# EFFECT OF ANTHROPOGENIC DISTURBANCE ON THE DIVERSITY AND DISTRIBUTION OF SOME SPECIES IN UNIVERSITY OF BENIN

**BY**

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**DECEMBER, 2023**

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF FORESTRY AND WILDLIFE MANAGEMENT, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILMENT FOR THE AWARD OF BACHELOR DEGREE IN AGRICULTURE (FOREST RESOURCES AND WILDLIFE MANAGEMENT)**

**DECEMBER, 2023**

## CERTIFICATION

This is to certify that this project work was carried out by Emenuwe miracle **I** in the Department of forest resources and Wildlife Management, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria.

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| ______________________________ | ______________________________ |
| Date | Date |

# DEDICATION

This research project is dedicated firstly to God Almighty for his mercies and grace throughout this project.

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I'll not fail to appreciate my class reps, Samuel and thanks for your service.

To my ever loving housemates, my friends turned into sisters; Doris Oghogho, Joanna Banana and my amiable Brother sunny. God bless you all

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# ABSTRACT

The study investigated the affect of Anthropogenic Disturbances of some selected species in University of Benin. The campus was divided into two habitat types; compartments A and compartment B.The survey was carried out for a period of six months( February 2023 to July 2023) converting both the dry and wet season.Using line transect method, animal census was carried out from 6:30 am to 10:00am in the morning and 4:00-6:00 In the evening. Each compartment was visited twice per day( morning and evening). Animal sighted we're identified. The number of individuals seen along the transect line were noted and count. A total number of 260 individuals belonging to 12 families and 12 species in both the wet and the dry season were identified and recorded within the studey area. The results of the family species and abundance of wildlife was higher (0.284) and relative abundance (28.4%) was observed among xerus erythopis while the was recorded among Hystrix cristata individual species Shannon taxas diversity index and evenness recorded high population in the transect line( C) 115, Shannon diversity index in transect( C); evenness 0.8622 and Margalef I'm transect (C)and(D)in both the dry and wet season. Species habitat preference were significantly different in both study sites. The species occur more ( 15.0@+- 2.76) site B and (25.4@+- 2.24) site B for both seasons. The species surveyed in both the dry and wet season we're highly dictected more during the day season (37.3@+5.33) as compared to wet season. On the animal activity investigated, Trail (54.5@+_6.2) and the calls(38.8b+_5.7) we're significantly different among the various activities surveyed for this studies.The Anthropogenic Activities in the study area were significantly different. Traps(43.0+_4.7a) and farming (26.5+_7.4b) were the major Anthropogenic activities observed in this study. While snares(26.0+_4.76a) and cage trap (9.3+_2.3b) records the most frequent use trap for animal capturing and poaching activities in the study area. Human induced activity is the major Anthropogenic factor influencing the wildlife disturbance in the study area. There is need for urgent conservation effect for the protection of the species population.

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background of the Study

Human activities often referred to as land-use, such as mining, forest exploitation, tourism, hunting, fishing, agriculture, have resulted in the loss of forest resources, such as deforestation and forest degradation. These activities have accelerated the process of exploitation of forests to meet human needs and its resources which has resulted in the reduction of global forest area and substantial reduction in carbon storage area (Lawes *et al.*, 2004; FAO, 1993). It has been estimated that 20% of forest area has reduced because of the activities mentioned above; further reports have indicated that many plants and animal species are currently endangered (FAO *et al.*, 2008; Sanz, 2007; IUCN, 2010). Wild resources are highly important, as these resources can mitigate the harmful effects of greenhouse gas emissions. They are able to absorb emissions and store large quantities of carbon as well as sustain biodiversity. They are important assets for some population, as they provide fuel, timber, food, pharmaceutical products and income (Patosaari, 2007; Sayer and Maginnis, 2005; Vie *et al.*, 2009; Aihoon *et al.*, 1994). Depletion of these resources poses threats such as soil erosion, loss of biodiversity; floods, global warming and locally it could cause a loss of income. Studies have demonstrated that this is most likely to occur in developing countries (Fonjong, 2008; Powers, 2009; Bryan *et al.*, 2010). Nigeria for instance her natural forest resources are fast diminishing and forecasts are that they may be exhausted by the end of this century as many species of flora and fauna are threatened with extermination (Umed, 1985). As soon as the vegetation cover of the soil is removed, the protective influence of the forest is reduced to the barest minimum. Soil conservation and improvement values of the forest are immediately lost and erosion.

However, the biodiversity and forest resources in country have been under severe stress due to economic pressure resulting in the exploitation of forest resources, as well as subsistence farming and hunting (Laurance *et al.*, 2005). For example Gabon has one of the highest percentages of forest cover in the Congo Basin mainland, second to the Democratic Republic of Congo (with an estimated total area covered by forest: 270,000 km2; Devers, 2006). The forests of Gabon range from dense tropical forests, to mangroves to savannahs (Direction Générale de l'Environnement,2004) and has one of the most diverse biodiversity and forest resources in the Sub-Saharan region (White *et al.*, 2000).

## 1.2 Statement of Problems

Most terrestrial and marine ecosystems of the world are facing disturbances, causing serious damage and change in the landscape habitat (Breininger et al., 2010). These disturbances also change vegetation and spatial patterns of many ecosystems, however it involve not only natural phenomena but also anthropogenic perturbations. Today, university of Benin forest ecosystems are much subjected to anthropogenic disturbances leading to displacement of species from their natural home range as results of over exploitation of resources, over population and structural development. There is there for the need to study and document the findings for future baseline data.

## 1.3 Objective of the Study

The main objective of this study is to investigate the anthropogenic disturbance on the diversity and distribution of fauna species in university of Benin

The specific of are to:

i evaluate the impact of anthropogenic disturbance on specie population in the study area ii investigate the diversity, specie composition, relative abundance and distribution of fauna species in the study area

iii Examine the changes that occurs on the diversity, composition and/or distribution of specie population in the study area

iv Identify the effect of anthropogenic disturbance on habitat structures of fauna species in the study area

v identify factors that influences the anthropogenic disturbance on the fauna species population in the study area

### 1.4 Justification of the Study

Historically, there has been a lack of data to allow resource managers to evaluate the state of our province's biodiversity, or to make scientifically-based land use decisions. Endeavors to catalogue the distribution and abundance of animal taxa in university Benin have been erratic. In only rare and exceptional cases have inventory and monitoring programs been designed to give statistically valid population estimates over time in nearby conservation area. Most of the research carried out have only focused on mammal and avian specie population; however, expanding human populations, structural activities and increasingly efficient methods of resource extraction as a results of habitat destruction have made it imperative for this research to develop a clear picture of the status and trends of a wide array of species and the impact of human activities and disturbance on biodiversity in the present study area.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

## 2.1 Background of the Study

Tropical rainforests harbour a particularly rich and unique biodiversity (Gibson *et al* 2018). Though representing only 7% of land surface, they support more than 60% of all known species. (Dirzo and Raven 2003) owever, their existence is compromised by many interrelated anthropogenic threats that have intensified over recent decades (Laurance 1999; sodhi 2007). Increased human population growth and economic expansion have fostered the rapid expansion of two of the main threats to wildlife, habitat destruction and unsustainable hunting. These disturbances have caused several declines in wildlife populations and have contributed to the degradation of many tropical forests (Laurance and peres 2006; Lawrence *et al* 2012; and mahli 2013). Over the past 20–30 years, threats to African tropical forests in particular have attracted national and international attention. Disturbance, biotic and abiotic, human and natural, is a necessary part of the natural functioning of ecosystems (Budiansky 1995; Colding *e/ al.* 2003). Krohne (2001) and Picket and White (1985) identify three main qualities of disturbance. Firstly, disturbance disrupts population, community and ecosystem structure; secondly, it alters resource availability; and thirdly, disturbances are often frequent events where many vegetation communities are in various stages of succession following a disturbance. As identified by Picket and White (1985), a disturbance affects the species richness, dominance and structure, as well as the functional attributes of ecosystems, such as nutrient cycling and energetics. Because no two disturbances are alike (Picket and White 1985) their effect will vary considerably depending on the severity, frequency and spatial extent of the disturbance (Picket and White 1985; Krohne 2001) as well as landscape characteristics (Picket and White (985). This has significant consequences for the structure and function of a landscape because as Budianksy (1995) states, ecosystems are never duplicated at different times and places. Loss of biodiversity is an issue of global concern as threats of species extinction grow, despite a target set in 2002 by world leaders at the World Summit on Sustainable Development (WSSD) to achieve a significant reduction in biodiversity loss by 2010 (WSSD 2004), Of the 44,838 species included in the 2008 IUCN Red List database (IUCN 2008), about 17,000 (38%) are threatened with extinction. Comparison ofthe IUCN Red Lists for 1996 and 2008 indicates that the number of species threatened with extinction has grown (IUCN 1996, 2008). Habitat loss and over-exploitation of wildlife species are universally acknowledged as the leading causes of biodiversity loss (Brooks et al. 2002; Millennium Ecosystem Assessment 2005; IUCN 2006, 2008). These two major causes are more prominent in developing countries, which, despite their wealth of wildlife and other natural resources, are characterized by low GDP per capita, with high population growth rates and densities and the majority of people living under extreme poverty with high rates of malnutrition (Millennium Ecosystem Assessment 2005; IMF 2006; IUCN 2008). Essentially, the use of wild resources remains the foundation for human survival in many of these countries: within non-agricultural and non-industrialized societies, 40% of people heavily depend on fishing, 33% on gathering and 28% on hunting of terrestrial resources (Hutton and Leader-Williams 2003). At the household level, poverty forces people to pursue ecologically destructive economic options, often violating laws in order to survive (Loibooki et al. 2002; Kideghesho et al. 2005; Himmelfarb 2006; Kingazi et al. 2008). At the national level, limited budgets reduce the capacity of governments to enforce conservation laws aimed at combating poaching and deforestation. Inadequate workforce in protected areas is one of the common constraints associated with poverty in many countries (Songorwa 1999; Baldus et al. 2003).

Human population growth has profound direct and indirect effects on consumption patterns of land and wild resources and is one of the major challenges facing wildliferich areas in Africa.

There is ample research-based literature associating this factor with wildlife poaching and habitat destruction, particularly where high human populations close to protected areas cause disruption of the ecological processes essential to maintain long-term biodiversity, due to increased hunting for home markets and pressure from local people to open protected lands for community use (Campbell and Hofer 1995; Hackel 1999; Kideghesho et al. 2005). For instance, using population census data for 1978 and 1988, Campbell and Hofer (1995) estimated the number of illegal hunters within 45 km west of Serengeti National Park boundary and adjacent protected areas for two periods at 23,294 and 31,655 - an increase of 36%. By 1998, the number had risen to 60,000 (Campbell et al. 2001; Loibooki et al. 2002) - a 90% increase from 1988.

## 2.2 Overexploitation of Wildlife Species

The problem of overexploitation of wildlife resources in Africa is well represented in most literature. Poaching has been documented as the main form of wildlife overexploitation. The most popular cases of species overexploitation through poaching occurred over the past three decades following a serious economic downturn that undermined law enforcement operations (Bonner1993; Adams and McShane 1996; Baldus et al. 2003). The African charismatic species, such as the black rhinoceros *(Diceros bicornis)* and African elephant *(Loxodonta africana)* lion *panther lio*, were the most affected. The rhino population was driven to the verge of extinction in 1992, when only 275 animals remained - 7% of the population recorded a decade earlier (Adams and McShane 1996; Sas-Rolfes 1997). The country's elephant population dropped by 72% from 203,000 individuals in 1977 to 57,334 in 1991 (IUCN 1998). This problem affected, among other areas, Tanzania's two flagship conservation areas: Selous Game Reserve (SGR) and Serengeti National Park (SNP). SGR lost 50% of its rhino population within a decade from 1976, when the number stood at 110,000 (Baldus et al. 2003). Within the same period, in SNP only 20% of elephants remained, and almost no rhinos (Dublin and Douglas-Hamilton 1987). Following the alarming loss of its wildlife populations, Tanzania launched 'Operation Uhai' in the late 1980s. This, along with the country's ratification of CITES, reduced the problem of poaching significantly (Baldus et al. 2003). The recovery has been apparent for the population of elephant,

## 2.3 Wild Fauna Resources in Nigeria

Nigeria is rich in wild fauna resources, and can therefore boast of a high biodiversity. There are 22,000 vertebrate and invertebrate species, about 20,000 insect, 1,000 bird, 1,000 fish, 247 mammal and 123 reptile species (Nigeria Fourth National Biodiversity Report (NFNBR), 2010). The diversity of Nigeria's wild animals can be attributed to the country's tropical location, size and its ecosystems (FAO, 2000). These varieties of ecosystems range from rainforests in the south to moist savannas in the central part of the country and dry arid savannas in the far north. There are also freshwater, brackish and marine ecosystems occurring, while features of montane vegetation have been found at high altitudes in the eastern borderlands (Falade & Adebanjo, 2008). The country's rich fauna is also as a result of the diverse vegetation types of these ecosystems. There are mammalian species such as the African Elephants *(Loxodonta africana),* African buffalo *(Syncerus caffer)* and hippopotamus (Hippopotamus amphibius) existing in the rainforest. Other large mammalian species found here are the large duikers *(Cephabius niger),* Chimpanzee *(Pan troglodytes),* and red river-hog *(Potamochoerus porcus).* The savannah areas house species such as the hartebeest *(Alcephalus buselaphus)* and warthog *(Phacochoerus aethiopicus)* and most of the carnivores. Grass cutters *(Thryonomys swinderiannus),* Giant rats *(Cricetomys spp.)* and tree squirrels *(Funisciurus spp.)* are among the vast variety of small mammals that exist in the savannahs as well as a range of primates (wcsnigeria.org, 2012). The lowland rain forest provides habitat also for about 200 species of birds (FAO, 2000). Four of the bird species; Anambra waxbill *(Estrilda poliopareia),* Ibadan malimbe, *(Malimbus ibadanensis),* Jos Plateau indigo-bird *(Vidua maryae)* and the Rock Fire-Finch *(Lagonosticta sanguinodorsalis)* are endemic to the country, making them globally important species for conservation (Nigeria National Biodiversity strategy and action plan (NBSAP), 2007). Wild bird species were found to be relatively abundant where there is dense tree vegetation according to a study on the Dagona-Waterfowl Sanctuary in Borno state, Nigeria (Lameed, 2011).

## 2.4 Positive Anthropogenic Impact

Disturbance, as part of the natural functioning of ecosystems (Berkes and Folke 2001; Colding *et al.* 2003), plays important roles where it increases heterogeneity, diversity and the number of habitats (Lindenmayer and McCarthy 2002; Colding *el at.* 2003). Studies indicate that suppression of this disturbance can reduce the ability of the ecosystem to renew itself due to a loss of diversity within functional groups (Berkes and Folke 2001). An example is the suppression of fire that occurred in Yellowstone National Park a classic example of how local people can create forest patches through disturbance is Fairhead and Leach's (1996) study of the Kissidougou in Guinea. The common perception held by development professionals, is that the landscape was originally covered with dense, humid forest. Their research revealed that local people had actively created forest patches, which occurred where people settled. When a settlement was abandoned the forest would eventually disappear. Laird (1999) describes a similar situation in Brazil where the Kayapo, through intimate knowledge and careful manipulation of ecological processes, create forest islands. These islands are called *apete* and occur in what would naturally be a savannah. The Montane Rain forest of South East Mexico is believed to be one of the most biologically diverse neo-tropical formations. This forest has, however, experienced centuries of intensive anthropogenic disturbance in the form of slash and burn agriculture (Ramirez-Marcial *et al.* 200]). Kandeh and Richards (1996) argue that a history of human settlement is good for biodiversity. They base this statement on a case study of the Gola North forest reserve in eastern Sierra Leone, which examined the relationship between land use history and bird species diversity. Their conclusion is that intensive human occupation of the area has probably concentrated bird species by creating a patchwork of primary forest, successional forest and farm land. Little (1996) states that savannah ecosystems in East Africa have been fundamentally shaped by human practices.

However, they presently "support the richest variety and density of large mammals in the world." This is backed up by Brockington and Homewood (2001) who explains that pastoral activity in Northern Tanzania is a rational choice for semi-arid savannahs and that the level of disturbance by cattle enhances diversity. For example, most of the present population of wildlife is concentrated on pastoral lands. This continues the co-existing relationship between pastoralists and wildlife that has survived for thousands of years (Brockington and Homewood 2001). habitat modification through anthropogenic disturbance is a necessary outcome for human habitation of an area (Taylor 2002). Val Grande National Park in Italy, for example, had experienced a reduction of human disturbance and was therefore reverting back to a seemingly wild state (Hocht *et al.* 2005). After assessing the impact on local people they state that an area that experiences a significant re-growth of vegetation, so that it could be termed a natural area, is not hospitable for human occupation. Toledo *et at.* (2003) document how the indigenous cultures of Mexico manage their tropical humid ecosystem through landscape patch management and multiple use of species and multiple land use strategies. The consequence is a high richness of useful Anthropogenic disturbance can result in ecosystems similar to those that would normally be classified as natural. For example, home gardens in Mexico, Indonesia and the Amazon are similar in structure to tropical forests (Altieri 1999; Wiersum 2004). In other cases, anthropogenic disturbance results in a change in structure and species composition favouring those most useful to local people (Wiersum 2004).

There is often an association with a reduction of primary forest, yet the landscape is enriched with multiple land use systems including natural and economically enriched forests, agro-forestry systems and monocropped fields (Wiersum 2004). Schmuck-Widmann (1996) document how the Jamuna char dwellers of Bangladesh rely on the yearly floods to irrigate and fertilize their agricultural fields. However, the construction of embankments and dykes by a Flood Action Plan, which aimed to stabilize the system.

### 2.5 Negative Anthropogenic Impact

The history of human existence is littered with examples of the lasting and devastating impacts that anthropogenic disturbance can have on ecosystems and the local people utilizing them. Examples include the Mesopotamians,' where it is believed that the intense disturbance caused by these peoples disrupted the natural environment to such an extent that their empire collapsed as a result of it (Jacks and Whyte 1939; Janssen and Scheffer 2004). The Polynesian expansion across the Pacific Islands resulted in the extinction of about 2000 bird species (15% of the world's avian diversity) (Dolman 2000), while vast tracts of land were deforested (Bowie 2000). A similar experience occurred when people arrived in the Americas, Oceania and Madagascar, where over one-hundred genera of large mammals were lost (Dolman 2000). In Malawi the Northern Ngoni Kingdom collapsed because of environmental degradation (McCracken 1987). There are many recent examples of anthropogenic disturbance resulting in soil compaction, forest ecosystem destruction, and loss of biodiversity, (Kozlowski 2000). For example by 1983 it was believed that desertification had occurred on 9 million km 2, which was believed to be caused by over grazing, cultivation and the harvesting of fuel wood (Dolman 2000). In the United States of America half of the rivers are significantly polluted while only 2% are free flowing (Dolman 2000). Many human activities thus result in a simplification and homogenisation of the world's biota (Feinsinger 2001; Stocking 2003). In these homogenised and intensively managed landscapes ecological memory is significantly reduced. It takes a much longer time for these landscapes to recover from disturbance, they are more prone to invasive species and have a reduced capacity to sustain ecosystem services (Folke *et al.* 2003). In this type of condition, natural environments no longer supply the vast array of benefits normally utilized by local people and can create many problems.

The prairies of North America are a good example, where intensive, prolonged anthropogenic disturbance turned once productive lands into a dust bowl (Jacks and Whyte 1939). Hoffman and Ashwell (2001) describe land degradation problems in South Africa resulting from anthropogenic disturbance. These includes soil erosion, where rill, gully and sheet erosion affects 70% of the land's surface. This negatively affects agricultural production, results in dam and river siltation and impedes socio-economic development. In the Transkei of the Eastern Cape there are gullies 20m wide and 6m deep. Another problem is the invasion of alien shrub and tree species, which cover ten million hectares. This reduces water resources (6.7% of South Africa's total annual runoff is used by these plants) and also threatens South Africa's high biodiversity levels. A riparian study undertaken by Corbacho *et al.* (2003) indicated that intensive land use schemes had resulted in invasive, non-indigenous species becoming dominant, such as *Typha, Eucalyptus, Populus* and *Arundo* formations, which is a common characteristic in landscapes highly affected by agricultural activities. In addition, these human-altered riparian landscapes were characterized by high structural and vegetative homogeneity, overall diversity was low and plants were of the same age class (Corbacho *et al. 2003)*. Lindenmayer and McCarthy (2002) conducted a study on the effects of clear felling on the montane ash forests of the central highlands of Victoria in Australia. They found that this anthropogenic disturbance had very different effects in terms of structure, plant composition, landscape patchiness and species richness when compared to natural disturbances in the form of wild fires. Wild fires result in complex multi-aged forests that are highly variable due to landscape patchiness being enhanced. This compares to clear felling which results in a simple, uniform, even-aged forest structure, and homogenous landscape patterns.

## 2.6 Wildlife as an Important Resource in Human Evolution

Research has shown that *Homo habilis* and *Homo sapiens* (archaic) increased the proportion of meat protein in their diets by hunting, resulting in the rapid development and increased volume of the brain (Wang, 2004). In addition, meat was crucial to the reproduction and evolution of prehistoric humans (Niche, 1995). Compared with *Homo habilis*, *Homo sapiens* (archaic) used fire to cook and soften food, resulting in large changes in human morphology (Qiao, 2011). The shortening of food chewing and digestion time resulted in significant changes in mandible and dental morphology, such as jaw retraction, smaller teeth, rostrum retraction, and smaller crinium viscerale (Yu & Zhai, 2004). In addition, human learned to use fire and the consumption of meat protein, which is more easily absorbed than raw meat, following the introduction of fire and cooking promoted the development of the human brain and body.

Furthermore, hunting activities improved human cognition and problem solving abilities, and promoted the evolution of physical fitness (Qiao, 2011). In short, the consumption of meat promoted human body health by reducing disease and strengthening the functions of the brain and other organs (Qiao, 2011).

### 2.7 Human impact on habitat resources of wildlife

For animals to survive in their habitat or be restored where they have been disturbed, man must be prepared to reserve a place for them to live. In other words, a suitable habitat must be provided, these suitable habitat refer to the maintenance or provision of the various habitat requirement through management. Over the years human impact on the habitat requirement for wildlife have been through various form of malpractice. Teleki (2004) reported the logging of *Afzelia africana, khyaya senegalensis, Termarindus indica* by the cattle Fulani men in Pandam Wildlife Park, we also have pagida and kwanbana Game Reserves, which provide cover and dry season browse able materials for wildlife. The effect of infrastructural development, industrial waste disposal and use of chemical on wildlife habitat have force some wild animals to migrate to other undisturbed habitat (Ayodele, 1988), the impact of human settlement will greatly affect the Game Reserves, this is because of the interference by the rural people on the wildlife Resources of the Reserve.

### 2.8 Habitat Loss

The 1995 World Resource Institute (WRI) report on status of world ecosystems in the late 1980s showed that Tanzania had lost about 43% of its original habitats (WRI 1995). Only 505,134 km2 of the previous habitat (886,200 km2) remained. The report further estimated the loss of dry forest at 39%, moist forest 80%, savannah ecosystem 49% and mangroves 60%. Despite conservation efforts that have included establishment of protected areas, the situation has worsened rather than improving. Habitat loss is escalating as a consequence of human population growth, market forces, technological improvement and increasing poverty. Measuring the total rate of habitat conversion (defined as change in forest area plus change in woodland area minus net plantation expansion) for 1990–2005, Tanzania has lost 37.4% of its forest and woodland habitats (FAO 2001, 2003; 2005a, 2005b). The loss of habitats has contributed notably to local extinctions and vulnerability of fauna in different localities, including protected areas comprising Tanzania's northern ecosystem component. Mkomazi Game Reserve, for example, lost four species namely, eastern white-bearded wildebeest (Connonchaetes taurinus), greater kudu (Tragelaphus strepsiceros), sable antelope (Hippotragus niger) and colobus monkey (Colobus angolensis) (Miller and Harris 1977). In Lake Manyara National Park, local extinction had occurred for nine species: black rhinoceros (Diceros bicornis), eland (Taurotragus oryx), hartebeest (Alcelaphus buselaphus), common reedbuck (Redunca arundinum), mountain reedbuck (Redunca fulvorufula), lesser kudu (Tragelaphus imberbis), oribi (Ourebia ourebi), African wild dog (Lycaon pictus) and cheetah (Acinonyx jubatus) (Silkiluwasha 1998). Kilimanjaro National Park and Forest Reserve lost two species: mountain reedbuck (Redunca fulvorufla) and klipspringer (Oreotragus oreotragus) (Newmark et al. 1991). Black rhinoceros is also locally extinct in Tarangire National Park (Meng'ataki, pers. comm. 2005).

**Fragmentation of Wildlife Habitat and its Effect**

Fragmentation of the landscape has both positive and negative impacts on species richness and resilience. One of the consequences of fragmentation is that it increases the ratio of the edge relative to the interior of an ecosystem. Wilcove *et al.* (1986) explain that the edge-effect influences vegetation composition 10-30m inside the forest, while its effect on predation can extend 300-600m inside the forest. They believe that this can have a strong negative impact on woodland fauna and flora. This compares to Turner *el al. (2003)* who state that ecosystem edges are often associated with high biodiversity and productivity, and have unique species assemblages. Forman and Godron (1986) incorporate both points of view and state that certain ecological processes are aided by a high interior to edge ratio, while other important processes are enhanced by a low ratio. They explain that the abundance of rare interior species decrease due to landscape heterogeneity, while species adapted to the edge of habitats, as well as animals requiring two or more ecosystems, increase and total species co-existence is enhanced. The effect of disturbance depends on its scale, frequency and intensity (Krohne 200 I). A landscape infrequently disturbed will become increasingly homogenous as a few species gain a competitive advantage and out-compete other species (Krohne 2001; Forman and Godron 1986).

A study based on Val Grande National Park in Italy found that species richness is decreasing in later successional stages due to uncontrolled nature development, where human disturbance has been minimized (Hochtl *el al. 2003).* This compares to an area experiencing either a chronic or repeated disturbance, which leads to a homogenised and species impoverished landscape. Scheffer *et al.* (2001) and Frelich and Reich (1998) identify three ways that ecosystems respond to anthropogenic disturbance. Some ecosystems respond in a smooth, continuous way to increasing stress. A more common occurrence is that ecosystems experience little change until stress reaches a critical level; when this point is reached the ecosystem changes into another state. Another possibility is when ecosystems have two or more alternative states and switch between them depending on the environmental conditions affected by anthropogenic disturbance. Sheffer *et al.* (2001) describe how shallow lakes can switch between a state of clear water and many birds and fish species, to a state that experiences murky water and a significantly reduced fish and bird population. They explain that this eutrophication occurs due to an overdose of nutrients. These different conditions must therefore be factored in when considering the effect that local people's disturbance has on their natural environment.

**Effect of Global Warming and Climate Change:**

Global warming is “an increase in the average temperature of Earth’s atmosphere,” either by “human industry and agriculture” or by natural causes. Burning of fossil fuels produces billions tones of CO 2, that contribute to global warming and climate change. Today Global warming has become a synonym with environmental change. Around the globe, seasons are shifting, temperatures are climbing and sea levels are rising. Hotter days, more severe storms, floods, snowfalls, droughts, fire and higher sea levels are expected in the foreseeable future. These changes threaten jobs, agricultural production, water supplies, industries, human lives and, ultimately, the survival of species and entire ecosystems. Scientists predict that a global temperature rise of close to 2°C (above pre-industrial levels) could result in 25% of the Earth’s animals and plants disappearing because they can’t adapt fast enough. Solving global warming will improve our lives by cleaning up air pollution while investing in clean energy, green jobs and smart energy solutions. We need to drive smarter cars, save money with energy efficient homes and offices, and build better communities and transportation networks. See how we can solve the climate crisis today The coastal zones cover those areas of land, sea and atmospheric interface and the underlying seabed and coastal terrestrial areas including the biota as well as abiotic resources. The marine and coastal areas are of great environmental, economic, social, cultural and recreational importance for the coastal people. Due to recent human activities the coastal.

## CHAPTER THREE

## 3.0 MATERIALS AND METHODS

### 3.1 Study Area

The study was conducted in University of Benin, Ugbowo campus, Benin City, Edo State, Nigeria. The University has a land area of 1,748 hectares. It is located between latitude $06.1^0$ and $06.8^07$'N and longitude $05.4^0$ and $06.0^0$E (Uniben Master Plan, 1993). The altitude is 74.5m above sea level. The climate in the University of Benin is that of the rainforest zone of the southwest Nigeria. Rainfall is usually high about 2,000mm annually and in some places exceeding The University of Benin has an annual rainfall of 1500mm (University of Benin Press, 1993). It has a relative humidity ranging from 75% (12noon) and 95%) (6.00am). the northern part of the campus is drained by Ikpoba River. The area is characteristically high temperature from $27^0$C to $32^0$C with an average temperature of $27^0$C (Uniben Master Plan, 1993).

### 3.2 Study site

Line transect method was used following the general guidelines for standardizing line transects by Peres (1999) and used by Ajayi *et al.,* (2011).

Transect method was employed using the existing roads within the campus premises. The data collection was done in three phases:

**Phase 1:** Reconnaissance survey was carried out for a period of three days between 28 and 31st January 2023. This was done to identify the existing roads in less built area within the campus and site B. Four roads were purposively selected from the existing roads; two roads each from less built-up area within the campus and two from site B. The roads were labelled A-D. The selected roads are presented in Table 1.

**Phase 2**: Dry season census was carried out from 4th February to April 3rd, 2023. The road transects were traversed at a speed of 1km/hr. following the guidelines of Lacher (2003) all transects were coordinated using GPS. Animal species were identified according to the classification of Serle et al., (1977) with binoculars during observations and a research data for recording of observations. This was done in all the selected 4 roads (transects).

**Phase 3**: Wet season census was carried out from 4th May to 3rd July, 2023. For both, census started between the hour of 7:00am – 10:00am and 4:00pm – 6:30pm., each transect was visited twice a month. Animals sighted were identified as outlined and described by Jean and Pierre (1990). The time of sighting, numbers of the individuals seen along the roads (transect) were noted. The developmental stages of the animals sighted (adult or juvenile) and sex (male or female) were also be recorded in the course of the transect walks. At each sighting, the GPS coordinate were taken alongside the information.

**Table 1: Selected roads in the less built up area and Site B**

| Areas | Selected roads | Dist. (m) | Latitude | Longitude |
|---|---|---|---|---|
| Less built up | VC's Lodge Rd | 780 | $06.4^0$5'N | $05.6^0$& $06.0^0$E |
| Less built up | Wildlife Domest. axis | 428 | $06.4^0$7'N | $05.6^0$& $06.0^0$E |
| Site B | River link | 820 | $06.4^0$6'N | $05.7^0$& $06.0^0$E |
| Site B | Utesi link | 900 | $06.4^0$5'N | $05.7^0$& $06.0^0$E |
| **TOTAL** | | **2928** | | |

### 3.3 Data Collection

The data collection was made from direct observations of animals and human activities during the censuses, the following data were collected.

(i) Species of animal sighted

(ii) Number of individual of the species

(iii) Animal activities when first sight

(iv) Indices of animal sighted

(v) Human activities in the area

### 3.4 Assumptions made for animal count

Five basic assumptions were made as recommended by Burnham, (1980), Seber, (1982) and Dunn, (1993), which were:

i. animals position directly over the transect line are not missed,

ii. animals are seen before they flee,

iii. none are counted twice,

iv. sighting of each animal or group of animals are done with certainty

v. all animals are distributed at random with respect to the transects.

### 3.5 Animals relative abundance

Animal's relative abundance was calculated as follow:

Relative abundance ($P_i$) = $n_i/N \times 100/1$ .................................................. (1)

Where $n_i$ is the number of individuals of same species and N is the total number of individual for all species (Achacoso *et al.,* 2016).

### 3.6 Biodiversity parameters estimated

The following biodiversity parameters were estimated according (Achacoso *et al.,* 2016) as follows:

Shannon diversity index $H^i = -\sum P_i \ln P_i$ ……………………………….. (2)

Evenness $D = e^x H^i / S$..........................……………………………… (3)

Richness R= S-1/InN …………………………………..……………. (4)

Where:

$P_i$ – proportion of Individuals for $i^{th}$ species out of the total number of individuals,

ln – natural log

$H^i$ – diversity index

S – Number of Species.

$e^x$ – exponential

N- total number of individual species

### 3.7 Statistical Analysis

Data collected were analysed using Student's t-test as recommended by (Alika, 2006) to determine significant differences at 5% level in biodiversity estimate of the animals in dry and wet seasons. While ANOVA were used for various animals accounted. Mean of the variables that were significant were separated using Ducan New Multiple Range Test at 5% level of significant.




# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.1 RESULTS

The results of the family, species and abundance of wild animals surveyed in University of Benin (wet season) are presented in Table 4.1. The results showed that a total of 260 individuals, belonging to 12 species and 8 families were observed during the wet season surveyed. The wild animals observed were *Thryonomys swinderianus*, *Naja nigricollis*, *Dendroaspis viridis*, *Atherurus africanus*, *Syivicapra grimmia*, *Cercopithecus aethiop*, *Hystrix cristata*, *Mungos gambianus, Viverra civetta, Xerus erythropus*, *Protoxerus stangeri* and *Cercopithecus mona.* Cercopithecidae, Sciuridae, Hystricidae, and Elapidae were the most represented families. The highest species abundance (0.327) and relative abundance (32.7%) were observed in *Xerus erythropus*, while the least species abundance (0.012) and relative abundance (1.2%) were recorded in *Hystrix cristata*.

**Table 4.1: Family, species and abundance of wild animals surveyed in University of Benin (wet season)**

| S/N | Family | Species | Number | Abundance | Relative Abundance |
|---|---|---|---|---|---|
| 1 | Sciuridae | *Xerus erythropus* | 38 | 0.146 | 14.6 |
| 2 | Viverridae | *Viverra civetta* | 20 | 0.077 | 7.7 |
| 3 | Sciuridae | *Protoxerus stangeri* | 85 | 0.327 | 32.7 |
| 4 | Thryonomyidae | *Thryonomys swinderianus* | 33 | 0.127 | 12.7 |
| 5 | Elapidae | *Naja nigricollis* | 10 | 0.038 | 3.8 |
| 6 | Elapidae | *Dendroaspis viridis* | 22 | 0.085 | 8.5 |
| 7 | Hystricidae | *Atherurus africanus* | 9 | 0.035 | 3.5 |
| 8 | Bovidae | *Syivicapra grimmia* | 6 | 0.023 | 2.3 |
| 9 | Cercopithecidae | *Cercopithecus aethiop* | 15 | 0.058 | 5.8 |
| 10 | Hustricidae | *Hystrix cristata* | 3 | 0.012 | 1.2 |
| 11 | Herpestidae | *Mungos gambianus* | 12 | 0.046 | 4.6 |
| 12 | Cercopithecidae | *Cercopithecus mona* | 7 | 0.027 | 2.7 |
| | **Total** | | **260** | | |

Source: Field survey, 2023

The results of the family, species and abundance of wild animals surveyed in University of Benin (wet season) are presented in Table 4.2. The results showed that a total of 447 individuals, belonging to 12 species and 8 families were observed during the wet season surveyed. The wild animals observed were *Thryonomys swinderianus*, *Naja nigricollis*, *Dendroaspis viridis*, *Atherurus africanus*, *Syivicapra grimmia*, *Cercopithecus aethiop*, *Hystrix cristata*, *Mungos gambianus, Viverra civetta, Xerus erythropus*, *Protoxerus stangeri* and *Cercopithecus mona.* Cercopithecidae, Sciuridae, Hystricidae, and Elapidae were the most represented families. The highest species abundance (0.284) and relative abundance (28.4%) were observed in *Xerus erythropus*, while the least species abundance (0.025) and relative abundance (2.5%) were recorded in *Hystrix cristata*.

**Table 4.2: Family, species and abundance of wild animals surveyed in University of Benin (dry season)**

| S/N | Family | Species | Number | Abundance | Relative Abundance |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | Sciuridae | *Xerus erythropus* | 62 | 0.139 | 13.9 |
| 2 | Viverridae | *Viverra civetta* | 35 | 0.078 | 7.8 |
| 3 | Sciuridae | *Protoxerus stangeri* | 127 | 0.284 | 28.4 |
| 4 | Thryonomyidae | *Thryonomys swinderianus* | 44 | 0.098 | 9.8 |
| 5 | Elapidae | *Naja nigricollis* | 23 | 0.051 | 5.1 |
| 6 | Elapidae | *Dendroaspis viridis* | 39 | 0.087 | 8.7 |
| 7 | Hystricidae | *Atherurus africanus* | 21 | 0.047 | 4.7 |
| 8 | Bovidae | *Syivicapra grimmia* | 17 | 0.038 | 3.8 |
| 9 | Cercopithecidae | *Cercopithecus aethiop* | 24 | 0.054 | 5.4 |
| 10 | Hustricidae | *Hystrix cristata* | 11 | 0.025 | 2.5 |
| 11 | Herpestidae | *Mungos gambianus* | 29 | 0.065 | 6.5 |
| 12 | Cercopithecidae | *Cercopithecus mona* | 15 | 0.034 | 3.4 |
| | **Total** | | **447** | | |

Source: Field Survey, 2020

The results of the distribution of wild animal species within University of Benin during the wet season in the study site are given in Table 4.3. The results showed that Compartment C (River links) had the highest number of individuals (115), Shannon Wiener Diversity (2.274), species evenness (0.8622). Compartment D (Utesi links) had the highest species richness (2.417). While the least Shannon Wiener Diversity (1.352), species evenness (0.7020) and species richness (1.246) were observed in Compartment B (Wildlife domestication ranges).

**Table 4.3: Distribution of the wild animals in University of Benin within the Transects ranges (Wet season)**

| Variables | A | B | C | D |
|---|---|---|---|---|
| **Taxas** | 7 | 6 | 12 | 12 |
| **Individual** | 37 | 43 | 115 | 65 |
| **Shannon Diversity Index** | 1.520 | 1.352 | 2.274 | 2.126 |
| **Evenness_e^H/S** | 0.7231 | 0.7020 | 0.8622 | 0.7796 |
| **Margalef** | 1.492 | 1.246 | 2.184 | 2.417 |

Source: Field Survey, 2023

A= SSQ ranges; B= Wildlife domestication ranges, C= River ranges, D= Utesi ranges

The results of the distribution of wild animal species within University of Benin during the dry season in the study site are given in Table 4.4. The results showed that Compartment C (River links) had the highest number of individuals (184), Shannon Wiener Diversity (2.352), species evenness (0.9023). Compartment D (Utesi links) had the highest species richness (2.204). While the least Shannon Wiener Diversity (1.522), species evenness (0.8017) and species richness (1.128) were observed in Compartment B (Wildlife domestication ranges).

**Table 4.4: Distribution of the wild animals in University of Benin within the Transects ranges (Dry season)**

| Variables | A | B | C | D |
|---|---|---|---|---|
| **Taxas** | 7 | 6 | 12 | 12 |
| **Individual** | 67 | 75 | 184 | 121 |
| **Shannon Diversity Index** | 1.644 | 1.522 | 2.352 | 2.303 |
| **Evenness_e^H/S** | 0.8131 | 0.8017 | 0.9023 | 0.8714 |
| **Margalef** | 1.316 | 1.128 | 2.042 | 2.204 |

Source: Field Survey, 2023
A= SSQ ranges; B= Wildlife domestication ranges, C= River ranges, D= Utesi ranges

The results of habitat preference of the wild animal species in the study sites wet season are given in Table 4.5. The results showed significant difference ($P<0.05$) between the abundance of animal species in site A and B areas. The number of wild animal species recorded in site B (15.0±2.76) was significantly higher than the observation made from the site A (6.7±1.32)

**Table 4.5: Habitat preference of the wild animal species in the study sites (Wet season)**

| S/N | Species | Site A | Site B |
|---|---|---|---|
| 1 | *Xerus erythropus* | 12 | 26 |
| 2 | *Viverra civetta* | 7 | 13 |
| 3 | *Protoxerus stangeri* | 34 | 51 |
| 4 | *Thryonomys swinderianus* | 13 | 20 |
| 5 | *Naja nigricollis* | 3 | 7 |
| 6 | *Dendroaspis viridis* | 8 | 14 |
| 7 | *Atherurus africanus* | 3 | 6 |
| 8 | *Syivicapra grimmia* | 0 | 6 |
| 9 | *Cercopithecus aethiop* | 0 | 15 |
| 10 | *Hystrix cristata* | 0 | 3 |
| 11 | *Mungos gambianus* | 0 | 12 |
| 12 | *Cercopithecus mona* | 0 | 7 |
| **Total** | | 80 | 180 |
| **Mean** | | **$6.7^{b}$±1.32** | **$15.0^{a}$±2.76** |

Source: Field survey, 2023

The results of habitat preference of the wild animal species in the study sites dry season are given in Table 4.6. The results showed significant difference ($P<0.05$) between the abundance of animal species in site A and B areas. The number of wild animal species recorded in site B (25.4±2.24) was significantly higher than the observation made from the site A (11.8±1.64)

**Table 4.6: Habitat preference of the wild animal species in the study sites (Dry season)**

| S/N | Species | Site A | Site B |
|---|---|---|---|
| 1 | *Xerus erythropus* | 14 | 48 |
| 2 | *Viverra civetta* | 12 | 22 |
| 3 | *Protoxerus stangeri* | 53 | 74 |
| 4 | *Thryonomys swinderianus* | 15 | 29 |
| 5 | *Naja nigricollis* | 8 | 15 |
| 6 | *Dendroaspis viridis* | 13 | 26 |
| 7 | *Atherurus africanus* | 5 | `16 |
| 8 | *Syivicapra grimmia* | 3 | 14 |
| 9 | *Cercopithecus aethiop* | 5 | 19 |
| 10 | *Hystrix cristata* | 0 | 11 |
| 11 | *Mungos gambianus* | 10 | 19 |
| 12 | *Cercopithecus mona* | 4 | 11 |
| **Total** | | 142 | 305 |
| **Mean** | | **$11.8^{b}$±1.64** | **$25.4^{a}$±2.24** |

Source: Field survey, 2023

The results revealed significant difference (P<0.05) in abundance of wild animal species between the distribution in wet and dry season. The dry season distribution (37.3±5.33) significantly dominated over the wet season distribution (21.7±3.48) (Table 4.7).

**Table 4.7: Wild animals surveyed between wet and dry season in University of Benin**

| S/N | Species | Wet Season | Dry Season |
|---|---|---|---|
| 1 | *Xerus erythropus* | 38 | 62 |
| 2 | *Viverra civetta* | 20 | 35 |
| 3 | *Protoxerus stangeri* | 85 | 127 |
| 4 | *Thryonomys swinderianus* | 33 | 44 |
| 5 | *Naja nigricollis* | 10 | 23 |
| 6 | *Dendroaspis viridis* | 22 | 39 |
| 7 | *Atherurus africanus* | 9 | 21 |
| 8 | *Syivicapra grimmia* | 6 | 17 |
| 9 | *Cercopithecus aethiop* | 15 | 24 |
| 10 | *Hystrix cristata* | 3 | 11 |
| 11 | *Mungos gambianus* | 12 | 29 |
| 12 | *Cercopithecus mona* | 7 | 15 |
| **Total** | | 260 | 447 |
| **Mean** | | **21.7$^{b}$±3.48** | **37.3$^{a}$±5.33** |

Source: Field survey, 2023

The results of the activities of wild animals within University of Benin are presented in Table 4.8. The activities observed were footprints, trails, calls, droppings and feeding spots. The results revealed significant difference (P<0.05) among the various activities of the wild animals observed in the University. The results also revealed significant difference (P<0.05) among the various activities of the wild animals observed in the selected compartment in University Benin.. Trails significantly dominated every other activities of the wild animals within the University, while activities recorded in compartment C differ significantly from others..

**Table 4.8: Activities of the wild animals observed within University of Benin**

| Transects | Footprints | Trails | Calls | Droppings | Feeding spot | Mean |
|---|---|---|---|---|---|---|
| **A** | 20 | 60 | 37 | 30 | 14 | **36.2$^{b}$±4.3** |
| **B** | 9 | 19 | 12 | 10 | 7 | **15.8$^{c}$±1.9** |
| **C** | 33 | 77 | 59 | 44 | 28 | **52.8$^{a}$±5.3** |
| **D** | 22 | 62 | 47 | 37 | 21 | **44.2$^{b}$±4.7** |
| **Total** | **84** | **218** | **155** | **121** | **70** | |
| **Mean** | **21.0±3.7$^{d}$** | **54.5$^{a}$±6.2** | **38.8$^{b}$±5.7** | **30.3$^{c}$±4.8** | **17.5±3.7$^{d}$** | |

Source: Field survey, 2023

The results of the anthropogenic activities within University of Benin are presented in Table 4.9. The results revealed significant difference (P<0.05) among the various anthropogenic activities observed within the University. Traps significantly dominated every other anthropogenic activities within the University.

**Table 4.9: Anthropogenic activities observed within University of Benin**

| Blocks | BC | F | BB | T | HF | H | P | Mean |
|---|---|---|---|---|---|---|---|---|
| **A** | 17 | 26 | 7 | 34 | 12 | 8 | 10 | **16.3$^{b}$±5.2** |
| **B** | 6 | 8 | 3 | 18 | 4 | 5 | 7 | **7.3$^{c}$±2.7** |
| **C** | 36 | 42 | 16 | 68 | 18 | 27 | 19 | **32.3$^{a}$±4.8** |
| **D** | 24 | 30 | 9 | 52 | 10 | 16 | 12 | **21.9$^{b}$±5.6** |
| **Total** | **83** | **106** | **35** | **172** | **44** | **56** | **48** | |
| **Mean** | **20.8±4.1$^{b}$** | **26.5±7.4$^{b}$** | **8.8±3.9$^{d}$** | **43.0±4.7$^{a}$** | **11.0±3.5$^{c}$** | **14.0±3.8$^{c}$** | **12.0±2.4$^{c}$** | |

Source: Field survey, 2023

**BC;** Building Construction, **F;** Farming, **BB;** Bush Burning, **T;** Traps, **HF;** Habitat Fragmentation, **H;** Hunting, **P;** Poisoning

The results of the frequently used traps within University of Benin are presented in Table 4.9. The results revealed significant difference (P<0.05) among the various traps observed within the University. Traps significantly dominated every other anthropogenic activities within the University.

**Table 4.10: Frequently used traps within University of Benin**

| Blocks | Cages | Snares | Gin Traps | Pit | Mean |
|---|---|---|---|---|---|
| **A** | 7 | 24 | 4 | 2 | **$9.3^b$±3.1** |
| **B** | 3 | 8 | 2 | 1 | **$3.5^c$±2.3** |
| **C** | 17 | 40 | 8 | 5 | **$17.5^a$±5.2** |
| **D** | 10 | 32 | 6 | 3 | **$12.8^b$±3.8** |
| **Total** | **37** | **104** | **20** | **11** | |
| **Mean** | **9.3±$2.3^b$** | **26.0±$4.7^a$** | **5.0±$1.9^c$** | **2.3±$1.2^c$** | |

Source: Field survey, 2023

# CHAPTER FIVE

# CONCLUSION AND RECOMMENDATION

## 5.1 CONCLUSION

Due to the investigation of the research study, it is therefore concluded that the university of Benin harbour high diversity of wildlife species. However,it is called for high conservation advise for the wide range of the current species conservation. The study records varied degree of human induced disturbance in the two study sites. The investigation recorded that the wildlife species faced with different Anyhropogenic pressure leading to habitat fragmentation which might have forced most of the species to local extinction in the study area, also season of the year plays a vital role in species population dictection. Though it is further concluded that the species occur during the dry season. The investigated species exhibit varied means of identification through calls, trials, dropping, feeding spot as the major activity of the animal sighted.

## 5.2 RECOMMENDATION

Based on the findings of this report, it is therefore recommended that

1. There is need for urgent conservation effort for the protection of the species population

2. The management of the university should reserve an area within the study site for species to utilize.

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## APPENDIX

| S/N | Family | Species | Number | Abundance | Relative Abundance |
|---|---|---|---|---|---|
| 1 | Sciuridae | *Xerus erythropus* | 38 | 0.146 | 14.6 |
| 2 | Viverridae | *Viverra civetta* | 20 | 0.077 | 7.7 |
| 3 | Sciuridae | *Protoxerus stangeri* | 85 | 0.327 | 32.7 |
| 4 | Thryonomyidae | *Thryonomys swinderianus* | 33 | 0.127 | 12.7 |
| 5 | Elapidae | *Naja nigricollis* | 10 | 0.038 | 3.8 |
| 6 | Elapidae | *Dendroaspis viridis* | 22 | 0.085 | 8.5 |
| 7 | Hystricidae | *Atherurus africanus* | 9 | 0.035 | 3.5 |
| 8 | Bovidae | *Syivicapra grimmia* | 6 | 0.023 | 2.3 |
| 9 | Cercopithecidae | *Cercopithecus aethiop* | 15 | 0.058 | 5.8 |
| 10 | Hustricidae | *Hystrix cristata* | 3 | 0.012 | 1.2 |
| 11 | Herpestidae | *Mungos gambianus* | 12 | 0.046 | 4.6 |
| 12 | Cercopithecidae | *Cercopithecus mona* | 7 | 0.027 | 2.7 |
| | **Total** | | **260** | | |

Source: Field survey, 2023

| S/N | Family | Species | Number | Abundance | Relative Abundance |
|---|---|---|---|---|---|
| 1 | Sciuridae | *Xerus erythropus* | 62 | 0.139 | 13.9 |
| 2 | Viverridae | *Viverra civetta* | 35 | 0.078 | 7.8 |
| 3 | Sciuridae | *Protoxerus stangeri* | 127 | 0.284 | 28.4 |
| 4 | Thryonomyidae | *Thryonomys swinderianus* | 44 | 0.098 | 9.8 |
| 5 | Elapidae | *Naja nigricollis* | 23 | 0.051 | 5.1 |
| 6 | Elapidae | *Dendroaspis viridis* | 39 | 0.087 | 8.7 |
| 7 | Hystricidae | *Atherurus africanus* | 21 | 0.047 | 4.7 |
| 8 | Bovidae | *Syivicapra grimmia* | 17 | 0.038 | 3.8 |
| 9 | Cercopithecidae | *Cercopithecus aethiop* | 24 | 0.054 | 5.4 |
| 10 | Hustricidae | *Hystrix cristata* | 11 | 0.025 | 2.5 |
| 11 | Herpestidae | *Mungos gambianus* | 29 | 0.065 | 6.5 |
| 12 | Cercopithecidae | *Cercopithecus mona* | 15 | 0.034 | 3.4 |
| | **Total** | | **447** | | |

Source: Field Survey, 2020

| Variables | A | B | C | D |
|---|---|---|---|---|
| **Taxas** | 7 | 6 | 12 | 12 |
| **Individual** | 37 | 43 | 115 | 65 |
| **Shannon Diversity Index** | 1.520 | 1.352 | 2.274 | 2.126 |
| **Evenness_e^H/S** | 0.7231 | 0.7020 | 0.8622 | 0.7796 |
| **Margalef** | 1.492 | 1.246 | 2.184 | 2.417 |

Source: Field Survey, 2023

A= SSQ ranges; B= Wildlife domestication ranges, C= River ranges, D= Utesi ranges

| Variables | A | B | C | D |
|---|---|---|---|---|
| **Taxas** | 7 | 6 | 12 | 12 |
| **Individual** | 67 | 75 | 184 | 121 |
| **Shannon Diversity Index** | 1.644 | 1.522 | 2.352 | 2.303 |
| **Evenness_e^H/S** | 0.8131 | 0.8017 | 0.9023 | 0.8714 |
| **Margalef** | 1.316 | 1.128 | 2.042 | 2.204 |

Source: Field Survey, 2023

A= SSQ ranges; B= Wildlife domestication ranges, C= River ranges, D= Utesi ranges

| S/N | Species | Site A | Site B |
|---|---|---|---|
| 1 | *Xerus erythropus* | 12 | 26 |
| 2 | *Viverra civetta* | 7 | 13 |
| 3 | *Protoxerus stangeri* | 34 | 51 |
| 4 | *Thryonomys swinderianus* | 13 | 20 |
| 5 | *Naja nigricollis* | 3 | 7 |
| 6 | *Dendroaspis viridis* | 8 | 14 |
| 7 | *Atherurus africanus* | 3 | 6 |
| 8 | *Syivicapra grimmia* | 0 | 6 |
| 9 | *Cercopithecus aethiop* | 0 | 15 |
| 10 | *Hystrix cristata* | 0 | 3 |
| 11 | *Mungos gambianus* | 0 | 12 |
| 12 | *Cercopithecus mona* | 0 | 7 |
| **Total** | | 80 | 180 |
| **Mean** | | **$6.7^{b}$±1.32** | **$15.0^{a}$±2.76** |

Source: Field survey, 2023

| S/N | Species | Site A | Site B |
|---|---|---|---|
| 1 | *Xerus erythropus* | 14 | 48 |
| 2 | *Viverra civetta* | 12 | 22 |
| 3 | *Protoxerus stangeri* | 53 | 74 |
| 4 | *Thryonomys swinderianus* | 15 | 29 |
| 5 | *Naja nigricollis* | 8 | 15 |
| 6 | *Dendroaspis viridis* | 13 | 26 |
| 7 | *Atherurus africanus* | 5 | `16 |
| 8 | *Syivicapra grimmia* | 3 | 14 |
| 9 | *Cercopithecus aethiop* | 5 | 19 |
| 10 | *Hystrix cristata* | 0 | 11 |
| 11 | *Mungos gambianus* | 10 | 19 |
| 12 | *Cercopithecus mona* | 4 | 11 |
| **Total** | | 142 | 305 |
| **Mean** | | **$11.8^{b}$±1.64** | **$25.4^{a}$±2.24** |

Source: Field survey, 2023

| S/N | Species | Wet Season | Dry Season |
|---|---|---|---|
| 1 | *Xerus erythropus* | 38 | 62 |
| 2 | *Viverra civetta* | 20 | 35 |
| 3 | *Protoxerus stangeri* | 85 | 127 |
| 4 | *Thryonomys swinderianus* | 33 | 44 |
| 5 | *Naja nigricollis* | 10 | 23 |
| 6 | *Dendroaspis viridis* | 22 | 39 |
| 7 | *Atherurus africanus* | 9 | 21 |
| 8 | *Syivicapra grimmia* | 6 | 17 |
| 9 | *Cercopithecus aethiop* | 15 | 24 |
| 10 | *Hystrix cristata* | 3 | 11 |
| 11 | *Mungos gambianus* | 12 | 29 |
| 12 | *Cercopithecus mona* | 7 | 15 |
| **Total** | | 260 | 447 |
| **Mean** | | **$21.7^{b}$±3.48** | **$37.3^{a}$±5.33** |

Source: Field survey, 2023

| Transects | Footprints | Trails | Calls | Droppings | Feeding spot | Mean |
|---|---|---|---|---|---|---|
| **A** | 20 | 60 | 37 | 30 | 14 | **$36.2^{b}$±4.3** |
| **B** | 9 | 19 | 12 | 10 | 7 | **$15.8^{c}$±1.9** |
| **C** | 33 | 77 | 59 | 44 | 28 | **$52.8^{a}$±5.3** |
| **D** | 22 | 62 | 47 | 37 | 21 | **$44.2^{b}$±4.7** |
| **Total** | **84** | **218** | **155** | **121** | **70** | |
| **Mean** | **21.0±$3.7^{d}$** | **$54.5^{a}$±6.2** | **$38.8^{b}$±5.7** | **$30.3^{c}$±4.8** | **17.5±$3.7^{d}$** | |

Source: Field survey, 2023

| Blocks | BC | F | BB | T | HF | H | P | Mean |
|---|---|---|---|---|---|---|---|---|
| **A** | 17 | 26 | 7 | 34 | 12 | 8 | 10 | **$16.3^{b}$±5.2** |
| **B** | 6 | 8 | 3 | 18 | 4 | 5 | 7 | **$7.3^{c}$±2.7** |
| **C** | 36 | 42 | 16 | 68 | 18 | 27 | 19 | **$32.3^{a}$±4.8** |
| **D** | 24 | 30 | 9 | 52 | 10 | 16 | 12 | **$21.9^{b}$±5.6** |
| **Total** | **83** | **106** | **35** | **172** | **44** | **56** | **48** | |
| **Mean** | **20.8±$4.1^{b}$** | **26.5±$7.4^{b}$** | **8.8±$3.9^{d}$** | **43.0±$4.7^{a}$** | **11.0±$3.5^{c}$** | **14.0±$3.8^{c}$** | **12.0±$2.4^{c}$** | |

Source: Field survey, 2023

| Blocks | Cages | Snares | Gin Traps | Pit | Mean |
|---|---|---|---|---|---|
| **A** | 7 | 24 | 4 | 2 | **9.3$^{b}$±3.1** |
| **B** | 3 | 8 | 2 | 1 | **3.5$^{c}$±2.3** |
| **C** | 17 | 40 | 8 | 5 | **17.5$^{a}$±5.2** |
| **D** | 10 | 32 | 6 | 3 | **12.8$^{b}$±3.8** |
| **Total** | **37** | **104** | **20** | **11** | |
| **Mean** | **9.3±2.3$^{b}$** | **26.0±4.7$^{a}$** | **5.0±1.9$^{c}$** | **2.3±1.2$^{c}$** | |

Source: Field survey, 2023