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# Conservation Of Terrestrial Flora And Fauna In Rachuonyo South Sub-County, Kenya: Situational Analysis Of Vegetation Clearance

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***Abstract***
*The Yearly Extinction Rates Of Flora And Fauna Species Are 25% And 34% Globally And 69% And 68% In Kenya Respectively. 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 Thus Posing A Great Threat To The Habitat. The Objectives Of This Study Were To: Identify The Terrestrial Flora And Fauna Species Threatened By Anthropogenic Activities And Determine The Effect Of Vegetation Clearance On Terrestrial Flora And Fauna Species Conservation. A Cross-Sectional Survey Was Used. Sample Size Of 379 Household Heads Was Obtained Through Stratified Random Sampling. Purposive Sampling Was Also Used To Get 11 Key Informants. Data Was Collected Through Questionnaires, Key Informant Interviews, Photography And Field Observation. The Results Indicated That A Total Of 80 And 25 Species Of Terrestrial Flora And Fauna Were Under Threat. 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). Vegetation Clearance Was Highly Prevalent (Mean=1.11 And Standard Deviation=0.309). Vegetation Clearance Was Greatly Affecting Terrestrial Flora And Fauna Species (Mean=1.26, Standard Deviation=0.439). The Frequency Of Vegetation Clearance Was Extremely High (Mean=2.90, Standard Deviation= 1.006). The Rate Of Vegetation Clearance Was Increasing In Trend (Mean= 1.20, Standard Deviation= 0.398). The Respondents Were Not Sure Whether There Were Effective Conservation Measures In Place To Mitigate The Effects Of Vegetation Clearance (Mean=1.70, Standard Deviation=0.457). The Study Concluded That The Survival Of Terrestrial Flora And Fauna Species Were Greatly Threatened By Vegetation Clearance. The Study Recommended That The Local Communities Should Be Sensitized More On The Conservation Of Flora And Fauna Species.*

***Keywords:*** *Terrestrial Flora; Terrestrial Fauna; Conservation; Vegetation Clearance*

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## I. 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, VanderWindt, 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/$Km^2$ in the sub-county which was far above the national population density of 82 persons/$Km^2$.

Globally, as a result of alteration of habitat for human consumption, a number terrestrial flora and fauna species have been on the decrease consistently (UNEP, 2014). Most experts believe that globally terrestrial species are threatened to extinction and that in the next few decades, 1 million species of flora and fauna species are at threat of being lost (AWF, 2015; UNEP, 2019a). This declining trend is attributed to the destruction of habitat due to vegetation clearance. Vegetation clearance is any activity causing destruction on local vegetation including cutting and removal of plant and trees burning, poisoning, slashing of understory, and removal of branches and shrubs (Native 2015). The findings of Neldner et al. (2017) agrees with the results of (AWF, 2015) and (UNEP, 2019a) that terrestrial species are at the verge of extinction due to habitat loss. The study noted that 233 flora and 33 fauna have been listed as near threatened meanwhile others are extinct.

These studies did not analyze how vegetation clearing caused the decline of these species and yet species were declining at alarming rate. Besides, there was a possibility of many flora and fauna species dying at the time of clearing, meanwhile many fauna that managed to escape during the clearing process died from stress, starvation or predation. There was therefore a need to assess if these outcomes were true.

The destruction of the natural habitat of terrestrial species for human settlement and transport infrastructure has immensely threatened numerous flora and fauna species (McDonald, Marcotullio & Giineralp, 2013; Bennie, Davies, Cruse & Gaston, 2016). A researcher affirmed this by asserting that the survival of numerous flora and fauna species are critically threatened by an ever growing and urbanizing human population (Giincralp, 2013). Additionally, some researchers forecasted that between 2010 and 2050 there will be an increase of 60% in the stretch of roads and railway and that by 2050 urban centres will host 6.3 billion residents (United Nations, 2015; Dulac, 2013), unfortunately, the regions that have a soaring terrestrial flora and fauna species is where most human settlement occur (Luck & Smallbon, 2010). This is a threat indicator to terrestrial species whose habitat are being destroyed for settlement. In support to this, Giincralp (2013) further inserted that due to urban growth above 25% of all species that have been listed as endangered or critically endangered.

The Counties enclosed by urbanized areas in the United Kingdom have greatly experienced species extinction. For instance, 35% of flora became extinct due to expansion of urban development in the region (Hardman 2011). A researcher confirmed this and acknowledged in the study done by the National Wildlife Federation that most of the American local flora and fauna species are significantly threatened due to transformation of their habitat for human settlement (Ewing and Kostyack 2016), further, the National Wildlife Federation noted that on an hourly basis 20 flora and 20 fauna species becomes extinct (Effects of overpopulation Magazine, 2013). Additionally, a researcher acknowledged that the fragmentation of the original habitat for the establishment of roads and houses has immensely enhanced the decline of terrestrial species (Cane, Minckley, Kervin, Roulston, & Williams, 2006). In as much as these studies keenly observed that terrestrial flora and fauna species are being affected by clearance of vegetation for settlement and infrastructure however, these studies did not analyze how this action affected specific flora and fauna species and yet the expansion of settlement was a serious threat to the integrity of habitat. The practice denied the habitat crucial natural interconnectedness, thus reducing the movement of species between habitats. Consequently, this led to migration and death due to starvation and predation. Hence this study found this a missing gap and sought to examine it.

African continent is experiencing a high population growth rate. This is greatly witnessed in most of her rural population in countries such as Benin, Burundi, Eritrea, Burkina Faso and Uganda (WB, 2013). Thus more land for agriculture and settlement is required which eventually causes a decline in species diversity due to habitat loss. In a similar manner, the IUCN indicated that due to agriculture, habitat is largely altered especially in West African countries (Nigeria, Cameroon, Gabon and Congo), threatening some species like Red-capped Mangabey (Cercocebus torquatus.

The over harvesting Fleurydora felicis (shrub) for medicinal purposes, and wood fuel in Guinea has seriously endangered this particular species and in Madagascar, 90% of rosewood and palissander (Dalbergia) are highly utilized (IUCN, 2019). Despite the great insight aired by these studies on the decline of flora species due to agriculture and wood fuel, regionally increasing population growth rate was still exerting a lot of pressure on habitat. This study therefore emphasized on this to address the effect of anthropogenic activities on terrestrial flora and fauna species.

In Kenya there is high dependency of wood fuel as a source of energy especially among the urban and rural population. Yearly, 2.4 million tons are approximated to be consumed inform of firewood and charcoal used by rural and urban population at a rate of 90% and 82% respectively (KES, 2018). The National Environmental Complaints Committee indicated that terrestrial flora and fauna species are at the brink of disappearance due to charcoal burning. This human activity majorly focuses on high density wood, however, other species are also cut down during their depletion enhancing habitat loss. This eventually cause flora and fauna species to disappear at a rate of 1 to 10 annually (NECC, 2018). In as much as the above studies have correctly indicated that wood fuel harvesting was a major threat to terrestrial species in Kenya, the dependence of most Kenyan population on wood fuel was still high and this posed a lot of threats to terrestrial flora and fauna species as their habitat were destroyed causing fauna species to relocate in search of new habitat and breeding points. This study addressed this gap. This

research was essential because the assessment of this activity will help in regulating the rate at which species are declining.

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/$Km^2$ in the sub-county which is far above the national population density of 82 persons/$Km^2$ 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 511persons per $Km^2$ 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 $km^2$. 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.

## II. METHODS

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 $34^o$ 14' E and $35^o$ 1'E and latitude $0^o$ 23' S and $0^o$ 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 $\boldsymbol{n0 = \frac{n}{1+(\frac{n-1}{N})}}$

Where $n_0$ is the sample size for finite population, n =384, and N =30990.

$\boldsymbol{n0 = \frac{384}{1+(\frac{384-1}{30990})}} = 379$

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) | sample 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.

## III. 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 2.

**Table 2**: 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 2 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 3**: 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. 10001-15,000 | 28 (8%) | | | | |
| | Above Ksh. 15,000 | 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 3) 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 7, 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 high population. According to the study, the land was distributed as: 1-3 acres (71%), 4-6 acres (25%) and above 7acres (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 6acres. 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 4.

**Table 4:** Identified threatened terrestrial flora species, classification, uses and the threatening anthropogenic activities

| Threatened terrestrial flora species | | Classification (indigenous/ exotic) | Uses | The 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, | *Combretum molle* | Indigenous | Wood fuel | Gathering/vegetation clearance |
| Akech | *Chameecrista hildebrandtii* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Alii, | *Acacia seyal* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Ang'we | *Kedrostis foetidissima* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Pilipili | *Capsicum frutescens* | Indigenous | Spice, medicinal | Gathering/vegetation clearance |
| Apuoyo | *Chloris gayana* | Indigenous | Fodder, thatch | Gathering/vegetation clearance |
| Apoth | *Corchorus trilocularis* | Indigenous | Vegetables, medicinal | Gathering/vegetation clearance |
| Arumbe, | *Acacia hockii* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Arupiny | *Commiphora Africana* | Indigenous | Medicinal, firewood | Gathering/vegetation clearance |
| Atego, | *Keetia gueinzii* | Indigenous | Fruit | Gathering/vegetation clearance |
| Atilili | *Psiadia punctulata* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Atipa | *Asytasia gangetica* | Indigenous | Vegetables | Gathering/vegetation clearance |
| Ayiergweng, | *Boscia angustifolia* | Indigenous | Wood fuel | Gathering/vegetation clearance |
| Bongu, | *Fiscu sur* | Indigenous | Wood fuel | Gathering/vegetation clearance |
| Bondo | *Euphorbia candelabrum* | Indigenous | Glue | Gathering/vegetation clearance |
| Chwaa | *Tamarindus indica* | Indigenous | Fruit, medicinal, wood fuel | Gathering/vegetation clearance |
| Deg akeyo | *Cleome gynandra* | Indigenous | Vegetables, medicinal | Gathering/vegetation clearance |
| Det, | *Ormocarpum trichocarpum* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Dwelle | *Melia azeradarch* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Huyandawa | *Withania somnifera* | Indigenous | Fire wood, medicinal | Gathering/vegetation clearance |
| Kagna | *Vaungueria apiculate* | Indigenous | Fruit, firewood | Gathering/vegetation clearance |
| Keyo, | *Combretum molle* | Indigenous | Wood fuel | Gathering/vegetation clearance |
| Konga | *Agave sisalama* | Indigenous | Fire, wood, construction, | Gathering/vegetation clearance |
| Koth-kiyombi | *Datura stramonium* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Kuogo, | *Lannea schweinfurthii* | Indigenous | Medicinal, wood fuel | Gathering/vegetation clearance |
| Madhare, | *Ozoroa insignis* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Milo | *Mucana pruriens* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Minya | *Cissus quadrangularis* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Modi | *Phragmites mauritianus* | Indigenous | Fodder | Gathering/vegetation clearance |

| | | | | |
|---|---|---|---|---|
| Ndap-nyaluo | *Nicotiana tabacum* | Exotic | Smoking | Gathering/vegetation clearance |
| Nderma | *Basella alba* | Indigenous | Vegetables, medicinal | Gathering/vegetation clearance |
| Nduga | *Acacia drepanolobium* | Indigenous | firewood, medicinal | Gathering/vegetation clearance |
| Ng'owo | *Ficus wakefieldii* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Nyabend-winy | *Lantana camara* | Indigenous | Firewood, medicinal | Gathering/vegetation clearance |
| Nyajuok-olaw | *Acmella caulirhiza* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Nyanyiek mon | *Bidens pilosa* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Nyayado, | *Senna occidentalis* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Obala-ndagwa, | *Ricinus communis* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Ober | *Albizia coriaria* | Indigenous | Medicinal, wood fuel | Gathering/vegetation clearance |
| Obino, | *Senna didymobotrya* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Obokeran | *Psychotria peduncularis* | Indigenous | Brick making, | Gathering/vegetation clearance |
| Obolobolo | *Annona senegalensis* | Indigenous | Medicinal, firewood | Gathering/vegetation clearance |
| Obong | *Cajanus cajan* | Indigenous | Vegetables | Gathering/vegetation clearance |
| Ochok, | *Solanum incanum* | Indigenous | fodder, Brick making | Gathering/vegetation clearance |
| Ochol | *Lepisanthes senegalensis* | Indigenous | Medicinal, wood fuel, | Gathering/vegetation clearance |
| Ochuoga | *Carissa spinarum* | Indigenous | Fruit, medicinal, Firewood | Gathering/vegetation clearance |
| Odielo | *Commelina Africana* | Indigenous | Vegetables | Gathering/vegetation clearance |
| Ododo | *Amaranthus hybridus* | Indigenous | Vegetables, medicinal | Gathering/vegetation clearance |
| Ojuok | *Euphobia tirucalii* | Indigenous | Medicinal, hedge | Gathering/vegetation clearance |
| Okita, | *Plectranthus barbatus* | Indigenous | Medicinal | Vegetation clearance |
| Okuro | *Alternantherapungens* | Indigenous | Weed | Vegetation clearance |
| Okworo | *Clerodendrum myricoides* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Olando | *Indigofera arrecta* | Indigenous | Basketry ,med | Gathering/vegetation clearance |
| Olemo | *Ximenia Americana* | Indigenous | Fruit, firewood, Medicinal | Gathering/vegetation clearance |
| Oludh-koun | *Allophylus africanus* | Indigenous | firewood, | Gathering/vegetation clearance |
| Ombasa, | *Tylosema fassoglense* | Indigenous | Medicinal, food | Gathering/vegetation clearance |
| Omen | *Hibiscus aponeurus* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Omieny | *Lippia javanica* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Ondati, | *Teclea nobilis* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Onera | *Terminalia brownie* | Indigenous | construction, wood fuel, medicinal | Gathering/vegetation clearance |
| Ongodi | *Sida acuta* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Ong'ono, | *Sclerocarya birrea* | Indigenous | Fruit, medicinal | Gathering/vegetation clearance |
| Onunga | *Morus nigra* | Indigenous | Wood fuel, fruits | Gathering/vegetation clearance |
| Onuong'o | *Hygrophila schulli* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Ohoho | *Phytolacca dodecandra* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Osani | *Leptochloa obtusiflora* | Indigenous | Fodder | Gathering/vegetation clearance |
| Oseno, | *Cordia monoica* | Indigenous | Firewood | Gathering/vegetation clearance |
| Osiri | *Acacia brevispica* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Osiri, | *Scotia myrtina* | Indigenous | Fruit, med. | Gathering/vegetation clearance |
| Otho | *Balanites aegyptiaca* | Indigenous | Wood fuel, fruit | Gathering/vegetation clearance |
| Pedo | *Harrisonia abyssinica* | Indigenous | Firewood, fodder, | Gathering/vegetation clearance |
| Pocho | *Ficus thonningii* | Indigenous | Medicinal, sacred | Gathering/vegetation clearance |
| Powo | *Grewia bicolor* | Indigenous | construction, wood fuel, basketry | Gathering/vegetation clearance |
| Roko | *Zanthoxylum chalybeum* | Indigenous | Medicinal | Gathering/vegetation clearance |
| Siala | *Markhamia lutea* | Indigenous | construction, wood fuel, medicinal | Gathering/vegetation clearance |
| Sangla | *Rhus natalensis* | Indigenous | Medicinal, wood fuel | Gathering/vegetation clearance |
| Yago | *Kigelia Africana* | Indigenous | Wood fuel, medicinal | Gathering/vegetation clearance |
| Yiendalusi | *Rhynchosia alegans* | 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 4. 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 4).

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 5.

**Table 5:** The current status flora species richness

| Questions | Scales(Frequencies/ percentages) | | | Statistics | |
|---|---|---|---|---|---|
| | Increasing | Decreasing | No change | Mean | Std. Dev. |
| **1.** What is the current status of terrestrial flora species? | 51(14%) | 278(76%) | 33(9%) | 1.96 | 0.487 |

**Source: Field data, 2022**

Table 5 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 4), 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 9. 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 4). 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 6.

**Table 6:** 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 | *Redunca redunca* | | Indigenous | Meat | Hunting, vegetation clearance |
| Aidha | *Protoxerus stangeri bea* | | Indigenous | Meat | Hunting, vegetation clearance |
| Apul | *Kobus ellipsi prymnus* | | Indigenous | Meat | Hunting, vegetation clearance |
| Apwoyo | *Lepus saxatilis* | | Indigenous | Meat | Hunting, vegetation clearance |
| Bim | *Papio cynocephalus* | | Indigenous | Not specified | Vegetation clearance |
| Chiewu | *Atherurus africanus* | | Indigenous | Meat | Hunting, vegetation clearance |
| Dwe | *Tragelaphus spekei* | | Indigenous | Meat | Hunting, vegetation clearance |
| Fuko | *Tachyoryctes slendens* | | *Indigenous* | Meat | Hunting, vegetation clearance |
| Gwothim | *Lycaon pictus* | | Indigenous | Not identified | Vegetation clearance |
| Jowi | *Syncerus caffer* | | Indigenous | Meat, horns | Hunting, vegetation clearance |
| Kibwe | *Canis mesomelas* | | Indigenous | Not identified | Vegetation clearance |
| Mbeche | *Potamochoerus porcus* | | Indigenous | Meat | Hunting, vegetation clearance |
| Mwanda | *Oreutragus oreotragus schillingsi* | | Indigenous | Meat | Hunting, vegetation clearance |
| Mwok | *Orycteropus afer* | | Indigenous | Meat, skin | Hunting, vegetation clearance |
| Ngau | *Sylvicarpa grimmia* | | Indigenous | Meat, horn, Skin | Hunting, vegetation clearance |
| Njiri | *Phacochoerus aethiopicus* | | Indigenous | Not identified | vegetation clearance |
| Nyakech | *Aepyceros melampus* | | Indigenous | Meat | Hunting, vegetation clearance |
| Ogwang Kibikibi | *Mellirora capensis* | | Indigenous | Not identified | Vegetation clearance |
| Ogwang-oluwo-bondo | *Nandinia binotata* | | Indigenous | Not identified | Vegetation clearance |
| Omoro | *Hyppotragus equines* | | Indigenous | Skin | Hunting, vegetation clearance |
| Ondiek | *Crocuta crocuta* | | Indigenous | Not identified | Vegetation clearance |
| Ong'er | *Cercopithecus aethiops pygerythrus* | | Indigenous | Not identified | Vegetation clearance |
| Oyieyo | *Aethomys chrysophilus* | | Indigenous | Not identified | Vegetation clearance |

| | | | | | |
|---|---|---|---|---|---|
| Riwo | *Connocheates taurlnus* | | 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 6. 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 slendens*), Gwothim (*Lycaon pictus*), Jowi (*Syncerus caffer*), Kibwe (*Canis mesomelas*), Mbeche (*Potamochoerus porcus*), Mwanda (*Oreutragus 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 (*Crocuta crocuta*), Ong'er (*Cercopithecus aethiops pygerythrus*), Oyieyo (*Aethomys chrysophilus*) and Riwo (*Connocheates taurlnus*) (Table 6).

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 6). An interview with key informant revealed that:

Rachuonyo South Sub County was once sparsely populated with human, having few patches of bare 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 7.

**Table 7**: The current status fauna species richness

| Questions | Scales(Frequencies/ percentages) | | | Statistics | |
|---|---|---|---|---|---|
| | Increasing | Decreasing | No change | Mean | Std. Dev. |
| **2.** 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 6 revealed that; 79% of the respondents indicated a decline in fauna species richness(Table 7), 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 11. 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 6). 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 vegetation clearance on terrestrial flora and fauna species conservation in Rachuonyo South Sub County**

The study further sought to determine the effect of vegetation clearance as an anthropogenic activity that threatened terrestrial flora and fauna species conservation. The respondents and the key informants were asked specific questions in line with the objective and responses were as discussed below.

The study identified types of vegetation, whether vegetation clearance was occurring and reasons for clearance within Rachuonyo South Sub County. It also determined its effect to terrestrial flora and fauna species conservation. The response on types of vegetation and reasons why they are cleared are summarized in Table 8.

**Table 8**: Response on types of vegetation cleared and reasons for their clearance

| | Types of Vegetation | Reasons for Clearance |
|---|---|---|
| 1. | Forest | Crop farming, urban settlement, brick making, wood fuel, road expansion and creation, hunting, population growth, logging, overstocking, uncontrolled lumbering. |
| 2. | Grassland | Brick making, urban-settlement, over grazing, crop farming, establishment of new homes due to population growth |
| 3. | Shrub land | Hunting, urban and rural settlement, crop farming, over grazing, brick making. |

**Source: Field Data 2022**

The results presented on Table 8 shows that the area had three common types of vegetation being cleared. They included forest, grassland and shrub land being cleared due to: Crop farming, urban settlement, brick making, wood fuel, hunting, human settlement, logging, overstocking, uncontrolled lumbering, road construction. This explain the fact that the study area was endowed with great vegetation cover as had been indicated that initially the area had vegetation which was thick and covering a larger area before rise in human population that accelerated exploitation of vegetation. Increase in human population and the accelerated human activities, has led to the clearance of most vegetation for human settlement, crop farming, road construction, brick making and an uncontrolled lumbering. These activities were found to be crucial to local humanity for their livelihood, despite their usefulness however, they have led to destruction of vegetation leading to loss and fragmentation of habitat which eventually resulted to the migration, reduction and extinction of fauna species within the study area causing an imbalance to the ecosystem that the community heavily depended upon.

The Plate 1 shows an excavated land for marram for road construction and expansion at Wire hills for constructing rural access roads and Oyugis -Kendubay road.

**Plate 1: Marram excavated land at Wire hills for construction of roads**
**Source: Field Data 2022**

**Table 9:** The occurrence of vegetation clearance and how it affects species

| Questions | Scales (frequency and percentages) | | Statistics | |
|---|---|---|---|---|
| | Yes | No | Mean | Std. Dev |
| Is vegetation clearance taking place in this area? | 326(89%) | 39(11%) | 1.11 | 0.309 |
| Does vegetation clearance affect flora and fauna species in this region? | 270(74%) | 95(26%) | 1.26 | 0.439 |

**Source: Field data 2022**

The findings on Table 18 indicated that 89% respondents agreed that vegetation clearance was occurring while 11% said "NO". On the other hand, 74% of the respondents indicated that terrestrial flora and fauna species listed on Table 8 and Table 10 were affected by the activity while 26% recorded that species were not affected. These findings inclined toward "Yes" as depicted by means of 1.11 and standard deviation of 0.309 and means of 1.26 and standard deviation of 0.439 respectively (Table 9). The result revealed that the activity was prevalent and had highly affected terrestrial flora and fauna species. This implies that these species were highly threatened by vegetation clearance due to crop farming, construction of rural access roads, brick making among others. This activity has caused areas that were initially covered by indigenous trees to be bare as seen in Plate 2 hence loss of habitat which is a major threat to the survival of fauna species. It has also reduced the number of large fauna species causing some like Jowi (*syncerus caffer*), Riwo (*connocheates taurlnus*) to be extinct, further, the interaction between species have been restricted especially due to habitat fragmentation caused by the construction of rural access roads as indicated in plate 1.

Further, the study established the extent of effect that vegetation clearance posed on flora and fauna species. The results are as presented in Table 10

**Table 10:** Response of the on how flora and fauna species are affected by vegetation clearance

| No | How flora and fauna species are affected | Percentages of household heads response |
|---|---|---|
| **1.** | Extinction of some fauna species | 83% |
| **2.** | Relocation of fauna species | 86% |
| **3.** | Reduction of fauna species richness | 78% |
| **4.** | Habitat loss | 98% |
| **5.** | Fragmentation of the habitat | 81% |
| **6.** | Extinction of some flora species | 93% |
| **7.** | Reduction of flora species richness | 95% |

**Source: field data 2022**

The findings on Table 10 indicated that vegetation clearance has greatly affected terrestrial flora and fauna species. About 73% of the respondents noted extinction of some fauna species, 86% relocation of some species, 95% reduction of flora and fauna species richness, 98% habitat loss, 81% fragmentation of the habitat, 93% extinction of some flora species while 78% indicated decline in predators. An interview with a key informant revealed;

Vegetation clearance has affected terrestrial fauna species through the extinction of some of the species such as nyakech(*aepyceros melampus)*, jowi(*syncerus caffer*), mwanda(*oreotragus oreotragus)*, njiri(*phacochoerus aethiopicus*), bim(*papio cynocephalus*), abur(*redunca redunca*) and some flora species such as oseno(*Cordia monoica)*, yago(*Kigelia Africana)*, reduction of terrestrial species, fragmentation of habitat, loss of habitat, change in eating habit of predators and relocation of fauna species due to reduced size of their habitat ( A male forest officer from Wire forest- December 2022).

This outcome confirms that vegetation clearance was a threat to terrestrial flora and fauna species conservation. It is evident that vegetation clearance has adversely affected terrestrial flora and fauna species through their uses as shown in Table 8. Most of flora and fauna species have become extinct, reduced in number or migrated (fauna). In as much as this species are heavily threatened, the local community are still subjecting them to more threat. It is therefore evident that most of the local inhabitants are ignorant of the importance of these species and the effect caused by the decline of species to their livelihood hence a need to conserve the threatened species.

The above findings were justified by studies conducted by (Reside et al. 2012; Travis et al. 2013 and Neldner *etal*. 2017) in Australia which asserted that at the point of land clearance numerous plants and animal species are killed, and those that escaped die soon due to stress, starvation or predation, the ability of the species to adapt and move is reduced. Even though the findings of these studies conformed to the outcome of the present study, nevertheless, they differ on their key objectives and area of study. For instance, study by Neldner *etal*. (2017) gave a general information on species threatened without listing specific species being threatened, a gap

knowledge filed in the present study by listing species threatened. Similarly, Reside et al. (2012) in Australia did not document on effect of vegetation clearance on terrestrial flora and fauna species but focused on changes in distributions of Australian tropical savanna birds under climate change. In addition, Travis et al. (2013) studied the inability of species to adapt and move due to vegetation disturbance but did not document on effect of vegetation clearance on terrestrial species rather focused on Dispersal and species' responses to climate change. The above studies were conducted in Australia while the present study was however conducted in an African rural set up characterized by high poverty level and rapid growth of human population.

Also, the study established the current status of vegetation clearance in the study area. The results were as shown in Table 11.

**Table 11**: Current status of vegetation clearance

| Questions | Scales(Frequencies/ percentages) | | Statistics | |
|---|---|---|---|---|
| | Increasing | Decreasing | Mean | Std. dev |
| From the information in the table 8 above tick the current status of rate of vegetation clearance in this area. | 293(80%) | 80(20%) | 1.20 | 0.398 |

**Source: Field data, 2022**

The response on Table 11 showed that 80% of the respondents noted an increase in the rate of vegetation clearance. The responses were skewed toward "Yes" as indicated by a mean of 1.20 and standard deviation of 0.398 (Table 20). The respondents also stated their findings on the reasons for the increase in the rate of vegetation clearance within the study area which were found to be linked to the purpose for which vegetation were cleared. These results were as summarized on Table 12

**Table 12**: Reasons for the increase in vegetation clearance

| No. | Reasons for the increase in vegetation clearance | Percentage of the respondents |
|---|---|---|
| 1. | Crop farming | 98% |
| 2. | Human settlement | 95% |
| 3. | Urban settlement | 60% |
| 4. | Rural access roads | 70% |
| 5. | Brick making | 82% |
| 6. | Wood fuel | 96% |
| 7. | Hunting | 78% |
| 8. | Uncontrolled lumbering | 70% |
| 9. | Overstocking | 83% |

**Source: Field data, 2022**

The responses on Table 12 showed the reasons for which vegetation clearance was on an increasing trend within the study area. About 98% of the respondents reported increase in vegetation clearance due to crop farming, 95% reported on human settlement, 60% indicated urban settlement, 82% recorded on brick making, 96% indicated on wood fuel, 78% recorded on hunting, 70% reported on uncontrolled lumbering while 83% recorded overstocking. Further an interview with key informant revealed that:

The scattered trees and shrubs are a clear indicator that vegetation clearance is on the increasing trend as opposed to the ancient days when the region was heavily forested. Most species such as otho, Alii, ober, oseno, ondati, yago, keyo that are used for wood fuel and medicinal purposes are very rare some have become extinct due to their uses. Currently human and urban settlement and rural access road networks are becoming more pronounced as more people are establishing their homes in areas which were once forested.

This implies that the purposes for vegetation clearance were the key reasons why there was an increase in vegetation clearance within Rachuonyo South. It is also evident that terrestrial flora and fauna species were greatly threatened by this activity however, the local residents were still heavily involved in clearing vegetation for their wellbeing. Therefore, if no attention is given to this worrying declining trend of vegetation then in the near future more species shall have become extinct. This declining trend of vegetation also prints a clear picture that majority of the respondents are not aware of the conservation measures that can be used to preserve and protect species from depletion therefore were heavily threatening the existence of terrestrial flora and fauna species.

The study established the frequency of vegetation clearance as shown in Table 13.

**Table 13:** Findings on frequency of vegetation clearance as an anthropogenic activity

| Question | Scales (frequency and percentages) | | | | | Statistics | |
|---|---|---|---|---|---|---|---|
| | Weekly | Monthly | Twice a year | Once a year | Not all | Mean | Std. dev |
| How frequently is vegetation clearance taking place in this region? | 39(11%) | 72(20%) | 149 (41%) | 92(25%) | 12(3%) | 3.06 | 1.079 |

**Source: field data, 2022**

Results on Table 13 indicated that 41% of the respondents recorded twice a year occurrence, 25% stated once a year, 20%, noted monthly, 11% stated weekly occurrence while 3% noted non-involvement. The distribution of findings on the response depicted a mean of 3.06 and a standard deviation of 1.079 which indicated a yearly vegetation clearance. This suggested that the cumulative annual rate of vegetation clearance in the study was at 72% (weekly 11%, monthly 20%, twice a year 41% Table 13). The above analysis indicated that cumulatively annual rate of vegetation clearance was at 72%. This implies that fauna species are greatly threatened due to loss of habitat which they heavily depend on for their interaction, predation, feeding, safe movement across the landscape and rest. This threat eventually causes some species to be extinct while others migrate to other safer regions thus reducing the species number within the study area. This extinction and reduction in species interferes with ecosystem function that affect livelihood.

These findings conformed to the research of studies conducted by (Cane et al. 2016; McDonald, Marcotullio & Giineralp, 2013; Bennie, 2016; KES, 2018; IUCN, 2019) which reported that the destruction of the natural habitat of terrestrial species for human settlement, transport infrastructure, the fragmentation of the original habitat for the establishment of roads and houses, alteration of habitat for agriculture, over harvesting Fleurydora felicis (shrub) for medicinal purposes, and wood fuel and high dependency of wood fuel as a source of energy especially among the rural population due to ever growing and urbanizing human population has critically threatened the survival of numerous terrestrial flora and fauna species. Even though the findings of these studies are in line with the outcome of the current study, these studies did not document on how terrestrial flora and fauna species were affected by vegetation clearance as an anthropogenic activity. For instance, (Cane et al. 2016), projected on complex responses within a desert bee guild to urban habitat fragmentation; Bennie et al, (2016) focused on ecological effects of artificial light at night on wild plants and did not document on effect of anthropogenic activities on terrestrial flora and fauna an area studied by the present study.

## IV. 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.

Vegetation clearance was reported to be prevalent within the study area. Most respondents recorded that vegetation clearance was highly affecting terrestrial flora and fauna species. They also noted that the frequency of this activity was very high as suggested by the cumulative annual rate of vegetation clearance in the study was at 89%. It was also reported that the rate of vegetation clearance was connected to the species uses such as Crop farming, urban settlement, brick making, wood fuel, road expansion and creation, hunting, population growth, logging, overstocking, and uncontrolled lumbering.

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