

Typology of Human-Wildlife Conflicts Encountered by the Local Communities in Kieni-West Sub-County, Kenya

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Abstract:

Human-wildlife conflicts (HWC) have become more frequent and severe over recent decade as a result of human population growth, expansion of agricultural and industrial activities which together have led to increased human encroachment on uninhabited and areas meant for wild animals. This study focused on the typology of human-wildlife conflicts in Kieni West Sub-County, Kenya. This study used a descriptive survey design. The target population of the study was 2340 households drawn from three villages namely: Amboni, Bendeni and Njeng'u. Data was collected using questionnaires, interview schedules for key informants, participant observations and focus group discussions. Collected data was later analyzed using descriptive statistics in form of frequencies, percentages, chi-squared tests and Spearman's rank correlation coefficient. Different types of human-wildlife conflicts and their occurrences were analyzed by frequencies and percentages. Chi-squared test was used to compare different variables while Spearman rank correlation coefficient was used to establish the relationship between variables. Information given by key informants and opinions by local leaders was analyzed thematically. Data was presented by frequency tables, figures, percentages and texts in a descriptive way. The findings of this study showed that the local communities in Kieni County encountered with various types of human-wildlife conflicts including human injuries and threats (3%), crop damage (53%), livestock predation (23%), disease transmission to livestock (16%) and property damage (5%). The observed difference in types of human-wildlife conflicts was significant ($X^2=248.7$, $df=5$, P 0.001).

Index Terms: Human-wildlife conflicts, Kieni West Sub-County, species, typology

I. INTRODUCTION

Human-wildlife conflict has been in existence for as long as humans have existed and wild animals and people have shared the same landscapes and resources [1,2]. According to the 2003 International Union for the Conservation of Nature (IUCN) World Parks Congress, human-wildlife conflict occurs when wildlife requirements encroach on those of human populations, with costs both to residents and wild animals [3]. Studies around the world show that HWC is more intense in the developing countries where livestock holdings and agriculture are an important part of rural livelihoods. In these regions, competition between local communities and wild animals, for the use of natural resources, is particularly intense and direct and resident human populations are very vulnerable [4]. However, human-wildlife conflicts occur everywhere around the world in one form or another. In Alberta, Canada, for example, over a period of 14 years (1982–1996) wolves killed 2,806 domestic animals, mainly cattle but also some dogs, horses, sheep, chickens, bison, goats, geese and turkeys. In Idaho, Montana and Wyoming in the United States, wolves killed 728 animals, mainly sheep and cattle, over a similar time period (1987–2001) [5]. In the state of Gujarat, Asia, near the Gir National Park and Sanctuary, the Asian lion and leopard hunt prey such as buffalo, cattle, pigs and dogs [6]. In the southern state of Karnataka, the overall annual damages caused by large tigers and leopards near the Bhadra Tiger Reserve, are reported to be approximately 12 percent of total family livestock holdings. In addition, elephant damage to crops accounted for an average loss of 14 percent of total annual production [7]. In Africa, human wildlife conflicts are also prevalent in many countries. In Mozambique, many deaths go unreported, simply because of the difficulty

for many people of getting to a government office. A rough estimate would be around 300 people killed by crocodiles per year nationwide [8] while lions killed 70 people in Cabo Delgado province over a period of 18 months between 2001 and 2002. Most of these people were out at night protecting their crops from elephants [8]. In the United Republic of Tanzania from 1999 to 2004, crocodiles killed at least 28 people and injured 57 others in the Jukumu Wildlife Management Area, an area of about 500 km² comprising 22 villages located in the northern buffer zone of the Selous Game Reserve. In one village alone 11 people were killed in a single year [9]. Lion attacks are also widespread where between 1990 and 2004, lions killed at least 563 people and injured more than 308. The problem has increased dramatically over the past 15 years, with the majority of cases occurring in the southern part of the country [10]. A few lions are known to eat humans, such as the notorious Osama which killed at least 34 people along the Rufiji River [11]. In South Africa, between 1996 and 1997, at least 11 (possibly more) illegal immigrants making their way on foot from Mozambique across the Kruger National Park were reportedly killed by lions. This tragic situation may have occurred many times over the years [12].

In Kenya, more than 200 people were killed over the last seven years by elephants alone [13]. At Kibwezi, 478 goats, 48 sheep and 50 cows were killed by crocodile over five years representing an economic value of US \$16 958 [14]. Kenya's unique landscape supports abundant and varied wildlife of scientific intrinsic and economic value and has a considerable extent of wildlife habitat [15,16; 17,18]. With a significant population of wildlife living outside protected areas on a seasonal or permanent basis, the country's wildlife resource has suffered from the effects of human economic activities poaching, human wildlife conflict, demand for wildlife products in the illegal market, and weak legislation, among other factors [19;20]. Kieni County is one of the areas where human-wildlife conflicts occur in Kenya causing human deaths and injuries, livestock deaths, crop destruction among others. Studies have been done in the global, regional and national levels concerning different types of human-wildlife conflicts affecting local communities. However, little has been done at the local level on the human-wildlife conflicts and therefore the study focused on the typology of human-wildlife conflicts in Kieni West Sub-County.

II. Materials And Methods

Research Site

The study was carried out in Kieni West Sub-County which was purposive sampled since it had incidences of human-wildlife conflicts. Three villages Amboni, Bondeni and Njeng'u were also sampled purposively. Administratively, Kieni West Sub-County has Mweiga, Endarasha, Gatarakwa, Labura, Mwiyo and Mugunda locations covering a total area of 1,230 Km². Kieni West Sub-County in Nyeri County covers an area of 623Km² and it's situated between longitude 36° 40' East and 37° 20' East and between the equator and latitude 0° 38' South. In terms of altitude the Sub-County lies between 3076 meters to 5188 meters above sea level. It registers mean monthly temperatures ranging from 12.8⁰ C to 20.8⁰ C and monthly rainfall ranging between 500 mm and 2400mm per annum. The population is mainly comprised of low-income families sparsely dispersed throughout the area. Kieni West Sub-County land has fertile ridges that are on the slopes of Aberdares Mountains. The transport infrastructure in most of Kieni West Sub-County is underdeveloped. The populated areas are mainly connected by dirt roads.

Sample size and sampling procedure

Kieni West Sub-County comprises of 6 locations with an estimated population of 79,312 people [21]. The target population of this study was drawn from three sub-locations namely Amboni, Bondeni, Njeng'u of Mweiga location, Kieni West Sub-County. Target population comprised of a total of 2345 households (Amboni has 1194, Bondeni 365 and Njeng'u 784 households) (Table 1). The respondents included farmers, Kenya Wildlife Service (KWS) officers, Agricultural officers, Veterinary officers and local opinion leaders. The sample size (n) was determined using the following formula given by Colton (1963) cited in Dongol (2007) at 95% confidence level.

Sample size (n) =

$$\frac{N * z^2 * P * (1-P)}{d^2}$$

$$N * d^2 + z^2 * P * (1-P)$$

Where,

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N=total number of households

Z=value of standard variant at 95% confidence level (1.96)

P=estimated population (0.05)

d=error limit of 5% (0.05)

Table 1: Total number of households and sampled households

Villages	Total households (N)	Sampled Households
Amboni	1194	69
Bondeni	367	61
Njeng'u	784	67
Total	2345	197

Source: KNBS (2009)

Data Collection & Analysis

Data was collected using structured questionnaires, FGDs, interviews with key informants and field observations. The researcher randomly administered structured questionnaires to the affected households in the three sampled village. Three FGDs were involved; each from the three villages comprising of 8 members of the local community. Interviews with key informants were conducted with agricultural officers, veterinary officers, Kenya Wildlife Service officer and local leaders. Field observations in the form of visits to the affected fields in order to have an appreciation of the nature of the conflicts between humans and wildlife were conducted on both affected and non-affected fields. Both primary data and secondary data were used. The study yielded both qualitative and quantitative data. Qualitative data was derived from open-ended questions in the questionnaires, Key Informant Interviews (KIIs) and FGDs. Analysis of quantitative data was done where descriptive statistics in form of frequencies, percentages, chi-square and spearman rank correlation coefficient was computed. The data collected was then presented by frequency tables, figures, percentages and texts in a descriptive way.

III. Results and Discussion

A. Encounter with wild animals

The study findings showed that 91% of respondents had encountered wild animals in their farms and homesteads while 9% had not encountered wild animals, a difference that was statistically significant ($\chi^2=123, df=1, P=0.001$). The survey finding indicates that most of the respondents in the local community have been affected by the wild animals in their farms and homesteads.

Encounter with Wild Animals

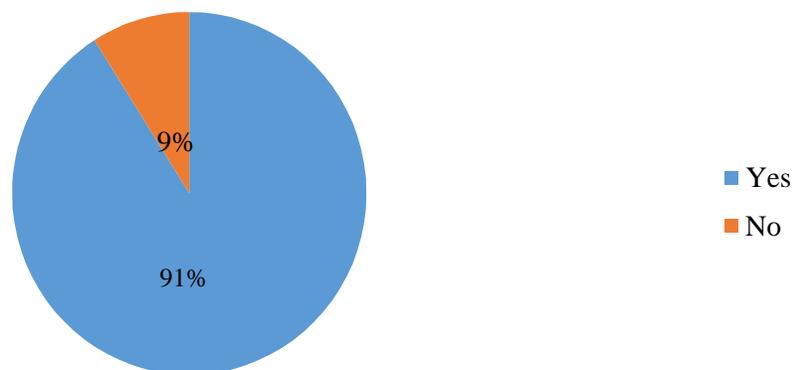


Figure 1: Encounter with Wild Animals

Source: Field Survey (2015)

B. Wild animal species encountered

According to the findings, ten different types of wildlife were reported to visit the local community farms. 92% of the respondents

reported that they encountered monkeys, 81% encountered Baboons, 12% Leopards, 15% encountered Buffaloes, 52% Elephants, 18% Hyenas, 29% wild dogs, 34% porcupines, 18% Antelopes, while 32% encountered Squirrels. The wild animals encountered by farmers varied significantly ($X^2=331.9, df=9, P 0.001$). The findings indicate that the local community had a great challenge when dealing with the wild animals in their farms. The findings also indicate that the farmers encountered with more than one wild animal.

Table 2: Wild animal species encountered by farmers

Wild animal	Frequency	Percentage
Leopard	21	12
Monkey	167	92
Baboon	148	81
Buffalo	28	15
Elephant	94	52
Hyena	36	18
Wild Dog	53	29
Porcupine	61	34
Antelope	33	18
Squirrel	59	32
N=182		

Source: Field Survey (2015)

C. Number of raiding species

On the number of wild animals that reached their farms relative to distance in meters, the survey results were as shown in table 3. From the findings, a strong negative correlation between the number of species that raided each farm and their approximate distance from ANP fence was found (Spearman’s $r_s = -0.942, P < 0.05, n=6$). This indicated that farms that were closer to the ANP fence were raided by more species, and farms farther from the ANP fence raided by relatively fewer species. However, animal species like squirrel, birds and porcupines had no distance limitations.

Table 3: Number of raiding species

Approximate Distance (m)	Average number of raiding species
0-200	6
200-400	5
400-600	3
600-800	4
800-1000	2
1000-1200	1

Source: Field Survey (2015)

D. Time of encounter with wild animals

The respondents indicated the time of the visit of the wild animals (Figure 2). The findings show that 81% of respondents encountered wild animals at night, 11% of the encountered wild animals during the day and 8% of respondents encountered wild animals at any time of the day a difference that was significant ($X^2=184.4, df=2, P 0.001$). Wild animals that were reported to reach the farms during the day include monkeys, baboons, squirrel, elephants, antelopes and wild dogs. Hyena, porcupine and leopard reached the crop lands and homesteads at night. However, elephants were also reported to reach the farms at night.

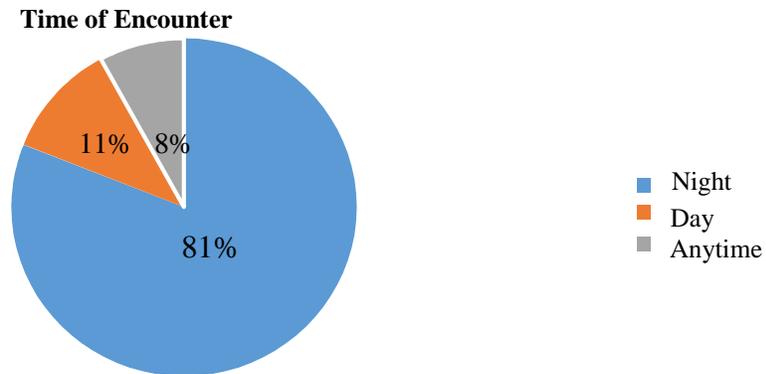


Figure 2: Time of Encounter
 Source: Field Survey (2015)

E. Frequency of encounter

The study further sought to establish the frequency of visit of by wild animals in the community farms and homesteads and the responses were indicated as shown in table 4. The survey results show that 71% of respondents reported that wild animals reached their cropland and/ or houses on daily basis, 3% once in a week, 5% twice a week, 7% monthly and 14% said that wild animals visited their cropland and homesteads at other times. Wild animals significantly visited on daily basis ($X^2=301.3$, $df=4$, $PM0.001$) than other times. The findings indicated that majority of the farmers were on constant conflict with the wild animals and hence had to be on their cropland most of the time to protect their crop land and their homesteads from wild animals attacks. Respondents mentioned that the frequency of visit by wild animals was found high during the maturing and harvesting periods of crops.

Table 4: Frequency of visit by wild animals

Visit by wild animals	Frequency	Percentage
Daily	129	71
Once a week	5	3
Twice a week	9	5
Monthly	13	7
Other times	26	14
Total	182	100

Source: Field Survey (2015)

F. Problems caused by wild animals

The study established that wild animals caused problems to the local communities as shown in table 5. There were a total of 213 recorded incidences of human-wildlife conflicts in the local community over a period of 12 months. From the result findings, 53% of respondents indicated that the major problem caused by wild animals in the local communities was crop damage, 3% human injuries and threat, 23% livestock predation, 16% disease transmission while 5% indicated property damage. There were no incidences of human deaths caused by wild animals in the area. Property damage in the local communities involved damage of fences (traditional and artificial), trees, gates, water pipes, buildings and other structures. However, incidences of property damage were not often reported since the community did not see it to have a direct impact on their lives. The observed differences were significant ($X^2=248.7$, $df=5$, $P<0.001$) with crop damage being the major problem. However, the findings are different from a similar study carried out by [8] noted that in less than a period of 18 months within one province (Cabo Delgado) of Mozambique 70 people were killed by lions, with almost 30 people killed by crocodiles in a 500km² area of north of Selons Game reserve in Tanzania in less than 5 years [9].

Table 5: Major problems caused by wild animals

Type of HWC	Frequency	Percentage
Human injuries/Threat	7	3
Human death	0	0
Crop damage	113	53
Livestock predation	48	23
Disease Transmission	34	26
Property damage	11	5
Totals	213	100

Source: Kenya Wildlife Service (KWS), Aberdare National Park Headquarters (2015)

G. Crops damaged by wild animals

The study further established that there were a total of 113 recorded incidences of crop by the elephants over a period of 13 months (i.e. from February 2014-March 2015). Different crops were damaged in the local communities (Table 6). From the findings, 45% of the crops destroyed by wild animals was maize, 18% bananas, 13% beans, 11% potatoes, 9% vegetables and other crops 4%. The difference between different crops that were damaged by wild animals was significant ($X^2=72.7, df=5, P<0.001$) with maize damaged more than other crops. The finding indicates that most of the farmers were largely affected in terms of yields produced and their nutrition after crop damage by the wild animals.

Table 6: Crops damaged by wild animals

Type of Crop	Frequency	Percentage
Potatoes	12	11
Bananas	20	18
Beans	15	13
Maize	51	45
Vegetables	10	9
Others	5	4
Totals	113	100

Source: Department of Agriculture, Kieni West Sub-County (2015)

H. Wild animals' species responsible for crop damage

In establishing the most responsible animal for crop damage, the study findings revealed that monkeys and baboons were the most responsible animal species for most of the crop damage in the local communities at 88% and 81% respectively. However, the incidences of crop damage by monkeys and baboons were not reported to Kenya Wildlife Service (KWS) Officers since the latter are not included for compensation. Crop damage by elephants was also reported (79%), rodents (squirrels and porcupines) (38%), birds (47%), antelopes (12%) and buffaloes (26%). The animals species reported for crop damage varied significantly ($X^2=183.4, df=6, P<0.001$) with monkeys and baboons being more responsible for crop damage. This indicates that monkeys and baboons accessed the local community farms throughout the year and hence caused much damage to the crops. It also suggests that farmers had a problem in dealing with monkeys and baboons from attacking their crops land. The findings also suggested that crops were damaged by more than one wild animal. Elephants were reported to destroyed crops during migration period where they damaged crops that they came across eating mature crops and trampling on young crops. Buffaloes also were also reported to attack crops any time of the year while birds also damaged crops throughout the year.

Porcupines attacked potatoes at tuber stage and other vine crops as monkeys attacked them when they were most hungry. Monkeys attacked maize mainly at the cobbing stage though they still attacked them at other stages. Porcupines attacked maize at cobbing stage while birds especially yellow-necked spur fowl attacked maize seeds during sowing and during silking stage by cutting off the silk. Squirrels also attacked maize during sowing where they were after the maize seeds. Elephants and buffaloes attacked maize at all stages of growth. Elephants attacked cabbages at mature stage while birds attacked the cabbages at the nursery beds. Birds

also attacked all vegetables at the nursery beds. They also attacked all legumes at all stages. Passion fruits were also attacked during the flowering stage by cutting the flowers. Antelopes damaged beans and sweet potatoes by eating their leaves.

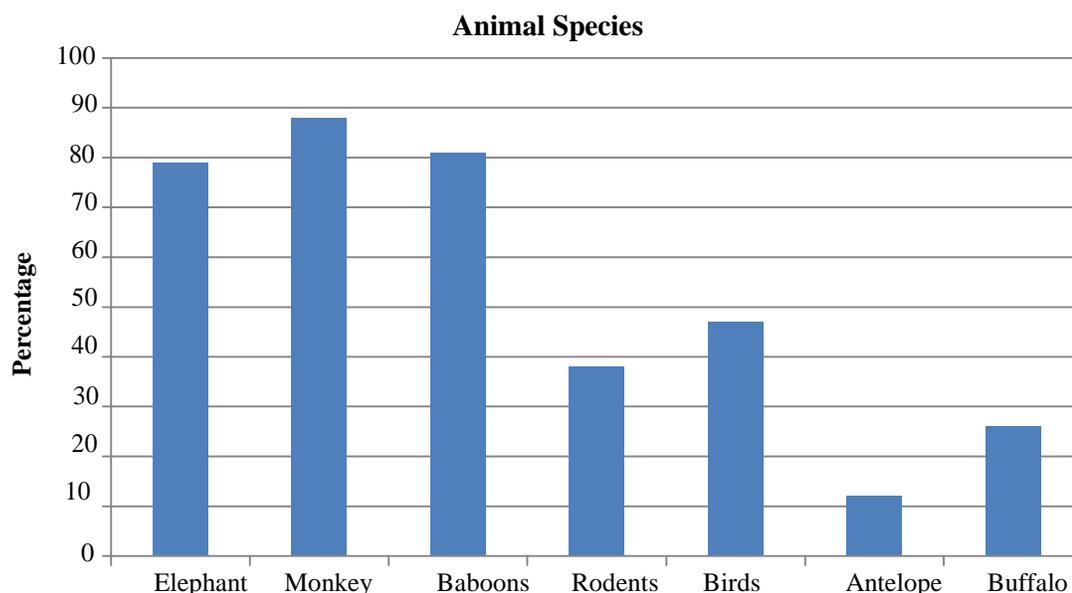


Figure 3: Animal Species
Source: Field Survey (2015)

I. Farm raids by elephants

The study further sought to investigate the crop raids by the elephants reported between February 2014 and March 2015 (Table 7). According to the findings, 51% of the incidences of farm raids by the elephants occurred in the months of February and March 2014, 16% in April 2014, 7% in June 2014, 8% in 2014, 10% in February 2015 and 8% in March 2015. There was significant difference ($X^2=180$, $df=13$, $PM0.001$) on crop damage by elephants in different months. The findings indicate that there was high numbers of elephants migrating of from Mount Kenya to Aberdares National Park destroying a lot of crops on their way in the months of February, March and April. This also indicates fact that there were a lot of crops in their farms. However, in 2015 during the same period the number of farm raids that were reported went down and this indicates that there were little crops in the farms as a result of the dry spell in the area. The findings further indicate that Kenya Wildlife Service (KWS) and farmers had taken precaution to protect their cropland. Lack of incidences of crop raids by elephants in the months of August 2014 to January 2015 indicates that there were no crops in the farms to be raided at that particular time.

Table 7: Farm raid incidences by elephants

Month of Raids	Frequency of farm raids	Percentage
Feb. 2014	27	24
March	31	27
April	18	16
May	0	0
June	8	7
July	9	8
August	0	0
September	0	0
October	0	0
November	0	0
December	0	0
Jan. 2015	0	0
February	11	10
March	9	8
Totals	113	100

Source: Department of Agriculture, Kieni West Sub-county (2015)

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J. Livestock predation

The livestock that were most preyed on by the wild animals were also indicated by the respondents (Figure 4). According to the findings, a total of 48 livestock were attacked by the wild animal species. From the results, 54% of the livestock predation was on sheep and goats, 15% of the attacks was on cattle while attacks on poultry and dogs were 21% and 10% respectively. However, most cases of dogs that were attacked went unreported. Different livestock were attacked by wild animals though the difference between the numbers of livestock was not statistically significant ($X^2=8.6, df=4, P=0.075$) small stock being attacked more than other livestock. The finding indicates that sheep and goats were exposed more to the predators and hence more vulnerable to the wild animal attacks.

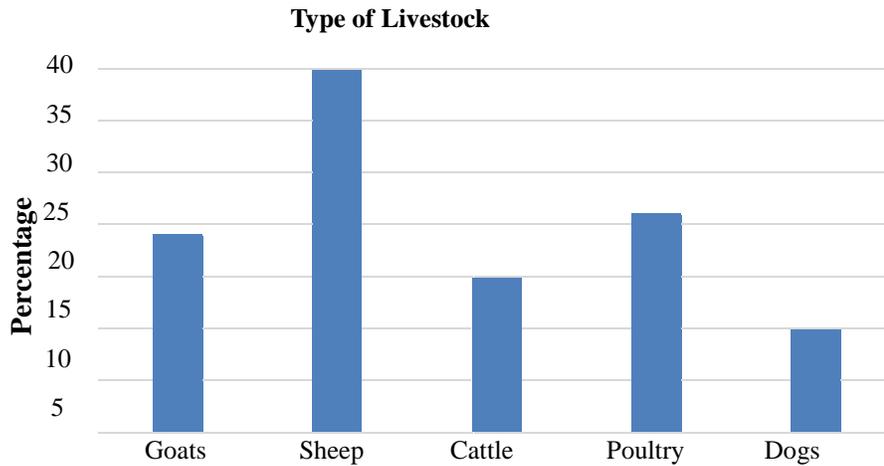


Figure 4: Type of Livestock
 Source: Field Survey (2015)

K. Wild animal species responsible for predation

The study findings revealed that different wild animal species were responsible for the livestock attacks as shown in figure 5. From the survey results, wild dogs were responsible for 31% of the attacks difference that was significant ($X^2=9.9, df=4, P=0.05$) compared to attacks caused by other animal species. Leopards were responsible for 27% of the attacks, hyenas for 23% of the attacks, elephants 8% of the attacks while baboons were responsible for 11% of the attacks. Wild dogs and hyenas attacked sheep and goats while baboon attacked small goats and also dogs inflicting serious wounds to them especially when they are protecting cropland from attacks. However, baboons only attacked dogs when they were in groups. Leopards attacked sheep and goats, calves and the udder of the cattle. Leopards in the area were reported to attack the livestock during the breeding season when they tended to wander around. The findings indicate that carnivores were responsible for most of predation incidences.

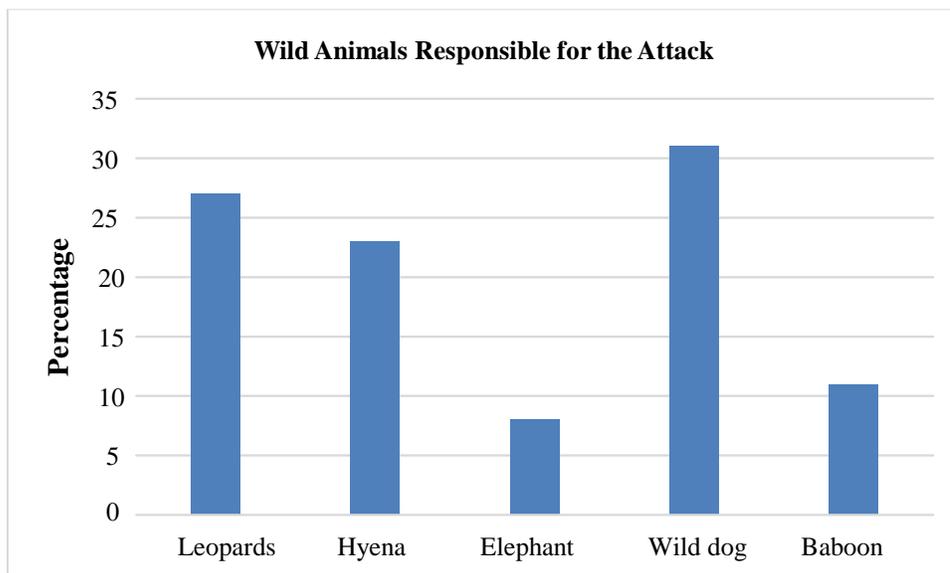


Figure 5: Animals Responsible for Attacks
Source: Field Survey (2015)

L. Time of the day when predation occurs

Findings from the survey results indicates that 51% of the livestock attacks occurred at night as compared to 40% of the attacks that occurred during the day while 9% of the attacks were reported to occur anytime of the day ($X^2=52.6, df=2, P=0.005$) a difference that was significant. Animals that attacked during the night were hyenas, leopards and wild dogs while baboons came during the day. However, hyenas were also reported to attack livestock during the day. The finding suggests that farmers were not able to protect their livestock during the night resulting to more attacks to the livestock.

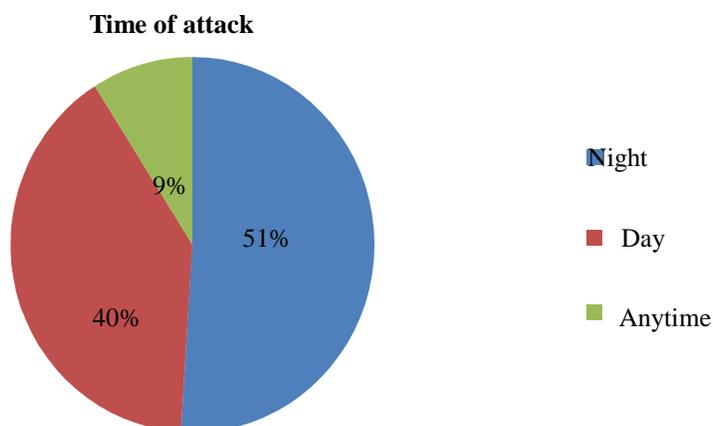


Figure 6: Time of Attack
Source: Field Survey (2015)

M. Disease transmission

There were a total of 34 reported incidences of disease transmission to the livestock over a period of 12 months. From the results, 61% of respondents reported that their cattle were diagnosed with East Coast Fever (ECF) while 39% reported that their livestock were diagnosed with Trypanosomiasis (Table 8). However, there was no significant difference in reported diseases that were transmitted to the livestock ($X^2=1.88, df=1, P=0.200$). East Coast Fever was reported to be transmitted to the cattle by the infected ticks from the buffaloes. This suggests that livestock and the buffaloes were sharing pasture and water when grazing. The findings further suggest that farmers used poor tick control measures exposing their livestock more to tick-borne diseases. However, domestic animals could transmit East Coast Fever (ECF) among themselves. Trypanosomiasis was reported in cattle and was said to be transmitted by tsetse flies from wild animals especially in the months of March and April at the onset of the long rains. However, there were no cases of human beings with sleeping sickness reported.

Table 8: Diseases Transmitted

Disease Transmitted	Frequency	Percentage
East Coast Fever	20	59%
Trypanosomiasis	14	41%
Totals	34	100

Source: Veterinary Department, Kieni West Sub-County (2015)

IV. CONCLUSION

The study results demonstrated that most of the people in the local communities encounter with wild animals causing different human-wildlife conflicts and hence the study concluded that different types of human-wildlife conflicts were significant in the local communities of Kieni West Sub-County. This has led to farmers not being able to realize the full potential benefits from the crops they grow and the livestock they keep. This is as a result of crop damage and livestock predation from wild animals denying farmers the economic benefits that accrue from crop farming and livestock rearing. The crop yields are affected when their crops are damaged by

wild animals and when livestock attacked by predators.

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