

# Conservation of Terrestrial Flora and Fauna in Rachuonyo South, Kenya: A Focus on Effects of Hunting and Gathering

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## ABSTRACT

Terrestrial flora and fauna species are at the brink of disappearance yearly due to increase in human population. Yearly, the extinction rate of these species are 25% and 34% globally and 69% and 68% in Kenya. However, the depletion rate and the status of species in Rachuonyo South is not specified in any literature and yet, the rise of human population in Rachuonyo South has increased anthropogenic activities for instance 74% and 97% of population depends on agriculture and wood fuel respectively. The purpose of this study was to examine the effect of hunting and gathering on terrestrial flora and fauna species conservation. A cross-sectional survey design was used by application of Stratified Random Sampling to generate a sample size of 379 household heads. Data was collected using questionnaires and interviews. The results indicated that there were 80 and 25 terrestrial flora and fauna species threatened. The terrestrial flora and fauna species were in a declining trend (mean=1.96, standard deviation=0.487 and mean=1.97, standard deviation=0.462) respectively. The frequency of hunting and gathering were extremely high (mean=2.90, standard deviation= 1.006). Hunting and gathering were greatly affecting terrestrial flora and fauna species (mean=1.22, standard deviation=0.414). The respondents were not sure whether there were effective conservation measures in place to mitigate the effects of the mentioned hunting and gathering (mean=1.70, standard deviation=0.457). In conclusion, the survival of terrestrial flora and fauna species in Rachuonyo South Sub County was greatly threatened by hunting and gathering. The local communities should be involved in conservation measures.

**Keywords:** Terrestrial Flora; Terrestrial Fauna; Conservation; Hunting and Gathering

## INTRODUCTION

By the rise of Iron Age in 1000 BC, a dramatic growth in human population of 72million was experienced. Since then the human population has grown by 100 times, thereby increasing anthropogenic activities for livelihood (Klein, Beusen & Janshen, 2010). This is a fundamental cause to the ongoing global mass extinctions of terrestrial flora and fauna species (Eldredge, 2000). Anthropogenic activities are socio-economic duties carried out by human beings on an environment such as farming, hunting, grazing, charcoal burning, firewood collection, and brick making. The Convention of Biological Diversity state that there are both indirect and direct anthropogenic factors of species extinction. The direct human factors are habitat loss, spread of invasive species, over harvesting, pollution, and climate change (Allister, Braat, Vander Windt, Rademaekers, Eichler & Turner (2009). A study done by Redford (1995) as cited by (Muluneh, 2021) noted that a third to half of earth surface have been greatly altered by direct human factors.

In addition, World Wide Fund, noted that currently, the greatest threat to terrestrial flora and fauna species is seemingly habitat loss and out of all species described in the IUCN's Red List 85% are threatened by habitat loss (WWF, 2020). Other studies such as (Odetta 2014; Vilà, Espinar, Hejda, Hulme, Jarošík, Maron, & Pyšek, 2011; Pejchar & Mooney, 2009) have greatly talked about how spread of invasive species, habitat loss, climate change, pollution and over harvesting threatens flora and fauna species. however, these studies occurred elsewhere and not in Rachuonyo, at the same time the depletion rate of flora

and fauna species were not documented in Rachuonyo South. The analysis of the above studies indicated that rapid population growth has led to increased anthropogenic activities and population pressure on the land hence increased depletion of flora and fauna species. This was replicated in Rachuonyo South whose population growth was rising as evidenced by 2019 Kenya population and demographic census which reported a population density of 511 persons/Km<sup>2</sup> in the sub-county which was far above the national population density of 82 persons/Km<sup>2</sup>.

The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) points to the global acceleration of the loss and decline of terrestrial flora and fauna species since 2010, with a high risk of mass extinction of species in the next few decades if urgent measures are not taken globally. They further predicted that one million plant and animal species are threatened with extinction (IPBES 2019a). Similarly, recent scientific knowledge such as the International Union for Conservation of Nature (2019 & 2021) and Food and Agriculture Organization (2021), acknowledge that yearly, there is global decline of species at a rate of 34% of flora and 25% of fauna and yet these species are greatly beneficial to human wellbeing through the numerous ecosystem services they support such as soil formation and protection, food and medicines. Studies by United Nations Environment Program (2019) and Convention on Biological Diversity (2019) are in agreement with Redford (1995) and asserted that these species are greatly threatened to extinction due to habitat loss. The rate of the threat is estimated at 1000 times background rates. These studies have concentrated on the importance of species diversity and the effect of its decline to humanity, however, the rate at which these species were declining was still worrying and this has weakened livelihoods, food security, health, and quality of life worldwide. Therefore, a better understanding on the available species of flora and fauna was still crucial and how these anthropogenic activities have threatened terrestrial flora and fauna species. The present study bridged these two identified knowledge gaps by identifying terrestrial flora and fauna species threatened by anthropogenic activities.

## REVIEW OF LITERATURE

Numerous studies indicated that globally, terrestrial flora and fauna species are undergoing the fastest rate of extinction known in geological history and hold the opinion that the earth has reached its sixth mass of extinction. For instance, out of 391,000 flora species known globally, 21% are threatened with extinction (UNEP report, 2010b; Mongabay, 2016). In addition, Cresswell and Murphy (2016) estimated that globally, 15 billion flora species are threatened with extinction yearly. These researchers affirmed that 90% of flora species have been removed in the United States and 480 fauna species have been recorded as extinct in Australia. A researcher indicated that in the next few decades up to 1 million terrestrial species could become extinct if the declining rate continues (Turku 2020). A study acknowledged that human activities and influences are greatly enhancing the extinction rate of species and yet their existence is not known (Camilo, Derek, Sina, Alastair, Simpson & Boris 2011). Further, Camilo et al. (2011) indicated that about 86% of all terrestrial flora and fauna species are yet to be discovered, described and catalogued. The result of their findings also indicated that out of 7.77 million faunae and 298,000 species of flora only 953,434 and 215,644 species respectively have been described and catalogued. These studies have noted that terrestrial flora and fauna species were being depleted at a high rate and yet these species were not documented globally, regionally and locally. Hence there was a need to examine the current status of these species. Therefore, the present study aimed at identifying threatened terrestrial flora and fauna species in the study area.

The challenge of terrestrial flora and fauna species decline is a universal phenomenon that includes African continent (Darwall, Smith, & Allen 2011). Studies done by Lindsey, Románach, Tambling, & Chartier (2011) and Plumer (2019) indicated that in Zimbabwe within a span of four years about 1400 large mammals had decayed in traps, similarly, in between the year 2009 and 2011, 7000 elephants had been killed by hunters in Mozambique. A study stated that hunting as an anthropogenic activity greatly endangers

animal species and that in the red list of threatened species recorded by IUCN out of 9000 species listed, 72% are threatened by hunting (Sean, Watson and Fuller 2016). This finding compared well with FAO (2015) findings which stipulated that wildlife in the majority of countries within savanna environment are greatly threatened by hunting. This threat is accelerated by an increasing demand for bush meat in rural areas of African continent that experiences a rapid growth of human population. However, FAO further indicated that the sum of bush meat hunted is not tracked anywhere. These studies (Lindsey et al 2011; Plumer 2019; Sean, Watson and Fuller 2016; and FAO 2015) concurred that hunting as an anthropogenic activity has threatened animal species to extinction. However, these studies majorly focused on hunting as an anthropogenic activity at the expense of gathering aspect, similarly, they did not analyze how hunting affected plant species and to what extent were specific fauna species affected and yet both plant and animal species were being threatened by this activity. Therefore, the current study described how hunting and gathering threatened terrestrial flora and fauna species conservation.

According to International Union for Conservation of Nature (2014), 3,148 flora species were listed to have faced extinction due to habitat loss being enhanced by vegetation clearance. In support to this, studies done by Neldner, Neihus, Wilson, McDonald, Ford & Accad (2017); Taylor, Eber & Toni, (2014) affirmed that habitat loss propagated by vegetation clearance is a great threat to terrestrial flora and fauna species whose intensity increases from no impact to above 95% loss of species richness. Further, Neldner et al (2017) and Morgan (2001) acknowledges that in a situation where clearance exceeds 20% of the vegetation then decline of terrestrial species take place and is accelerated in areas whose native vegetation is less than 30 percent. Convention on Biological Diversity (2016), noted that in as much as a lot of measures have been put in place to reduce the decline of species in Africa, however, seemingly the continent is still experiencing a high rate of extinction. For instance, approximately 140,000 and 372,000 hectares of natural vegetation are lost yearly in Nigeria and Tanzania respectively (Nguon & Kulakowski, 2013; Sangedas & Maleko, 2018). In as much as these studies clearly outlined the decline of flora species due to loss of habitat. However, these studies did not analyze how habitat loss due to vegetation was affecting fauna species and to what extent each group of flora species were affected by a specific activity and yet these species are essential for human livelihood. Due to this gap there was a need to determine how terrestrial species were threatened by vegetation clearance. Hence, the present study bridged this knowledge gap by determining how vegetation clearance threatened terrestrial flora and fauna species.

Kenya is endowed with over 35,000 terrestrial flora and fauna species. Some of these species do not exist in other parts of the globe making Kenya to be traditionally known as a mega bio diverse country (Lusweti, 2011). A study conducted by Convention on Biological Diversity acknowledged the fact that these species in Kenya have remained highly protected. However, on the contrary, the study also pointed out that many areas still remained unprotected (CBD, 2019). Further CBD (2019) indicated that this has increased the rate of decline due to numerous threats barring conservation. According to Ogutu, Piepho, Said, Ojwang, Njino, Kifugo & Wargute, (2016), 69% flora and 68% fauna are being depleted annually due to habitat destruction enhanced by rapid growth in human population. Similarly, Masumi (2020) noted that the survival of terrestrial species in Kenya as was determined using the IUCN Red List Index (RLI) showed a downward trend from 1993 to 2020. The CBD (2019) finding measured up with the outcomes by Lusweti (2011) and FAO (2019), which acknowledged that habitat destruction greatly fuels the decline of species essential for human wellbeing. Further, Lusweti (2011) noted that destruction of habitat may cause modification of habitat due to fragmentation thus barring stability and continuity of the habitat making species to be isolated thus enhancing species extinction. NEMA (2019), noted that the government has not been able to attain the aim of reducing species diversity decline by 2010 due to destruction of habitat.

Globally, terrestrial flora is experiencing a massive collapse in their population size (Ripple 2016). Worldwide ecologists asserted that humans are responsible for the extinctions of flora, they estimated that 24 species a day, go extinct due to hunting and gathering (Turtenwald, 2018). Hunting is the seeking,

pursuance and capture or destruction of game and wild animals for subsistence, profit or sport (FAO report, 2018). Kirby (2012) stated that 301 out of the 4,500 terrestrial mammal species listed by the IUCN threatened with extinction is due to hunting. Further, FAO report, (2018) reported that; USA alone is annually losing 175 million fauna including; 24,000 bear, 55,000 caribou, 67,000 moose, 84,000 antelope, and million rabbits among others. The above studies showed that hunting was a source of decline for terrestrial fauna species globally, however, these studies did not clearly show how gathering affects flora and fauna species. There was a need for more studies to link hunting and gathering to species decline. The current study, therefore found this a missing knowledge gap and therefore addressed the effect of hunting and gathering on the threatened terrestrial flora and fauna species.

African continent is currently faced with the local extirpation of many larger terrestrial mammals (Jimoh, Ikyaaaba, Alarape, Adeyemi, & Waltert 2012; Maisels, 2013), such as Miss Waldron's red colobus monkey in Ghana, decimation of game herds in Botswana, wild bear and warthog in Muslim Countries (FAO, 2018; Rinkesh, 2019). Besides, between 2014 and 2017 Africa lost more than 100,000 elephants (Actman, 2019), in Central Africa 178 species are estimated to be currently hunted and out of these 97 species are greatly threatened and are at the verge of extinction due to hunting (Taylor, 2012; IUCN, 2012). Sadly, hunting is still on the increase in Africa, being fueled by the rising human populations, improved weaponry and overseas demand for exotic bush meat. The above studies have agreed that hunting was a dangerous activity especially to flora species, however, neither of them focused on the effect it brought on the plant species and yet hunters affected flora species as they accessed the habitat in search for the prey. This therefore gave this study a leeway to broaden the knowledge scope on effect of hunting and gathering on flora and fauna species.

In Uganda more than 1,400 pangolins were killed in between 2012–2016 due to illegal hunting (Rossi, 2018). On the other hand, over 1,000 rhinos were illegally hunted in 2017 in South Africa (AWF, 2017). Researcher noted that on average, hunting leads to 83% reduction fauna species within 25 miles of hunter access point like roads and towns (Justin 2017). Some experts have noted that Tanzania is experiencing illegal hunting making large mammals like elephants, eland and giraffe to be extremely rare and others to be locally extinct (Alex, Foley, Foley, De Luca, Mshu, Tim, Davenport & Sarah 2014). Despite these interesting insight concerning the effect of hunting to fauna species, none of these researchers clearly documented on the species which were highly threatened. The current study bridged this gap by identifying fauna species threatened by hunting.

A study carried out in Kenya by Gilbert (2019) pointed out that, about 300,000 tons of bush meat is consumed yearly. Meanwhile AWF, (2014), noted that; the demand for wildlife products; ivory and rhino horn has led to a resurgence of elephant and rhino illegal hunting. Ogutu (2016) asserted that; the rates of decline for each species varied substantially between counties but virtually all counties fared very badly. Further, Ogutu (2016), noted that, the number of the most common fauna species in Kenya reduced from a total of 1,809,605 in 1977-1980 to 607,233 in 2011-2013 and that the actual rate of decline in numbers fauna varied among species. It was most extreme (64-88%) for wildebeest, giraffe, gerenuk, Grant's gazelle, warthog, lesser kudu, among others. It was clear from the above studies that terrestrial fauna species were lost due to hunting. None of the above researches have clearly listed the species that were highly threatened and to what extent they were threatened. The listing of these species helps in identifying the threatened species which, enhanced species conservation and eventually improve the livelihood.

Studies done by Akama, (2003) and Mungai, (2004) asserted that the population around protected regions in Kenya kill a number of wild animals for their consumption especially in dry season. Further, Mungai (2004) noted that out of 2 million metric tons of illegal bush meat harvested in Africa yearly, 300,000 tons are approximated to be consumed in Kenya. Mostly fauna species are hunted for human use. Hunting has been pointed out as an activity that poses both conservation and human livelihood challenges (Bennett, Eves, Robinson and Wilkie, 2002; Brown, 2003; Milner, Gulland & Bennett, 2002). As

a conservation challenge, it causes the reduction in the population of targeted species leading to local eradication and even to extinctions of species globally (Bennett, Eves, Robinson and Wilkie, 2002; Brown, 2003; Milner, Gulland & Bennett, 2002; Barnett, 2000; Peres, 2000a; 2000b; Steadman and Stokes, 2002; Olson & James, 1982; Holdaway & Jacomb, 2000; Oates, Abedi, McGraw, Struhsaker & Whitesides 2000). A study conducted by Department for International Development (DFID) affirmed that hunting leads to the decline of fauna species in rain forest (DFID, 2002). According to Ariya (2015), sales of dry bush meat are done to small hotels within Homabay, Mbita, Sori and Ndhiwa. These bush meats are acquired through illegal hunting that is occurring in Homabay County. These studies Akama, (2003); Mungai, (2004) and Ariya (2015) agreed that hunting was a great threat to animal species conservation and greatly led to their decline. However, these studies did not factor how hunting affected various plants, yet during hunting as hunters paved their way into the bush plant species were cut down and some were also trodden upon. This study therefore bridged this gap by describing how hunting and gathering threatened terrestrial flora and fauna species conservation.

### **Study Area.**

Rachuonyo South Sub County receives an average annual rainfall of 700-800mm, which is scanty and unreliable, it has a well-drained and fertile soil supporting a range of vegetation including trees, herbs, and shrubs (GoK Report, 2013 and James, 2017). A study conducted by Appiah & Pappinen, (2010) indicated that the dominant occupant of the region is Luo speaking community who are mainly farmers cultivating maize, sorghum, cassava, beans and bananas, coupled up with animal rearing. GoK Report (2013) further asserted that in addition to farming the community are also involved in residential and commercial settlement, sand harvesting, and brick making. Vegetation cover has constantly been disturbed by being exposed to agents of soil erosion thereby causing them to lose their fertility and porosity essential for the growth of plants and trees. This is due to over reliance on agriculture, vegetation clearance and continuous herbs collection for food and medicinal purpose (GoK Report, 2018). A study entitled "Farm Forestry Prospects among some local communities in Rachuonyo District, Kenya" conducted by Appiah and Pappinen (2010), reported that tree product is a major contributor to the household cash income of about 32%. Farmers therefore amalgamate small scale mixed cropping with multipurpose trees and some livestock but highly favours exotic tree species for cash income, fuel and shade.

### **UNIT OF ANALYSIS**

The Sub County is dominated by a Luo community known as Rachuonyo. Historically, the Rachuonyo people were reknowned hunters and gatherers, a skill they inherited from their ancestor Rachuonyo who was an excellent hunter and made a big hunt for his master, Chien (Ayot, 1978). Though this study does not give a clear indication of the depletion of flora and fauna species, it can be used to justify the fact that there is a lot of hunting and gathering happening in the study area. A study by Ariya (2015) further acknowledged that hunters in Homabay tend to ensnare wild animal species through galvanized steel, sisal ropes and copper. This study by Ariya (2015) was good because it provided a direction on how hunting led to depletion of fauna species. However, this study did not look on the effect of hunting on plant species and the rate at which animal and plant species were affected by the same activity. Therefore, the present study bridged this gap by describing the effect of hunting and gathering on terrestrial plant and animal species.

According to the findings of Homabay County Integrated Development Plan (2018), thousands of species are threatened to extinction in Homabay where Rachuonyo South is located. This is due to high population growth and poverty level which increases human activities on the habitat within the county. Further, HCIDP (2018), noted that high rate of fertility within the County which stand at 5.2 children per woman higher than the national rate which is 4.6 children per woman and of counties such as Siaya and Migori whose fertility rate stood at 3.2 and 4.2 children respectively. For instance, by 2009, the sub county was a

home to 113,118 people, currently according to 2019 census, the population rose to 130,814 people implying a population density of 511 persons/Km<sup>2</sup> in the sub-county which is far above the national population density of 82 persons/Km<sup>2</sup> and some surrounding counties such as Siaya and Migori whose densities are 393 and 430 persons per square kilometer SCIDP (2018) and MCIDP (2018). Meanwhile, Homabay county where Rachuonyo is situated is also experiencing a steady rise in her rate of population growth for instance in the census of 1999, the county had 751,332 people this rose to 963,794 in 2009 and in the 2019 census the county has a population 1,131,950. The county has an annual population change of 1.6% between the year 2009 and 2019 (Brinkhoff, 2020). This has greatly posed a great threat to the species. In addition, (GoK 2018) asserted Activities such as Intensive agriculture, wildlife poaching, vegetation clearance has exacerbated environmental degradation and that bush and forest clearing to farming, charcoal burning and human settlement within the region has led to the loss of vegetation. Further GoK (2018), noted that these activities often lead to decline on plant species, biomass and animal habitat and yet forest is a home to over 80% of animal species such as Topi antelope, hyenas, Roan antelopes, giraffes, buffaloes, hare and various species of snakes. In as much as measures such as reforestation, ecotourism, seed banks, nature preserves and government's legislation have been emphasized in the region unfortunately the decline is still high due to acceleration of these anthropogenic activities on habitats by densely human populated region. For instance, 74% of population is employed in agriculture, and at least 97% of the households use wood fuel for cooking, (GoK Report, 2018). However, these activities were cutting down various species of plants causing a relocation of animal species and yet these species were not documented. Hence, this study assessed the effect of the anthropogenic activities on terrestrial flora and fauna species conservation in Rachuonyo Sub County, Homabay County.

Globally, terrestrial flora and fauna species are threatened majorly by rapid human population growth, increased human activities geared toward reducing poverty levels and cultural activities. In Kenya, particularly in Rachuonyo South, human population growth was found to be alarming hence human activities escalating. According to Kenya population and demographic census of 2019, the Sub County had a population density of 511 persons per Km<sup>2</sup> which was far above the population densities of some surrounding counties such as Siaya and Migori whose densities are 393 and 430 persons per square kilometer respectively while national population density is 82 persons per km<sup>2</sup>. The fertility rate of the Sub County stood at 5.2 children per woman greater than the national rate of 4.6 children per woman and of counties such as Siaya and Migori whose fertility rate stood at 3.2 and 4.2 children respectively. Thus it is worth noting that human population growth in the sub county has accelerated human activities on the habitat posing a great threat to flora and fauna species.

Historically, Rachuonyo community are renowned hunters and gatherers a skill acquired from their ancestral link to Rachuonyo who was one of the greatest and excellent hunters in Luo community. This activity could be threatening game found within the study area. However, most of the reviewed studies have focused on the mega- terrestrial fauna species as being threatened leaving the aspect of other species such as small game while some studies majorly focused on hunting as an anthropogenic activity at the expense of gathering aspect. Considering the global and local threats to terrestrial flora and fauna species coupled with the deficiency of the reviewed pieces of literature, the present study focused on examining the effect of anthropogenic activities (hunting, gathering and vegetation clearance) on terrestrial flora and fauna species conservation in Rachuonyo South Sub County, Homabay County.

## METHODOLOGY

The study employed a cross-sectional descriptive research design because data was collected at one point at a time from the study area and described to depict the effect of human activities on terrestrial flora and fauna species conservation. Rachuonyo South Sub County is in Homabay County. It is bordered by Rachuonyo North Sub County to the North, Rachuonyo East sub county to the North East, Rangwe sub county to the West and Kisii County to the South.

Rachuonyo South Sub County lies between longitudes 34o 14’ E and 35o 1’E and latitude 0o 23’ S and 0o 36’ S (figure). It has a total area of 259 square kilometres. Rachuonyo South sub County is divided into five wards namely; West Kasipul, East Kamagak, Central Kasipul, West Kamagak, and North Kamagak, these wards are further sub divide into twenty-five sub locations which had a specific boundary (Government of Kenya 2018). A stratified random sampling technique was employed to select respondents from five wards in the study area. The sample size was determined by the Fisher’s formula as articulated by Madhuri and Dheerji (2022):

$$n = \frac{z^2pq}{d^2}$$

Where: n = the desired minimum sample size (when target population is infinite), Z = the standard normal deviate at the required confidence level (Marginal error); at 95%, z=1.96, P= the proportion in target population estimated to have the characteristic being measured q=1-p,

d= Level of significance.

Source: Madhuri and Dheerji (2022) formula to determine sample size of a population.

Therefore: at 0.05 confidence level, z=1.96, p= (50% =0.5). Thus  $n = \frac{(1.96)^2 \times (0.5 \times 0.5)}{(0.05)^2} = 384$

Since the study population is finite at N=30990 household heads, then the sample size formula is Where n0 is the sample size for finite population, n =384, and N =30990.

$$= 379$$

Hence, the minimum sample size of the study was 379 indicating that questionnaires were administered to 379 household heads. The unit of analysis were household heads composed of either adult male or female in the study area who provided key information concerning human activities that were greatly threatening the existence of species in Rachuonyo South Sub County. The sample size per ward used in the study was attained by dividing the total number of households from each ward by the total households of the entire sub county and then multiplied by total sample size as shown in table 1 column 5.

Table 1: Sampling matrix of Respondents

No.	Name of Ward	Sampling method	Number of households(N)	ample size (n)
1.	West Kasipul	Stratified Random Sampling	12,148	$\frac{12148 \times 379}{30990} = 149$
2.	East Kamagak		8582	$\frac{8582 \times 379}{30990} = 101$
3.	Central Kasipul		2352	$\frac{2352 \times 379}{30990} = 29$
4.	West Kamagak		3496	$\frac{3,496 \times 379}{30990} = 43$
5.	North Kamagak		4412	$\frac{4,412 \times 379}{30990} = 54$
Total	5		30,990	379

Source: Modified from (KNBS 2019)

To get individual household heads from the sample size for each ward, stratified random sampling was employed by considering the wards as strata. The list of all household names was obtained from the Ward executive officer, to get the sampling frame after which the respondents were randomly picked at an interval of ten to avoid biasness. Internal consistency reliability was employed through computation of Cronbach alpha. The reliability statistics are displayed in table 2.

Table 2: Reliability Statistics

Cronbach's Alpha	N of Items
0.709	11

## RESULTS AND DISCUSSION

### Respondent's Response Rate

The United State Government Accountability Office (2017) defined response rate as the percentage of the eligible sampled elements of the target population who provided usable data for the analysis. According to GAO Internal Guidance Resource (2017) the computation of the response rate can be done using the following formula;

$$\text{Response rate} = \left[ \frac{\text{Usable Responses}}{\text{Eligible sampled element}} \times 100\% \right]$$

The present study adopted this formula to compute the respondents' response rate as shown in table 3.

Table 3: Respondents Response Rate Summary

Respondents	Eligible sampled element	Usable Response	Rate (%)
Household heads	379	365	96 %
Chiefs	5	4	80%
Environmental officers	2	2	100%
Herbalist & Hunter	2	2	100%
Forest Officers	2	2	100%

The respondents' response rate (household heads =96%, chiefs =80%, environmental officers =100%, herbalist and hunter =100%, forest officers =100%) as shown in Table 3 for this study were sufficient as they were far above the 50% bench mark rate proposed by the United State Government Accountability Office (2017). This high response rate enhanced the reliability and validity of the study.

### Socio-Demographic Characteristic of the Respondents

Connelly (2013) asserted that demographic characteristics of participants are essential in informing the readers of the research about what population outcome may generalize. In this study, the data collected focused on gender, age, household size, education, main occupation, period lived in the study area, approximate size of land and approximate income per month of the household heads as the active participants in human activities. The table below shows clearly the demographic characteristics of the respondents.



Table 4: Socio-Demographic Characteristic of the Respondents

Demographic Characteristics		Response Categories				
Variable	Indicator	Household Heads	Chiefs	Environment officer	Hunter/herbalist	Forest officer
Gender	Male	149 (41%)	3(75%)	1 (50%)	1(50%)	1(50%)
	Female	216 (59%)	1(25%)	1 (50%)	1(50%)	1(50%)
Age bracket	31- 40yrs	17 (5%)				
	41-50 years	112 (31%)				
	51-60 years	149 (40%)				
	Above 60 years	87 (24%)				
Level of Education	Primary	185 (51%)				
	Secondary	100 (27%)				
	Certificate/Diploma	49 (13%)				
	University	31 (9%)				
Period of Residence	5-10 years	3 (1%)				
	10-15 years	16 (4%)				
	15-20 years	112 (31%)				
	More than 20 years	234 (64%)				
Main Occupation	Formal Employment	53 (15%)				
	Casual Employment	25(7%)				
	Business	60 (16%)				
	Farming	227 (62%)				
Approximate land size	1-3 acres	259 (71%)				
	4-6 acres	90 (25%)				
	Above 7acres	16 (4%)				
Approximate Income	Ksh. 0-5000	103 (28%)				
	Ksh. 5001-10000	183 (50%)				
	Ksh. 10001-15000	28 (8%)				
	Above Ksh. 15000	51 (14%)				
Years of Service	Below 5yrs		1(25%)	0(00%)	0(0%)	0(0%)
	Above 5yrs		3(75%)	2(100%)	2(100%)	2(100%)

Gender wise, the study was balanced with both male and female respondents (Household: Male= 41%, Female=59%, Chief: male=75%, female=25%; Environment officer: male=50%, female=50%, herbalist: female=50%; hunter: male=50%, forest officer: male=50%, female=50%). This implied that for their livelihood, both male and female were actively engaged on anthropogenic activities which threatened the terrestrial flora and fauna species. UNEP, (2017) conform to the finding of this study (Table 4) that both men and women in the world are actively involved activities that threatens biodiversity. Further, UNEP noted that biodiversity is seen to be closely connected to development, access to resources, income-generating activities, food, and essential household products therefore on a daily routine both men and women collect, utilize, sell plant and animal products.

Age bracket in the study depicted maturity and experience of respondents. It was included because it was a determinant of people carrying out various anthropogenic activities, have a history of the occurrence of these activities, knowledge on various terrestrial flora and fauna species and how these activities have affected terrestrial flora and fauna species within Rachuonyo South Sub County. According to the study, the ages of respondents were distributed as: 31-40 years (5%), 41-50years (31%), 51-60 years (40%) and above 60 years (24%). From the results presented in Table 4, it was evident that most of the respondents were in age range from 51 to 60. This implied that mature and experienced indigenous respondents were considered to give history of terrestrial flora and fauna species that were indigenous and how the anthropogenic activities have affected them.

Level of education indicates the ability of a respondent to articulate issues regarding terrestrial flora and fauna species conservation, anthropogenic activities threatening species and the involvement of the respondent in these activities. In the study, the level of education was distributed as: Primary (51%), secondary (27%), certificate/diploma (13%) and university (9%). Analysis of education level indicated that majority of respondents had basic education (78%) which empowered them to provide the information inquired of by the study, at the same time, this analysis indicated the level of involvement of the respondents to the activities that threatens the survival of species. This implied that in as much as the respondents could articulate issues regarding species, majority of the respondents that had education below tertiary level were greatly involved in the anthropogenic activities. UNESCO, (2015) support this finding by indicating that, by improving knowledge, instilling values, fostering beliefs and shifting attitudes, education has considerable power to help individuals reconsider environmentally harmful lifestyles and behavior. Further, UNESCO, (2015) pointed out that 25% of people with less than secondary education worry about environment as opposed to 46% of people with tertiary education.

Period of residence and years of service in a given area may be commensurate with knowledge of the study area. It was included because it was an evidence that the information given by the respondents were truthful since, the more the time the respondents stay in the study area, the more reliable the information given. In the study, 3 (1%), 16 (4%), 112 (31%) and 234 (64%) respondents had stayed in the study area for periods 5-10 years, 10-15 years, 15-20 years and More than 20 years respectively. The study revealed that 64 % of the respondents have lived in the area for more than 20 years and 31% for 15-20 years (Table 7). This implied that majority of the respondents had adequate knowledge of the distribution of flora and fauna species, anthropogenic activities threatening species, the purpose of these activities and conservation measures in the study area. The studies (Omari, 2006; Babatunde & Qaim, 2009), supported this finding, they asserted that when people stay in a particular area for a longer duration, they get experience on the conditions of the environment, become aware of the available natural resources like terrestrial species, give relevant information to researchers on the various activities they do for a living.

Occupation and an approximate monthly income of the respondents gives light on the resource utilization within the study area. In this study, the formally employed, casually employed, business oriented and

farming oriented respondents accounted for 15%, 7%, 16% and 62% respectively and majority of respondents' monthly income fell in the range between Ksh. 5001 to Ksh. 10,000 which accounted for 50%. This implied that most respondents heavily depended on the available natural resources such as land and species for their livelihood. The analysis depicted that a greater percentage 62% of respondents depend on farming an activity that threatens the survival of species as a result of vegetation clearance at the same time majority of the respondents 50% had a low income of Ksh. 5001 to Ksh. 10,000. This can be interpreted that majority of the residents are poor making them to rely on activities such as farming, hunting and gathering that threatens the survival of terrestrial flora and fauna species. Gok report, (2018), reported that 74% and 97% of the household heads within Homabay County are employed in agriculture, and use wood fuel for cooking and that the region is characterized by high level of poverty.

Approximate land size in the study depicted the level of land fragmentation due to diversified activities of high population. According to the study, the land was distributed as: 1-3 acres (71%), 4-6 acres (25%) and above 7 acres (4%). The majority of respondents (71%) owned farms of average sizes of 1 acre 3 acres while 25% of the respondents owned farms of average sizes of 4 to 6 acres. This suggested that the respondents depended highly on land and that due to high population, the land is highly fragmented. Gok (2018), reported that the region is characterized by a rapidly growing population and high population density and falling food production putting pressure on the available resources.

Years of service of the key informants reflects their professional experience. In the study, the key informants which included; Chiefs, environment officer, herbalist, hunter and gatherer and forest officer had served for a period of above five years. This implied that the key informant had requisite experience. Cossham, A. & Johanson, G. (2019); Marshall, M. N. 1996), indicated that key informants are knowledgeable individuals that contribute a perspective on a research phenomenon or situation and have a role in the community or understanding of the phenomenon that gives them information that the researcher is seeking. Further, Marshall, indicated that they are expert source of information who due to their personal skills, or position within a society provide more information and deeper insight into what is going on around them.

**Terrestrial flora and fauna species threatened by anthropogenic activities in Rachuonyo South Sub County**

There was need to establish whether there were any terrestrial flora and fauna species being threatened within Rachuonyo South Sub County, hence the researcher sought to identify the various terrestrial flora and fauna species threatened by anthropogenic activities and their uses.

The study established that some terrestrial flora species were threatened in Rachuonyo South Sub County. The results are summarized in Table 5.

Table 5: Threatened Terrestrial Flora Species, Classification, Uses and the Threatening Anthropogenic Activities

Threatened terrestrial flora species		Classification (Indigenous Exotic)	Uses	Threatening Anthropogenic Activities
Local name	Botanical name (Kokwaro & Johns 2013)			
Anyuka	Vangueria madagascariensis	Indigenous	Fruit, firewood	Gathering/vegetation clearance
Achak	Euphorbia inaequilatera	Indigenous	Vegetables	Gathering/vegetation clearance

Adugo,	<i>Combretum molle</i>	Indigenous	Wood fuel	Gathering/vegetation clearance
Akech	<i>Chameecrista hildebrandtii</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Alii,	<i>Acacia seyal</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Ang'we	<i>Kedrostis foetidissima</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Pilipili	<i>Capsicum frutescens</i>	Indigenous	Spice, medicinal	Gathering/vegetation clearance
Apuoyo	<i>Chloris gayana</i>	Indigenous	Fodder, thatch	Gathering/vegetation clearance
Apoth	<i>Corchorus trilocularis</i>	Indigenous	Vegetables, medicinal	Gathering/vegetation clearance
Arumbe,	<i>Acacia hockii</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Arupiny	<i>Commiphora Africana</i>	Indigenous	Medicinal, firewood	Gathering/vegetation clearance
Atego,	<i>Keetia gueinzii</i>	Indigenous	Fruit	Gathering/vegetation clearance
Atilili	<i>Psiadia punctulata</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Atipa	<i>Asytasia gangetica</i>	Indigenous	Vegetables	Gathering/vegetation clearance
Ayiergweng,	<i>Boscia angustifolia</i>	Indigenous	Wood fuel	Gathering/vegetation clearance
Bongu,	<i>Fiscu sur</i>	Indigenous	Wood fuel	Gathering/vegetation clearance
Bondo	<i>Euphorbia candelabrum</i>	Indigenous	Glue	Gathering/vegetation clearance
Chwaa	<i>Tamarindus indica</i>	Indigenous	Fruit, medicinal, wood fuel	Gathering/vegetation clearance
Deg akeyo	<i>Cleome gynandra</i>	Indigenous	Vegetables, medicinal	Gathering/vegetation clearance
Det,	<i>Ormocarpum trichocarpum</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Dwelle	<i>Melia azeradarch</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Huyandawa	<i>Withania somnifera</i>	Indigenous	Fire wood, medicinal	Gathering/vegetation clearance
Kagna	<i>Vaunqueria apiculate</i>	Indigenous	Fruit, firewood	Gathering/vegetation clearance
Keyo,	<i>Combretum molle</i>	Indigenous	Wood fuel	Gathering/vegetation clearance

Konga	<i>Agave sisalama</i>	Indigenous	Fire, wood, construction,	Gathering/vegetation clearance
Koth-kiyombi	<i>Datura stramonium</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Kuogo,	<i>Lannea schweinfurthii</i>	Indigenous	Medicinal, wood fuel	Gathering/vegetation clearance
Madhare,	<i>Ozoroa insignis</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Milo	<i>Mucana pruriens</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Minya	<i>Cissus quadrangularis</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Modi	<i>Phragmites mauritianus</i>	Indigenous	Fodder	Gathering/vegetation clearance
Ndap-nyaluo	<i>Nicotiana tabacum</i>	Exotic	Smoking	Gathering/vegetation clearance
Nderma	<i>Basella alba</i>	Indigenous	Vegetables, medicinal	Gathering/vegetation clearance
Nduga	<i>Acacia drepanolobium</i>	Indigenous	firewood, medicinal	Gathering/vegetation clearance
Ng'owo	<i>Ficus wakefieldii</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Nyabend-winy	<i>Lantana camara</i>	Indigenous	Firewood, medicinal	Gathering/vegetation clearance
Nyajuok-olaw	<i>Acmella caulirhiza</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Nyanyiek mon	<i>Bidens pilosa</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Nyayado,	<i>Senna occidentalis</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Obala-ndagwa,	<i>Ricinus communis</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Ober	<i>Albizia coriaria</i>	Indigenous	Medicinal, wood fuel	Gathering/vegetation clearance
Obino,	<i>Senna didymobotrya</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Obokeran	<i>Psychotria peduncularis</i>	Indigenous	Brick making,	Gathering/vegetation clearance
Obolobolo	<i>Annona senegalensis</i>	Indigenous	Medicinal, firewood	Gathering/vegetation clearance
Obong	<i>Cajanus cajan</i>	Indigenous	Vegetables	Gathering/vegetation clearance
Ochok,	<i>Solanum incanum</i>	Indigenous	fodder, Brick making	Gathering/vegetation clearance
Ochol	<i>Lepisanthes senegalensis</i>	Indigenous	Medicinal, wood fuel,	Gathering/vegetation clearance

Ochok,	<i>Solanum incanum</i>	Indigenous	fodder, Brick making	Gathering/vegetation clearance
Ochol	<i>Lepisanthes senegalensis</i>	Indigenous	Medicinal, wood fuel,	Gathering/vegetation clearance
Ochuoga	<i>Carissa spinarum</i>	Indigenous	Fruit, medicinal, Firewood	Gathering/vegetation clearance
Odielo	<i>Commelina Africana</i>	Indigenous	Vegetables	Gathering/vegetation clearance
Ododo	<i>Amaranthus hybridus</i>	Indigenous	Vegetables, medicinal	Gathering/vegetation clearance
Ojuok	<i>Euphobia tirucalii</i>	Indigenous	Medicinal, hedge	Gathering/vegetation clearance
Okita,	<i>Plectranthus barbatus</i>	Indigenous	Medicinal	Gathering/Vegetation clearance
Okuro	<i>Alternantherapungens</i>	Indigenous	Weed	Gathering/Vegetation clearance
Okworo	<i>Clerodendrum myricoides</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Olando	<i>Indigofera arrecta</i>	Indigenous	Basketry ,med	Gathering/vegetation clearance
Olemo	<i>Ximenia Americana</i>	Indigenous	Fruit, firewood, Medicinal	Gathering/vegetation clearance
Oludh-koun	<i>Allophylus africanus</i>	Indigenous	firewood,	Gathering/vegetation clearance
Ombasa,	<i>Tylosema fassoglense</i>	Indigenous	Medicinal, food	Gathering/vegetation clearance
Omen	<i>Hibiscus aponeurus</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Omieny	<i>Lippia javanica</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Ondati,	<i>Teclea nobilis</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Onera	<i>Terminalia brownie</i>	Indigenous	construction, wood fuel, medicinal	Gathering/vegetation clearance
Ongodi	<i>Sida acuta</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Ong'ono,	<i>Sclerocarya birrea</i>	Indigenous	Fruit, medicinal	Gathering/vegetation clearance
Onunga	<i>Morus nigra</i>	Indigenous	Wood fuel, fruits	Gathering/vegetation clearance
Onuong'o	<i>Hygrophila schulli</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Ohoho	<i>Phytolacca dodecandra</i>	Indigenous	Medicinal	Gathering/vegetation clearance

Osani	<i>Leptochloa obtusiflora</i>	Indigenous	Fodder	Gathering/vegetation clearance
Oseno,	<i>Cordia monoica</i>	Indigenous	Firewood	Gathering/vegetation clearance
Osiri	<i>Acacia brevispica</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Osiri,	<i>Scotia myrtina</i>	Indigenous	Fruit, med.	Gathering/vegetation clearance
Otho	<i>Balanites aegyptiaca</i>	Indigenous	Wood fuel, fruit	Gathering/vegetation clearance
Pedo	<i>Harrisonia abyssinica</i>	Indigenous	Firewood, fodder,	Gathering/vegetation clearance
Pocho	<i>Ficus thonningii</i>	Indigenous	Medicinal, sacred	Gathering/vegetation clearance
Powo	<i>Grewia bicolor</i>	Indigenous	construction, wood fuel, basketry	Gathering/vegetation clearance
Roko	<i>Zanthoxylum chalybeum</i>	Indigenous	Medicinal	Gathering/vegetation clearance
Siala	<i>Markhamia lutea</i>	Indigenous	construction, wood fuel, medicinal	Gathering/vegetation clearance
Sangla	<i>Rhus natalensis</i>	Indigenous	Medicinal, wood fuel	Gathering/vegetation clearance
Yago	<i>Kigelia Africana</i>	Indigenous	Wood fuel, medicinal	Gathering/vegetation clearance
Yiendalusi	<i>Rhynchosia alegans</i>	Indigenous	Medicinal	Gathering/vegetation clearance

Source: field data 2022 and Kokwaro & Johns (2013)

The response from household questionnaires and the key informants indicated that some terrestrial flora species are threatened in Rachuonyo South Sub County as shown in Table 5. A total of 80 flora species were identified as threatened. Most of the threatened flora species identified were indigenous apart from Ndap Nyaluo (*nicotiana tabacum*) which is exotic. Indigenous flora species threatened included; Anyuka (*Vangueria madagascariensis*), Achak (*Euphorbia inaequilatera*), Osiri, (*Scotia myrtina*), Adugo, (*Combretum molle*), Akech (*Chameecrista hildebrandtii*), Alii, (*Acacia seyal*), Ang'we (*Kedrostis foetidissima*), Pilipili (*Capsicum frutescens*), Otho (*Balanites aegyptiaca*), Pedo (*Harrisonia abyssinica*), Pocho (*Ficus thonningii*), Powo (*Grewia bicolor*), Roko (*Zanthoxylum chalybeum*), Siala (*Markhamia lutea*), Sangla (*Rhus natalensis*), Yago (*Kigelia Africana*) and Yiendalusi (*Rhynchosia alegans*) among others (Table 5).

The uses of the identified terrestrial flora species were established to be wood fuel, fruits, vegetables, fodder, construction, timber, brick making, for basketry and medicinal purposes. These uses led to anthropogenic activities such as vegetation clearance, hunting and gathering which posed a great threat to the identified flora species. This implies that Rachuonyo South is endowed with various terrestrial flora species which support their livelihood in areas such as food, wood fuel, medicinal and construction among others and that the local community majorly depend on indigenous species at the expense of exotic species this has posed heavy threat to the existing indigenous species leading to extinction of some species. An interview with key informants revealed:

Initially, Rachuonyo South Sub County was heavily forested with indigenous trees, thick bushes and shrubs, but currently due to increased human activities such as charcoal burning, brick making, rural access roads and crop farming most species have reduced in number and specific species used for herbal medicine have become rare forcing the herbalist to take a long duration in gathering herbs. (Female herbalist from Kotieno Sub location in West Kasipul – December 2022).

Another key informant also revealed that:

As a result of increased human activities such as charcoal burning, firewood collection and brick making accelerated by rapid population growth and poverty in the sub county most indigenous terrestrial flora species such as yago (*Kigelia Africana*), siala (*Markhamia lutea*), alii (*Acacia seyal*), konga (*Agave sisalama*) kuogo (*Lannea schweinfurthii*), ng’owo (*Ficus wakefieldii*), ober (*Albizia coriaria*), onera (*Terminalia brownie*) and otho (*Balanites aegyptiaca*) have been greatly threatened and that some species such as oseno (*Cordia monoica*), keyo (*Combretum molle*), roko (*Zanthoxylum chalybeum*) and dwele (*Melia azeradarch*) have become extinct within the region. (Forest Warden at Kodera Forest– December 2022)

This implies that the species are greatly essential to the livelihood of the local community. However, the rate at which these species were being used have threatened their existence and these threat were due to increased human activities enhanced by rapid population growth and high poverty level within the study region. Hence, there is a likelihood of high rate of species extinction in the next few decades within the study area if the poverty level and rapid growth of human population is not controlled.

The study established the current status of terrestrial flora species richness and the results were summarized in Table 6.

Table 6: The current status flora species richness

Questions Scales (Frequencies/ percentages)	Statistics			
	Decreasing	No change	Mean	Std. Dev.
What is the current status of terrestrial flora species?	51(14%)	278(76%)	33(9%)	1.96 0.487

Source: Field data, 2022

Table 6 shows that 76% of respondents noted a decrease in the number of terrestrial flora species, they further identified the reasons for the decrease which were found to be linked to the uses of terrestrial flora species (Table 6), 14% of the respondents indicated an increase in species richness basing their argument on tree planting, agroforestry, planting of vegetables for consumption, usage of modern technology of cooking and building while 10% indicated no change in species richness. This finding shows that the distribution of the response from household heads leaned highly toward “Decreasing” (mean=1.96 and standard deviation= 0.487) as presented in Table 6. This quantitative decline in species richness was explained by the qualitative data resulting from the summary on the uses of the terrestrial flora species (Table 6). Additionally, an interview with key informants revealed that:

Most of the indigenous community are greatly involved in activities such as crop farming, settlement of new homes, charcoal burning, firewood collection and brick making and these activities have posed threats to terrestrial flora species as no replacement is done for the species cut at the same time once an area has been cleared for crop farming and settlement it is permanently left for that activity leaving no room for regrowth of the species. Further, due to population pressure more habitat are constantly encroached this has made terrestrial flora species to decrease in number thus habitat loss. (Administrative Chief from East Kamagak – December 2022).



This explains the fact that terrestrial flora species are greatly essential for the livelihood of the residents of Rachuonyo South Sub County, however, rapid growth of human population has accelerated human activities within the study region that exerts a lot of pressure on the available flora species thus threatening them to extinction. These human activities (uses of the species) are also important to the local community, some of them such as crop farming, charcoal burning and brick making among others are sources of earning a living within the study area. It is evident, therefore, that the uses of these species are linked to the anthropogenic activities (vegetation clearance, and gathering). This eventually led to loss and fragmentation of habitat that caused fauna species to relocate to safer and larger habitat and even those that would remain would eventually die due to competition for food. Further there was a clear indication that the residents were ignorant of the various species conservation measures put in place within the study area as evidenced by the responses of the 14% respondents. It barred the residents from managing habitat by practicing activities which prevented degradation and thereby enhancing the quality of vegetation.

The findings of IUCN (2019), noted that increase in human population has led to the release of anthropogenic activities that lead to loss and fragmentation of habitat which threatens species to extinction. Similarly, Carrington (2020) asserted that the key reasons for the loss of plant species is the clearance of wild habitat to create farmland, overharvesting of wild plants for herbal medicines that has threatened 723 species with extinction. These findings from IUCN (2019) and Carrington (2020) are consistent with the findings of the present study. However, IUCN studied population density, diversity and abundance of antelope species in a Lake National park while Carrington (2020) on the other hand focused on the race against time to save plants and fungi. These studies did not document on specific human activities such as vegetation clearance, hunting and gathering and how these activities are affecting terrestrial flora and fauna species conservation an area studied by the current study.

The study further established whether terrestrial fauna species were also threatened in Rachuonyo South Sub County. The results are summarized in Table 7.

Table 7: Identified threatened terrestrial fauna species, classification, uses and the threatening anthropogenic activities

Threatened terrestrial fauna species		Classification (indigenous/exotic)	Uses	The threatening Anthropogenic activities
Local name	Botanical name (Kokwaro & Johns 2013)			
Abur	<i>Redunca redunca</i>	Indigenous	Meat	Hunting, vegetation clearance
Aidha	<i>Protoxerus stangeri bea</i>	Indigenous	Meat	Hunting, vegetation clearance
Apul	<i>Kobus ellipsi prymnus</i>	Indigenous	Meat	Hunting, vegetation clearance
Apwoyo	<i>Lepus saxatilis</i>	Indigenous	Meat	Hunting, vegetation clearance
Bim	<i>Papio cynocephalus</i>	Indigenous	Not specified	Vegetation clearance
Chiewu	<i>Atherurus africanus</i>	Indigenous	Meat	Hunting, vegetation clearance
Dwe	<i>Tragelaphus spekei</i>	Indigenous	Meat	Hunting, vegetation clearance
Fuko	<i>Tachyoryctes splendens</i>	Indigenous	Meat	Hunting, vegetation clearance

Gwothim	<i>Lycaon pictus</i>	Indigenous	Not identified	Vegetation clearance
Jowi	<i>Syncerus caffer</i>	Indigenous	Meat, horns	Hunting, vegetation clearance
Kibwe	<i>Canis mesomelas</i>	Indigenous	Not identified	Vegetation clearance
Mbeche	<i>Potamochoerus porcus</i>	Indigenous	Meat	Hunting, vegetation clearance
Mwanda	<i>Oreotragus oreotragus schillingsi</i>	Indigenous	Meat	Hunting, vegetation clearance
Mwok	<i>Orycteropus afer</i>	Indigenous	Meat, skin	Hunting, vegetation clearance
Ngau	<i>Sylvicarpa grimmia</i>	Indigenous	Meat, horn, Skin	Hunting, vegetation clearance
Njiri	<i>Phacochoerus aethiopicus</i>	Indigenous	Not identified	vegetation clearance
Nyakech	<i>Aepyceros melampus</i>	Indigenous	Meat	Hunting, vegetation clearance
Ogwang Kibikibi	<i>Mellirora capensis</i>	Indigenous	Not identified	Vegetation clearance
Ogwang-oluwo-bondo	<i>Nandinia binotata</i>	Indigenous	Not identified	Vegetation clearance
Omoro	<i>Hyppotragus equines</i>	Indigenous	Skin	Hunting, vegetation clearance
Ondiek	<i>Crocota crocuta</i>	Indigenous	Not identified	Vegetation clearance
Ong'er	<i>Cercopithecus aethiops pygerythrus</i>	Indigenous	Not identified	Vegetation clearance
Oyieyo	<i>Aethomys chrysophilus</i>	Indigenous	Not identified	Vegetation clearance
Riwo	<i>Connocheates taurinus</i>	Indigenous	Meat	Hunting, vegetation clearance

Source: Field data 2022 and (Kokwaro & Johns 2013)

The response from household questionnaires and the key informants interviewed indicated that some terrestrial fauna species were threatened in Rachuonyo South Sub County as shown in Table 7. A total of 24 fauna species were identified as threatened. All the fauna species identified were indigenous and they included Abur (*Redunca redunca*), Aidha (*Protoxerus stangeri* bea), Apul (*Kobus ellipsi prymnus*), Apwoyo (*Lepus saxatilis*), Bim (*Papio cynocephalus*), Chiewu (*Atherurus africanus*), Dwe (*Tragelaphus spekei*), Fuko (*Tachyoryctes splendens*), Gwothim (*Lycaon pictus*), Jowi (*Syncerus caffer*), Kibwe (*Canis mesomelas*), Mbeche (*Potamochoerus porcus*), Mwanda (*Oreotragus oreotragus schillingsi*), Mwok (*Orycteropus afer*), Ngau (*Sylvicarpa grimmia*), Njiri (*Phacochoerus aethiopicus*), Nyakech (*Aepyceros melampus*),Ogwang Kibikibi (*Mellirora capensis*),Ogwang- oluwo-bondo (*Nandinia binotata*), Omoro (*Hyppotragus equines*), Ondiek (*Crocota crocuta*), Ong'er (*Cercopithecus aethiops pygerythrus*), Oyieyo (*Aethomys chrysophilus*) and Riwo (*Connocheates taurinus*) (Table 7).

The study established that fauna species were used for meat, horn and skin and that these uses resulted in anthropogenic activity (hunting and gathering) which was found to be a threat to species conservation (Table 7). An interview with key informant revealed that:

Rachuonyo South Sub County was once sparsely populated with human, having few patches of barren land for crop farming while the rest of the land was covered by vegetation and various animal species were roaming in groups, currently the region has high human population, scattered shrubs and reduced fauna species while other such as riwo, nyakech, ngau, and jowi becoming extinct (Administrative Chief from North Kamagak – December 2022).

This implies that Rachuonyo South is endowed with various terrestrial fauna species which are greatly used by the local community as a source of game meat to replace beef which are costly and so most of them cannot afford, while other species are hunted for their horns which are used for making musical instrument known as “abuu” and for their skin which is used for making traditional drums for various local churches and traditional regalia worn by council of elders during special ceremonies and functions. This indicate that the community heavily depend on these species for their survival however the overdependence on them have threatened some of the species to extinction and the community is ignorant about the threat caused to the species due to overdependence.

The study established the current status of terrestrial fauna species richness. Their response is summarized in Table 8.

Table 8: The current status fauna species richness

Questions	Scales (Frequencies/ percentages)			Statistics	
	Increasing	Decreasing	No change	Mean	Std. Dev.
What is the current status of terrestrial fauna species?	45(12%)	287(79%)	33(9%)	1.97	0.462

Source; Field data, 2022

The findings on Table 7 revealed that; 79% of the respondents indicated a decline in fauna species richness (Table 8) due to the uses of species as shown in Table 10, 12% of the respondents noted that the species richness are increasing due to rearing of domestic animals and keeping poultry for consumption and usage of modern instruments in various churches. while 9% recorded no change. This finding showed that the distribution of the response from household heads leaned highly toward “decreasing” (mean=1.97 and standard deviation= 0.462) as presented in Table 8. This quantitative decline in species richness was explained by the qualitative data resulting from the summary on the uses of the terrestrial fauna species (Table 7). Further, the uses of these species were also observed to be connected to the anthropogenic activities (vegetation clearance, hunting and gathering). It is evident that despite the threat the local community was causing to terrestrial fauna species most of them were still engaged on the same activities. These activities are however key to their livelihood. There is therefore need to create awareness to the local community on the importance of species to ecosystem, effects of their destruction and further engaging them on activities such as poultry rearing to help them find other sources of protein.

This finding is in agreement with a report by WWF (2014), which recorded that there has been a constant decline in fauna population over the past 40 years and that a period between 1970 and 2012 experienced a decline of 52% of all fauna species population. Further, (WWF report, 2019), affirmed that about 99.9% of species that have ever lived have become extinct. In as much as this study indicated the quantitative rate of decline of fauna species, it did not list fauna species threatened and specific reasons for their threat. The current study has listed specific fauna species threatened and the factors that pose threat to them.

Therefore, it is a clear indication that both terrestrial flora and fauna species identified within the study area were facing drastic decline due to anthropogenic activities such as vegetation clearance, hunting and gathering. These findings were consistent with those of (Butchart, 2010; Hoffmann, 2010) who noted that as mankind is increasingly using the natural resources and modifying the environment, the terrestrial species is in decline and that much of the decline were due to habitat loss and transformation. However, these studies focused on timing and direction of trend inflections as well as estimating the trend in which species population changed over time. Furthermore, Hoffmann (2010) coded each species according to IUCN threats, conservation actions and utilization action classification scheme. The current study however, studied specific anthropogenic activities actually threatening terrestrial flora and fauna species conservation in Rachuonyo South.

Effect of hunting and gathering on terrestrial flora and fauna species conservation in Rachuonyo South Sub County.

After identifying the terrestrial flora and fauna species threatened, the second objective sought to explain hunting and gathering as an anthropogenic activity that threatens terrestrial flora and fauna species identified in objective one. The response from household heads and the key informants are presented on Table 9 below.

Table 9: Frequency distribution of Anthropogenic Activity (hunting and gathering)

Questions Scales (frequency and percentages)	Statistics			
	Yes	No	Mean	Std. Dev
Is hunting and gathering activity taking place in this region?	360(99%)	5(1%)	1.01	0.116
Do you or any member of your household engage in gathering activity?	257(70%)	108(30%)	1.30	0.457
In your opinion, is hunting and gathering activity affecting plants and animal species in this area?	285(78%)	80(22%)	1.22	0.414

Source: Field data, 2022

Responses from the household heads indicated that hunting and gathering was taking place within the study area as shown in Table 9. About 99% of the respondents indicated the presence of the activity while 70% accepted their involvement in the activity. These findings indicated that the distribution of the response leaned highly toward “Yes” (mean=1.01 and standard deviation= 0.116 and mean of 1.30 and standard deviation of 0.457) respectively as shown on Table 9. It is therefore clear that hunting and gathering as human activity was prevalent within the study area and most respondents were heavily involved in the activity as a source of acquiring food (from both game meat and traditional vegetables), medicine and firewood among others for their livelihood. However, in as much as this activity is crucial for the survival of the local community, it is greatly endangering the indigenous species causing some to be extinct. An interview with key informant revealed that:

Majority of the local inhabitants have no proper source of income for their livelihood apart from agriculture and small scale business therefore they are highly depending on flora species for local vegetable (such as achak, apoth, atipa, obong, odielo and ododo among others); for medicinal purposes, firewood, charcoal burning (for sale and personal use), construction, basketry (for sale) and fauna species are hunted for game meat, skin and horn. This activity is on an increasing trend due to increase of human population making each house hold to have a larger population being fed and later on settled hence posing a lot of pressure to

the naturally available resources.

This implies that hunting and gathering was prevalent within the study area as majority of the respondents were actively involved in the activity as a means of food procurement, construction, basketry and medication among others. This activity was accelerated by their low economic power justified by their approximate income per month that ranges between Ksh.5001 to Ksh.10000 (Table 3). This therefore, resulted in unsustainable use of flora and fauna species which was a threat to their conservation.

The presence of hunting and gathering as human activity occurring in Nyalenda sub Location was justified by plate 1a and b as shown below.



Plate 1(a)

plate 1(b)

**Plate 1(a and b):**Hunting and Gathering activity in Nyalenda and Sino Kogola respectively.

The above findings were supported by the results from the previous studies carried out by (Andy, Milner-Gulland, Ingram & Aidan, 2019) and (Nasi, Brown, Wilkie, Bennett, Tutin, Van Tol & Christophersen, 2008) which asserted that time taken by individual in hunting depends entirely on their economic power and that in times of hardship hunting act as economic guard. In as much as the outcome of these studies supported the findings of the present study, however, these studies focused on hunting for consumption on tropics and tropical forest respectively further, Andy et, al. (2019), studied on influences of hunting methods and effort on the types of animals caught in the Tropics. They did not document on how hunting and gathering as an anthropogenic activity affects both flora and fauna species. This gap was bridged by this present study.

A research carried out in Latin America, Asia and Africa by (Nielsen et al. 2018), on the Importance of Wild Meat in the Global South: noted that once a year, 39% of household out of the 7978 household interviewed hunted wildlife for meat and that reliance on wild meat is highest among the poorest households. A study in West Africa by (Schulte-Herbrüggen, Marcus, Katherine, Laura Charlotte & Guy, 2013) noted that conservation and rural livelihood of many who depends entirely on bush meat for income and food are greatly threatened by unsustainable hunting. It is noted that these studies concentrated on the economic importance of wild meat to rural population, patterns of hunting, wildlife depletion, and the integration of hunting into agricultural livelihoods. Also, the study was done in an intensively managed farm forest (protected area). The current study however, was conducted in an unprotected area, and did not consider economic importance of hunting and gathering activity rather, it concentrated on effect of hunting and gathering activity on species conservation.

Household heads were asked to list both flora and fauna species being hunted and gathered stating reasons why they were being hunted and gathered. Evidence from questionnaires and key informants interviewed identified various flora and fauna species hunted and gathered which used to generate Table 10.

Table 10: Terrestrial Flora Species Gathered and Fauna Species Hunted and Reasons.

Flora gathered	Botanical name	Uses	Fauna hunted	Botanical name	Uses
Anyuka	<i>Vangueria madagascariensis</i>	Fruit, firewood	Abur	<i>Redunca redunca</i>	Meat
Achak	<i>Euphorbia inaequilatera</i>	Vegetables	Aidha	<i>Protoxerus stangeri bea</i>	Meat
Adugo,	<i>Combretum molle</i>	Wood fuel	Apul	<i>Kobusellipsi prymnus</i>	Meat
Akech	<i>Chameecrista hildebrandtii</i>	Medicinal	Apwoyo	<i>Lepus saxatilis</i>	Meat
Alii,	<i>Acacia seyal</i>	Wood fuel, medicinal	Chiewu	<i>Atherurus africanus</i>	Meat
Ang'we	<i>Kedrostis foetidissima</i>	Medicinal	Dwe	<i>Tragelaphus spekei</i>	Meat
Pilipili	<i>Capsicum frutescens</i>	Spices, medicinal.	Fuko	<i>Tachyoryctes splendens</i>	Meat
Apuoyo	<i>Chloris gayana</i>	Fodder ,construction	Jowi	<i>Syncerus caffer</i>	Meat, horns
Apoth	<i>Corchorus trilocularis</i>	Vegetable, medicinal	Mbeche	<i>Potamochoerus porcus</i>	Meat,
Arumbe,	<i>Acacia hockii</i>	Wood fuel, medicinal	Mwanda	<i>Oreutragus oreotragus schillingsi</i>	Meat
Arupiny	<i>Commiphora Africana</i>	Medicinal, firewood	Mwok	<i>Orycteropus afer</i>	Meat, skin
Atego,	<i>Keetia gueinzii</i>	Fruit	Ngau	<i>Sylvicapra grimmia</i>	Meat, skin, horn
Atilili	<i>Psiadia punctulata</i>	Medicinal	Nyakech	<i>Aepyceros melampus</i>	Meat,
Atipa	<i>Asytasia gangetica</i>	Vegetables	Omoro	<i>Hyppotragus equines</i>	Skin
Ayiergweng,	<i>Boscia angustifolia</i>	Wood fuel	Riwo	<i>Connocheates taurlnus</i>	Meat
Bongu,	<i>Fiscu sur</i>	Wood fuel			
Bondo	<i>Euphorbia candelabrum</i>	Glue			
Chwaa	<i>Tamarindus indica</i>	Fruit, medicinal, wood fuel			
Deg akeyo	<i>Cleome gynandra</i>	Vegetables, medicinal			
Det,	<i>Ormocarpum trichocarpum</i>	Medicinal			
Dwelle	<i>Melia azeradarch</i>	Wood fuel, medicinal			
Huyandawa	<i>Withania somnifera</i>	firewood, medicinal			

Kagna	Vaungueria apiculate	Fruit, firewood		
Keyo,	Combretum molle	Wood fuel		
Konga	Agave sisalama	fire wood, construction,		
Koth-kiyombi	Datura stramonium	Medicinal		
Kuogo,	Lanea schweinfurthii	Medicinal, wood fuel		
Madhare,	Ozoroa insignis	Medicinal		
Milo	Mucana pruriens	Medicinal		
Minya	Cissus quadrangularis	Medicinal		
Modi	Phragmites mauritianus	Fodder		
Ndap-nyaluo	Nicotiana tabacum	Smoking		
Nderma	Basella alba	Vegetables, medicinal		
Nduga	Acacia drepanolobium	firewood, medicinal,		
Ng'owo	Ficus wakefieldii	Wood fuel, medicinal		
Nyabend-winy	Lantana camara	Firewood, medicinal		
Nyajuok-olaw	Acmella caulirhiza	Medicinal		
Nyanyiek mon	Bidens pilosa	Medicinal		
Nyayado,	Senna occidentalis	Medicinal		
Obala-ndagwa,	Ricinus communis	Medicinal		
Ober	Albizia coriaria	Medicinal, wood fuel		
Obino,	Senna didymobotrya	Medicinal		
Obokeran	Psychotria peduncularis	Brick making,		
Obolobolo	Annona senegalensis	Medicinal, firewood		
Obong	Cajanus cajan	Vegetables		
Ochok,	Solanum incanum	fodder, brick making		
Ochol	Lepisanthes senegalensis	Medicinal, wood fuel,		
Ochuoga	Carissa spinarum	Fruit, medicinal, fire wood		
Odielo	Commelina Africana	Vegetables		
Ododo	Amaranthus hybridus	Vegetables, medicinal		
Ojuok	Euphobia tirucalii	Medicinal, fencing		
Okita,	Plectranthus barbatus	Medicinal		

Okworo	<i>Clerodendrum myricoides</i>	Medicinal			
Olando	<i>Indigofera arrecta</i>	Basketry , medicinal			
Olemo	<i>Ximenia Americana</i>	Fruit, firewood, medicinal			
Oludh-kuon	<i>Allophylus africanus</i>	firewood,			
Ombasa,	<i>Tylosema fassoglense</i>	Medicinal, fruit			
Omen	<i>Hibiscus aponeurus</i>	Medicinal			
Omieny	<i>Lippia javanica</i>	Medicinal			
Ondati,	<i>Teclea nobilis</i>	Wood fuel, medicinal			
Onera	<i>Terminalia brownie</i>	Pole, wood fuel, medicinal			
Ongodi	<i>Sida acuta</i>	Wood fuel, medicinal			
Ong'ono,	<i>Sclerocarya birrea</i>	Fruit, medicinal			
Onunga	<i>Morus nigra</i>	Wood fuel, fruits			
Onuong'o	<i>Hygrophila schulli</i>	Medicinal			
Ohoho	<i>Phytolacca dodecandra</i>	Medicinal			
Osani	<i>Leptochloa obtusiflora</i>	Fodder			
Oseno,	<i>Cordia monoica</i>	Firewood			
Osiri	<i>Acacia brevispica</i>	Medicinal			
Osiri,	<i>Scotia myrtina</i>	Fruit, medicinal			
Otho	<i>Balanites aegyptiaca</i>	Wood fuel, fruit			
Pedo	<i>Harrisonia abyssinica</i>	Firewood, fodder,			
Pocho	<i>Ficus thonningii</i>	Medicinal, sacred			
Powo	<i>Grewia bicolor</i>	construction, wood fuel, basketry			
Roko	<i>Zanthoxylum chalybeum</i>	Medicinal			
Siala	<i>Markhamia lutea</i>	construction, wood fuel medicinal			
Sangla	<i>Rhus natalensis</i>	Medicinal, wood fuel			



Yago	Kigelia Africana	Wood fuel, medicinal			
Yiendalusi	Rhynchosia alegans	Medicinal			

Source: Field data, 2022

The findings presented on Table 10 indicated that flora and fauna species are being gathered and hunted respectively. There are 79 flora species gathered for medicinal purposes, fruit, basketry, wood fuel, construction, vegetable among other uses while 15 fauna species are hunted and gathered for the purpose of meat, skin and horn (Table 10). Some of the flora species being gathered include; Achak (*Euphorbia inaequilatera*), Osiri, (*Scotia myrtina*), Adugo, (*Combretum molle*), Akech (*Chameecrista hildebrandtii*), Alii, (*Acacia seyal*), Ang’we (*Kedrostis foetidissima*), Pilipili (*Capsicum frutescens*), Otho (*Balanites aegyptiaca*), Pedo (*Harrisonia abyssinica*), Pocho (*Ficus thonningii*), Powo (*Grewia bicolor*), Roko (*Zanthoxylum chalybeum*), Siala (*Markhamia lutea*), among others and fauna species being hunted include; Abur (*Redunca redunca*), Aidha (*Protoxerus stangeri*), Apool (*Kobus ellipsi prymnus*), Apwoyo (*Lepus saxatilis*), Jowi (*Syncerus caffer*), Kibwe (*Canis mesomelas*), Mbeche (*Potamochoerus porcus*), Mwanda (*Oreotragus oreotragus schillingsi*), Ngau (*Sylvicarpa grimmia*), Nyakech (*Aepyceros melampus*), Ogwang Kibikibi (*Mellirora capensis*), Omoro (*Hyppotragus equines*), and Riwo (*Connocheates taurinus*).

It is evident therefore that flora species are more threatened than fauna species in Rachuonyo South Sub County. This is because from Table 10, the uses of flora species are more than the purposes for which fauna are hunted and gathered. Majority of the community heavily depended on flora species for herbal medicine, vegetables, fruits, basketry. About 97% of the population use wood fuel as a source of energy. This has led to the clearance of vegetation as seen in Plate

1(a) and (b) causing the destruction of fauna habitat (especially for large mammal) leading to migration, reduction and extinction of species as seen in Plate 1(a) and (b). Further, this clearance has caused hunters to trek over a long distance on an open field in search for fauna species a clear indicator of migration, reduction and extinction of fauna species within the study area.

These findings are consistent with (IUCN report, 2019) stating that yearly depletion rate of flora and fauna species were 34% and 25% respectively. Meanwhile in Kenya according to (Ogotu, Piepho, Said, Ojwang, Njino, Kifugo & Wargute, 2016), the rate of depletion of flora and fauna were 69% and 68% respectively.

The household heads further responded on the question if hunting and gathering are affecting flora and fauna species and how species of flora and fauna are affected. The responses are summarized in Tables 11 and 12 respectively.

Table 11: Whether Hunting and Gathering Affects Terrestrial Flora and Fauna Species

Is Hunting and Gathering affecting Terrestrial Flora and Fauna Species	Number of Respondents	Percentage (%)
Yes	285	78
No	80	22
Total	365	100

Mean 1.22 and Standard deviation 0.414

Source: Field data, 2022

Table 12: Ways in which Terrestrial Flora and Fauna Species are affected by Hunting and Gathering

In which way are flora and fauna species affected	No of Respondents	Percentages (%)
Extinction of some flora and fauna species	266	73
Relocation of fauna species	314	86%
Reduction of flora and fauna species richness	347	95%
Habitat loss,	336	92%
Fragmentation of the habitat	296	81%

Source: field data 2022

The result presented on Table 11 showed that 78% of respondents indicated “Yes” while 22% noted “No”. The distribution of the response towards this question was moderately spread however, it was still leaning toward “Yes” (mean=1.22, standard deviation=0.414). Further, the study revealed that 73% of flora and fauna species were affected by extinction, 86% of fauna have relocated, 95% by reduction of species number 92% by Habitat loss, and 81% fragmentation of habitat (Table 12). An interview with some key informants revealed;

Hunting and gathering has led to relocation of fauna species, reduction of flora and fauna species richness, extinction of some flora and fauna species such as nyakech (that used to walk in group of fifties), jowi, njiri, bim, abur, oseno and yago, habitat loss, fragmentation of the habitat, adaptation to new feeds in fauna species, decline in predators, increase of the prey and imbalance in the biomass are ways in which hunting and gathering has affected flora and fauna species (A male hunter at Nyalenda Sub location and female herbalist at Kamuma Sub Location – December 2022).

This information confirms that terrestrial flora and fauna species are highly affected by hunting and gathering activity within the study area as indicated by the responses above, majority of the respondents noted a decline in species as a result of the uses of the species and over dependence for instance 95% and 73% of the respondents noted reduction and extinction of species respectively some of the species noted to have become extinct are yago, oseno, roko, nyakech, bim, jowi njiri among others. This decline and extinction of species has led to imbalance on the ecosystem. At the same time 92% and 81% of the respondents indicated loss and fragmentation of habitat this has exposed the land to agents of erosion rendering the soil unable to support the growth of more flora due to depletion of nutrient.

These findings are justified by Mazor et al. (2018) who reported that the global diversity is highly threatened by hunting of wild animals and that 20% of species in the IUCN Red list are directly threatened by hunting. Similarly, Ripple et al., (2015) also indicated that over 300 mammal species are threatened by hunting. In as much as these findings conforms to the present findings, however, these studies focused on how drivers of biodiversity loss can be realigned to match the predicted severity for an informed policy goals and threats of large herbivores of body mass equal to or greater than 100kg and over looked ecosystem effects respectively. The present study however did not examine how to realign drivers of biodiversity loss with the predicted severity rather concentrated how plants and animals are threatened by hunting and gathering.

Further, studies by Lusweti, (2011); Ariya, (2015); Justin, (2017); and Turtenwald, (2018) asserted that hunting leads to extinction of species, 83% reduction fauna species and modification of habitat due to fragmentation thus barring stability and continuity of the habitat making species to be isolated thus

enhancing species extinction. In addition, Andy, Milner- Gulland, Ingram & Aidan (2019) noted that hunting in the tropics are at unprecedented rate.

Even though the outcome of the above studies conquered with the current study, these studies did not consider hunting and gathering as an anthropogenic activity threatening both flora and fauna species. For instance, Andy et al. (2019), discussed influences of hunting methods and effort on the types of animals caught, the efficiency of harvest, and the implications of these factors for sustainability. Meanwhile, Lusweti (2011) studied relevance, importance and status of biodiversity in Kenya while Ariya (2015) focused on establishing the level of wildlife utilization, types and sources of wildlife snaring materials in Ruma National Park. Above studies did not document on the effect of hunting and gathering on both flora and fauna species, a gap which was bridged by the present study.

The study further established the frequency of occurrence of hunting and gathering and the results were summarized in Table 13.

Table 13: Frequency of the occurrence of Hunting and Gathering

Frequency of Hunting and Gathering	Number of respondents	Percentage (%)	Cumulative Percentage (%)
Daily	117	32	32
Weekly	168	46	78
Monthly	44	12	90
Yearly	7	2	92
Not at all	29	8	100
Total	365	100	

Mean 2.08 and Standard Deviation 1.109

Source: Field data, 2022

The finding presented on Table 13 showed that 46% of respondents stated weekly occurrence, 32% recorded daily, 12% recorded monthly, 8% stated non-involvement while 2% stated yearly occurrence. The response was not evenly spread within the scale but greatly leaned toward weekly and daily. This indicated that the frequency of hunting and gathering was very high (mean=2.08, standard deviation=1.109), making the cumulative annual hunting and gathering rate in the study at 90% (Daily 32%, weekly 46%, monthly 12% totaling to 90%). This result implied that hunting and gathering activity was on an increasing trend within the study area. The implication of these data is that the increasing trend has caused threat to terrestrial species leading to a decline and extinction to some flora and fauna, migration and loss of habitat. If the activity is not curtailed, then in the near future the region shall have lost a greater percentage of species.

These findings are justified by Schulze, Knights & Coad (2018) in their study about an assessment of threats to terrestrial in protected areas which reported that unsustainable hunting and collection of terrestrial animals was the most frequent (61%), followed by impacts of recreational activities (55%), fire or its suppression (49%), invasive alien species (48%), and gathering of terrestrial plants (48%). Critique of the above study revealed the study focused on assessing threats to terrestrial species in protected areas. The current study however, was carried out in an unprotected area and did not consider threats to terrestrial species rather effects of specific human activities such as hunting and gathering and vegetation clearance to terrestrial flora and fauna species conservation. It is evident from the above analysis that hunting and gathering as an anthropogenic activity is prevalent within Rachuonyo South Sub

County and this may be attributed to lack of public awareness on the importance of terrestrial species to the ecosystem and the effect of their decline to the livelihood of the community. This has posed a great threat to terrestrial flora and fauna species conservation.

## CONCLUSION

The study found out that in Rachuonyo South sub county there were 80 terrestrial flora and 24 fauna species threatened and that terrestrial flora were more threatened than the terrestrial fauna. The threats to these species were found to be due to anthropogenic activities such as hunting, gathering and vegetation clearance which were highly connected to uses of species such as wood fuel, brick making, logging for lumbering, road creation and expansion and crop farming, over stocking.

Hunting and gathering as an anthropogenic activity was found to prevalent within the study area. Most members of the household were engaged in this activity as was evident by most respondents accepting that hunting and gathering was affecting terrestrial flora and fauna species within the study area. However, the respondents were not sure whether there were effective conservation measures in place to mitigate the effects of the mentioned anthropogenic activity.

## RECOMMENDATION

There is a need to create an awareness on the importance of terrestrial species to the ecosystem services that the community is enjoying and the dangers that would be faced by the community due to the destruction of the species. This should be done by putting in place adequate conservation measures by relevant governmental and non-governmental authorities and monitoring anthropogenic activities by some local authority established under county government.

The residents of Rachuonyo South Sub County should be actively involved in the conservation of flora and fauna species, in doing this, the county government should take active role in sensitization programs on the environmental conservation, offering incentives to the local conservationist and even organizing general exhibitions on flora and fauna conservation at ward level.

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