11% by the reserve adjacent households, particularly but not exclusively in the NGO sector.

Wildlife Protected Area Resource Extraction and Degradation

The WPA resources extracted by the Kamnarok adjacent households at present are fuel wood, fodder, charcoal, clay soil & sand, fish, water among other resources figure 2.

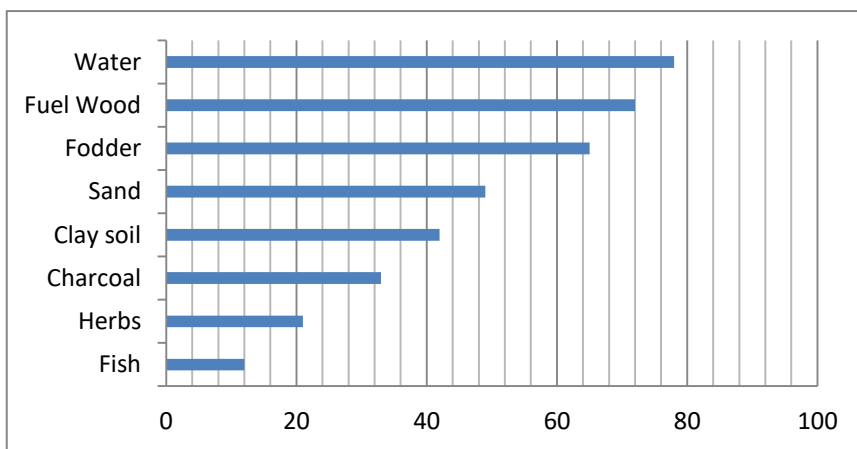


Figure 2. Percentage of Households Extracting Various Resources of Kamanrok NR

Water and fuel wood was found to be the most extracted natural resources from the WPA by the adjacent households. Approximately 78% of the adjacent households obtain their water for all purposes from Lake Kamnarok and Kerio river which passes across the WPA. 72% of the households also collect their fuel wood from the WPA as a source of cooking energy and for sale to generate livelihood incomes. In addition, nearly 68% of the households graze

their livestock in the WPA land. Clay soil (42.2%) for brick making was also a valuable resource obtained from the reserve and sand mining was another important resource for the local households. Other WPA resources that were collected but in small quantities included herbs for self-treatment (21.1%), fish (12%), and charcoal (33%). The study found that all households spread in the three locations depended on the resources of Kamnarok NR especially on water, fuel wood

and fodder and this findings is corroborated by the findings of Gillingham and Lee (2003).

During the Focus Group Discussion (FGD), a majority of the participants (69.4%) raised concerns about resource extraction exposing wildlife to bare habitats. Habitat destruction as a result of cutting trees and shrubs reduces wildlife habitats, thus exposing the adjacent households to frequent human wildlife conflicts (HWCs). This information was verified by an analysis of resources sustainability trends. The increasing household populations, pressure with increasing human settlement around the WPA and the expansion of agriculture were major factors for resource conflicts and human wildlife within the study area.

Kamnarok NR Resources and the Adjacent Household Economy

Our survey indicated that nearly 45% of the households have diversified livelihoods, though slightly more than 65% of the households still adopt pastoralism and mixed farming as main stay livelihoods, other forms of livelihoods existed. Households have diversified livelihoods to include small businesses, school teaching, casual labour, house helps and other form of jobs. A third of household sampled were food insufficient attributing this problem to the wildlife from Kamnarok NR. This means that 33% of the adjacent households depend on reserve resources for their own consumption or for sale of such resources to obtain money for food. Kiringe *et al.*, (2002) in their study

found that more than 80% of households' populations living adjacent to Amboseli national park in Kenya depended on the park resources for maintain households food security and livelihoods. Wishtemi *et al.*, (2011) found that over 74% of the local Samburu community residing adjacent to Samburu national reserve in Northern Kenya depended on its resources to supplement their income and food. Overall, the study found that over 30% of households extract Kamnarok NR resources for variety of purposes. The economic quantification of Kamanrok resources extracted by households were valued to have an economic value of KES. 17,345 (USD 174) to 24,745 (USD 248) per annum per household (table 2). The total mean gross annual income for each resource extracting household sampled was KES. 14,952 with a standard deviation of \pm KES. 4,015. The economic value of resource income that a household derive from the national reserve was 16% of the total gross household income. Studies of economic contribution of Wildlife Protected Areas (WPAs) resources extraction are more available in Kenya and the figures from this study can be compared with the findings of households resources extraction done in other wildlife protected areas (WPAs) in Kenya to enable generalization. Seno and Shaw, (2009) reported an average contribution of 11.4% of the total household income for the local Masai community extracting Masai Mara reserve resources.

Table 2. Monetary Value of Kamnarok NR Resources Extracted by the Adjacent Households

WPA Resource	Av. QTY of resources extracted (hh/Yr)	Unit Value (Ksh.)	Mean	Std. Deviation
Fuel Wood	73.5	100	7350.2	3075.57
Water	10800	0.5	5400	1500
Fodder	17.5	225	3937.5	1748.26
Clay Soil	3	8	24.3	11.39
Sand	4.6	200	920	520.77
Charcoal	1.2	400	480	422.26
Herbal Medicine	0.3	20	6.4	10.47
Fish	0.02	45	766.74	329.36
Total			18885.14	

Total No. of sampled households = 360

Statistical analysis showed that the wildlife protected area resources (fuel wood, water, fodder, charcoal and clay soil) contributed significantly ($X^2 = 12.807$, $df = 5$, $P < .005$) to the adjacent household livelihood economy. The mean income of households from the WPA resources was significantly higher than zero. This shows the economic contribution of Kamnarok NR resources to the local users.

Human Wildlife Conflicts

The study established that there were four forms of adverse human wildlife interactions within Kamanrok NR adjacent areas. Crop damages, property destruction, livestock predation and human injury and deaths were the common forms of HWC experienced (figure 3).

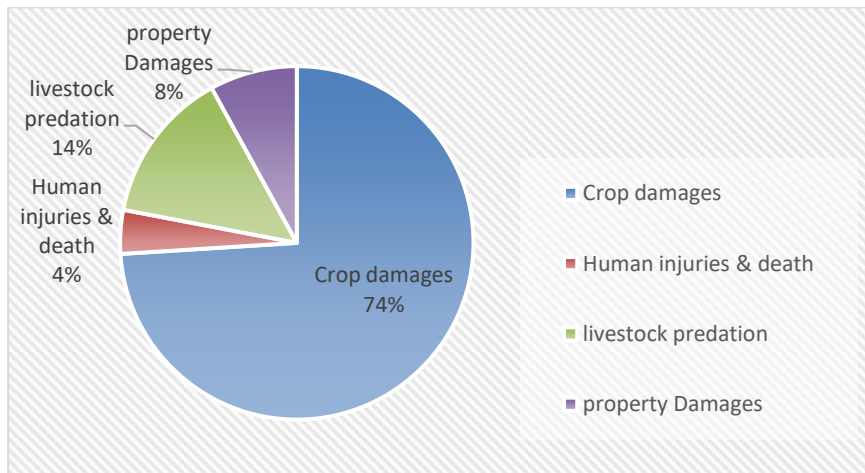


Figure 3. Patterns of HWCs in Kamnarok Adjacent Environs

From the study findings, it can be deduced that 74% of the reported cases of HWCs experienced around Kamnarok NR is associated with crop damage. The number of crop farm destruction incidents increased with time as indicated in the trend line incident of between the years 2013 to 2017 figure 3. The average number of incidents of crop damage especially by elephants per year was 119 and this translated to an average of 10 incidents per month. Crop damages were more frequent between the months of May to September than other months as this were crop growing period. A chi-square was conducted between the months of the year and type of HWC. The result ($X^2 = 29.743$, $df = 5$, $P = 0.000$) showed that the months of the year seasons during which HWC occurred were significantly ($P = 0.000$) associated with types of HWC experienced in Kamnarok NR adjacent areas. It was also observed that the main crops damaged included maize, millet, sorghum, fruit trees and vegetables. This findings

concur with the findings of Pittiglo, (2008) were in his findings, maize, millet and fruit trees were mostly damaged by wildlife in Monduli and Simanjiro districts of Tanzania between 2006 and 2008. The research further showed that crops were destroyed in total of 378.84 acres of land with an average farm or small holding size of $3.48 \text{ acres} \pm 0.93 \text{ acres}$. The least land size damaged was 0.32 acres and the most was 18.5 acres. The majority (68%) of the case of crop damage occurred on land smaller than the average size of land owned by household around Kamnarok NR. Only (32%) occurred on land more than 20.0 acres in size. The findings of this study corroborate the findings of Wildaji and Thcamba (2003) who examined conflicts between people and wildlife within Bernoue wildlife conservation area. They established that the human wildlife conflicts resulted mainly in crop damages (76%) and elephant was associated with 97% of the damages. A similar study conducted around Kerinci

Sablak National Park- Sumatra in Indonesia by Linkie et al., (2006) found that crop damage was common around Wildlife Protected Areas

(WPAs) boundaries and it was poor households who bore individual costs of crop damages.

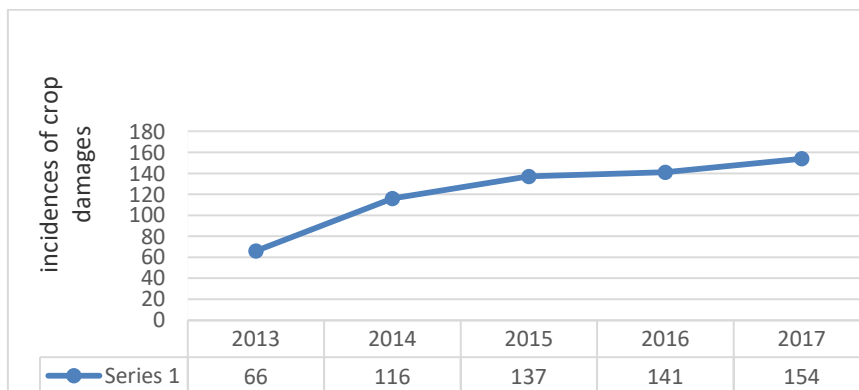


Figure 4. Trendline of Crop Damage over a period of 5 years (2013 to 2017)

Human Injuries and Deaths

Incidences of injuries and deaths due to crocodiles and elephants were reported by Kamnarok NR respondents. Human injuries occurred to both genders in and around Kamnarok NR and along Kerio River with an average of 6 persons injured every year. The study found out that 19 men were killed, while 3 female and 16 male were injured by wild animals.

Livestock Predation

Livestock – carnivore conflicts is now a very common conflict in Kamnarok NR adjacent areas. Carnivores like leopard, brown hyenas, wild dogs and crocodiles were responsible for most of the livestock predation in the study area. 64.4% of the households attributed loss of their livestock to carnivores while (28.6%) attributed to vector borne causing diseases such as Foot & mouth and East Coast Fever (ECF) from wildlife. The households listed about 58 cows, 107 shoats to have been preyed by leopard, wild dogs, hyenas and crocodiles in the last two years. The major livestock predators cited by respondents were hyenas (48%), crocodile (41%), leopard (32%) and wild dog at (18%). During this research survey, 13 shoats were mullied by crocodiles of both lake Kamnarok and Kerio River and 6 cows were killed by hyenas. The local community killed two hyenas in revenge

for the loss of the shoats. This findings is supported by the findings of Kiringe and Okello, (2011) were local communities living in Kimana wildlife ranch near Amboseli National Park resorted to retaliatory measures to mitigate human wildlife conflict. The common reasons cited by the adjacent households for such conflicts were unavailability of food (46%) by wildlife and non-compensation (51%) on the loss of their livestock by the wildlife management authority.

Property Damage

The wildlife of Kamnarok NR has imposed a significant economic cost to the adjacent communities. The study revealed that the most destroyed properties were water pipes, water tanks, fences, houses and food granaries. Elephants were responsible for 62.4% of the damaged fences, 36.2% of the water tanks, 13.8% of the vandalized water pipes and 4% of the houses, while Baboons were responsible for 28.6% of the damaged food granaries. 56.8% of the households reported to have experienced property damage as a result of the actions of wildlife especially the elephants. The results of the Focus Group Discussion (FGD) indicated that 27% of the households have had their food granaries vandalized, 48% have had their fences destroyed and 24% had their houses

destroyed. The cited wild animal causing vandalism and destruction were elephants and baboons. Jones and Barnes, (2006) reported similar findings from Namibia.

Reasons for Livelihood Diversification

Part of the objective of the study was to identify reasons for why Kamnarok NR adjacent households engagement in livelihood diversification activities beside farming and livestock keeping. To fill the objective,

information was obtained on four key identified reasons which were; to increase household income, to cushion households against risks associated with wildlife damages, ensure food security and to meet household necessities. The households in the respective three locations were asked to rank these reasons on the basis of priority that is from first to fourth. The legend in the bar chart (R₁ – R₄) indicates the rankings.

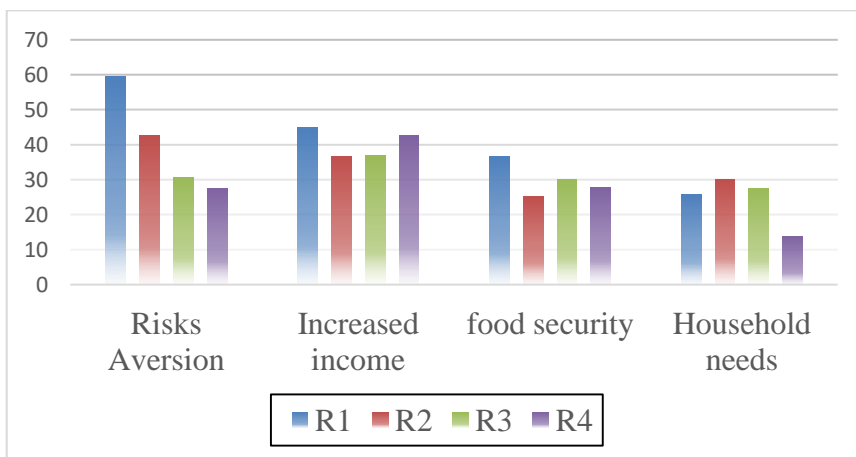


Figure 5. Reasons for Livelihood Diversification

The results of these analysis reveals that 59.4% of the households reported risk aversion associated with wildlife damages as their first priority reason for engaging in livelihood diversification. 42.6% considered income as number one priority for diversification, 36.7% of the households diversify livelihood portfolios for meeting household’s necessities. The findings shows that the main reason why Kamnarok NR adjacent households are engaged in livelihood diversified activities was to avert risks associated with wildlife damages from the adjacent Kamnarok Wildlife Protected area (WPA). This is because among the reasons for engaging in livelihood diversification, risks associated with Kamnarok NR wildlife had the highest score (59.4%) as the first against the other reasons for engaging in livelihood diversifications. This findings corroborates those of (Okello *et al.* 2003; Keringe, 2010; Okello *et al.* 2011) who’s *AER Journal Volume 3, Issue 1, pp. 51-64, 2018*

studies showed that households living adjacent to wildlife protected areas in Kenya diversify livelihood portfolios to minimize risks of human wildlife conflicts brought by wild animals.

Factors Influencing Livelihood Diversification among Kamnarok NR Adjacent Households

In the study, it was hypothesized that there is no significant relationship between contextual factors;- livestock predation, market, human wildlife conflicts, credits and asset possessions and livelihood diversification by households. Table 3 shows the analysis carried out using logit regression model (forward stepwise) selection approach was adopted. Market (X₂) and physical asset possessions (X₅) were found not to be significant at .05% level of significance. Human wildlife conflict (X₃) encounters with households had a positive influence on

household livelihood diversification and so do credits (X_4) received by households. The results showed that frequency change in human wildlife conflicts encountered by households (X_2) will result in an increase of household's attitude behaviours towards engagement in livelihood diversification by 0.674. This implies that human wildlife conflicts (HWCs) contribute .674 prediction of household influence into livelihood diversification. This findings corroborates earlier findings in this study which reveal that Kamnarok NR adjacent households diversify livelihoods to avert risks brought by wild animals. This is an indication that households who frequently encounters wildlife damages and other forms of conflicts are more likely to engage in livelihood diversification activities. For credits, an amount received by a households will positively influence a

household engagement into livelihood diversification by .848 and any loss of livestock (X_1) due to wild animal predation will raise the probability of a household engaging in livelihood diversification by .418. The implication of this finding is that loss of livestock through wildlife predation implies that wildlife conservation has dealt a great loss of economic livelihoods to adjacent households. This explains why Kamnarok NR adjacent households have negative attitude wildlife conservation. In conclusion, the hypothesis that there is no significant relationship between contextual factors (livestock predation, market, HWC, credits and asset possessions) and livelihood diversification (LD) is reject with minor modification since market existence and asset possessions respondents had no significant relationship with livelihood diversification.

Table 3: Logit Model Estimates of Contextual Factors Influencing Livelihood Diversifications

Contextual Variable	B	SE	T	Remarks
Livestock Predation	-0.418	0.112	0.014	Significant
Market	0.0617	0.176	0.511	Not Significant
Human Wildlife Conflicts	-0.674	0.163	0.016	Significant
Credits	-0.848	0.062	0.0001	Significant
Asset possession	0.0492	0.158	0.614	Not significant
Constant		4.238		
Model X^2		64.58		
-2log likelihood		0.00		
Cox and Snell R^2		0.73		
Nagelkerke R^2		1.00		

Overall number of households was 95%

CONCLUSION AND POLICY RECOMMENDATION

The results of this study reveal that Kamnarok NR adjacent households have been affected by wildlife in different ways. It was established that their livelihoods have been frequently disrupted by wildlife making them poorer and vulnerable in their ancestral land. However, the study also found that Kamnarok NR resources contributed to the economic wellbeing of the adjacent households. But the overall goal of the households involvement in livelihood diversification activities is to avert risks likely to result from wild animals from Kamnarok NR. The quest for improved standards of living which has been sought after by the vulnerable and marginalized rural

AER Journal Volume 3, Issue 1, pp. 51-64, 2018

households living adjacent to wildlife protected areas (WPAs) would be met with higher success when WPA adjacent households realize their potentiality and effectiveness of livelihood diversification in the overall scheme of rural poverty reduction. This is critical especially rural households bordering WPAs who do not benefit from the wildlife resources. Therefore, it can be concluded that livelihood diversification is a positive undertaking by households living adjacent to WPAs. This is because it enables rural households to increase their income portfolios, insure families against risks of human wildlife conflicts and food insecurity while reducing their vulnerability to fears, diseases, hunger and sudden deaths. Based on

the findings of this study, Kamnarok NR adjacent households should be allowed and given an opportunity to participate in various income generating activities in both agricultural and off-farm activities adjacent to WPA. The wildlife management authorities should consider compensating these households adequately and promptly whenever wildlife damage their livelihoods

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