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Status of large mammals: case study of gorilla (*Gorilla gorilla diehi*), chimpanzee (*Pan troglodytes ellioti*) and buffalo (*Syncerus caffer*), Menchum South, NW Cameroon

Mvo Denis Chuo[1,*], Tsi Evaristus Angwafo[1, 2]

[1]*Department of Forestry, Faculty of Agronomy and Agricultural Sciences (FASA), P. O. Box 222 Dschang, University of Dschang, Cameroon*

[2]*Department of Fundamental Science Higher Technical Teacher Training College (H.T.T.T.C.) P.O. Box 39 Bambili University of Bamenda - Cameroon*

Abstract— *This study entitled status of large mammals: case study of gorilla, chimpanzee and buffalo, was carried out in the Black Bush Area of Waindow (BBAW), Menchum South, NW Cameroon from January-March, 2014. The general objective was to determine the status of large mammal's species and to investigate the presence of gorilla, chimpanzees and buffalo reported by the indigenous people in order to contribute to the conservation of these species in the region. The recce-survey method was used for species inventory whereby direct and indirect observations of bio-indicators of these species and human signs were recorded. From the result, the encounter rates of buffalo and chimpanzee were 0.35 and 0.26 signs per km respectively with no gorilla sign observed. Spatial distribution maps revealed great concentration of these species in the northern zone. Hunting recorded the highest encounter rate of 0.42 signs per km of anthropogenic activities. As such, one could deduce that the pressures exacerbated on these animals due to human activities and encroachment by Nigeria traders, and grazers placed the remaining species under intense threat of disappearing within the study areas. It is therefore necessary to intensify conservation efforts so as to urgently address these species concerns.*

Keywords— *status, conservation, Gorilla, chimpanzee, buffalo, BBAW.*

I. INTRODUCTION

Despite the global increase in the number of protected areas, it is greatly remarked that biological values are not delimited by protected areas since all species do not have the same habitat requirements as well as do not have the same range boundaries (Milligan, 2009). As such, Non-protected areas retain value and are therefore of prime importance for wildlife conservation activities due to the presence of large charismatic mammal species such as gorilla, chimpanzee, buffalo and their role in the connectivity between protected areas (Bennett, 1998). Moreover, despite the impressive commitment to conserve biodiversity, many large mammal species in protected areas are constantly declining due to the conversion of wildlife friendly habitat for agriculture (Jones et al., 2007 and Newmark, 2008), as well as the irreversible disappearance of non protected areas that act as connective corridors to protected areas (Dobson et al., 1999). To this effect the sustainable management of large mammals outside protected areas should therefore be considered as an aspect for wildlife conservation (Halladay and Gilmour, 1995). A raft of studies is showing that Africa is losing species from many national parks despite the fortification of biodiversity conservation (Western et al., 2009). The underlying causes are due to deficiencies in boundary design, loss of many connective corridors, inadequate protection and ecological management of large mammals in non protected areas (Western et al., 2009).

Cameroon is part of the Congo Basin and harbours a wide range of biological resources. It is the fourth most biodiversified country in Africa after the Democratic Republic of Congo, Tanzania and Madagascar (UNDP, 2001). With 409 mammal species, of which 14 are endemic; 165 reptile species; 916 bird species, of which 8 are endemic while about 150 are migratory; 9000 plant species, of which 156 are endemic; 200 amphibian species, of which 63 are endemic; and about 1500 Butterfly species (UNDP, 2001). This have boast the domain of wildlife conservation in which Cameroon has developed a network of protected areas which covers a surface area of about 8138800 hectares and 17 National Parks, all of which covers about 19.2% of the national territory. Other protected areas are grouped into the following categories; 6 wildlife reserves, 1

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wildlife sanctuary, 3 Zoological Gardens, 46 hunting concessions and 22 community hunting zones (MINFOF, 2010). However, this success seems to have had a limited impact in terms of countering the decline in biodiversity. Indeed, most of these species are considered threatened with high extinction rate. This problem is further exacerbated by the fact that most large mammals species lives outside protected areas. For example, recent data shows that gorillas, chimpanzees and buffalos are more populous in hunting zones and some concessions than in protected areas (MINFOF, 2010). This highlights the need to recognize non protected areas in which these species are found. Although it is generally assumed that protected areas offers the best type of legal protection for wildlife conservations, the implication is that in countries which lack financial resources and infrastructures, large mammals species will be inadequately protected in protected areas thus the need to protect them even more in non protected areas (William et al., 1990).

For instance, Law no 94/01 of 20 January 1994 (also refer as Forestry code), to lay down forestry, wildlife and fishery regulations and its subsequent Implementation Decree. Section 11 of the law stipulates that: "the genetic resources of the national heritage shall belong to the State of Cameroon". No person shall use them for scientific, commercial or cultural purposes without prior authorization". This is the case of the non protected area of Waindow, in which the profitable exploitation of gorillas, chimpanzees and buffalos by local residents is considered as a valuable option to reconcile development and to improve standard of living without taking into consideration the sustainable management of these species. Thus a greater call for concern in which the sustainable use of these species within the study area should be considered as a vital issue for conservation objectives. However, the application of such a concept in communal lands outside protected areas has to meet two main requirements to ensure a sustainable implementation. First, it must rely on the support of local communities, through their active involvement in wildlife management operations and hence decision making (Hulme and Taylor, 2000). Second, it requires precise and regular information on wildlife abundance and trends to ensure that management schemes are adaptive and allow for a sustainable use of wildlife populations (Kremen et al., 1994).

The main problem that calls the attention of this research is decrease in the population of large mammal's species in the BBAW. This decrease is driven by habitat loss resulting from human activities such as; illegal logging, poor agricultural practices, encroachment in critical corridors, poaching due to high demand for bush meat, traditional medicines, for festivals and rituals couples with poor governance (Tsi and Chuo, 2016). Habitat loss in this area is cause by habitat fragmentation and degradation resulting from poor agricultural practices such as forest fires outbreaks due to slash-and-burn agriculture. Logging companies are almost absent in the region but wood for house construction and for artisanal wood processing is rampant as local engine saws are often used to cut down trees (Picture 16: Appendix 3). These pressures are further exacerbated due to encroachment of grazers from Nigeria and from other parts of the country who still carried out transhumant and at times cut down certain trees species to feed their cattle especially during draught (Chuo, 2014). Equally the destruction of many biases especially the hot spring at Itiaku by cattle is a serious threat to connective routes of large mammals species in this area.

Poaching remains a principal threat to various large mammals' populations in this area. The availability of many short guns of one to five ranks, the present of many different kinds of cartridges for instant cartridge 66, 32g (Picture 9: Appendix 3) used to kill duikers, monkeys and other small mammals, cartridge BB, 34g (Picture 10: Appendix 3) used to kill bush buck, olive baboons and other medium size mammal, and cartridge 99, 36g (Picture 11: Appendix 3) specialized to kill leopard, hyena, gorillas, chimpanzees, buffalos and other large mammals (Chuo, 2014). Equally the high availability of snare wires arranged in inches of 3, 6-8, and 15-20 (Picture 12, 13 and 14: Appendix 3) to trap animals of sizes duikers, bush buck and buffalo respectively sold at relatively cheap prices through black marked business in the area have intensify hunting. The presence of many domestic dogs greatly encourages group hunting especially during the dry seasons. The wide use of "gamaline and arata bomb" through food substances to poison these large mammals is a serious threat (Chuo, 2014). In these areas, large mammals such as gorillas, chimpanzees and buffalos are highly demanded for their hands, legs, heads, skulls, skins and/or the whole animals for use during traditional rituals and festivals. They are equally hunted for food, medicinal purposes and commerce. Primate capture either for pets (Picture 8: Appendix 3) or kept in preparation for sacrifices to shrine is a predominant aspect highly practice by the natives of these areas (Tsi and Chuo, 2016). The relative isolation of this area, inaccessibility and indigenous brutality, has led to poor governance making it difficult to provide information on the abundance, distribution and threats to large mammals population. This serious weakness has given free liberty for poachers to do as they want thus the continued decline of large mammal species in this area.

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II. MATERIAL AND METHODS

2.1. The location of the study area

The Black bush area of Waindow is located between latitude 6° N and 7° N and longitude 9°E and 10°E and is situated in Menchum South Constituency, North West Region of Cameroon. It has an altitude of about 900m to 2140m above sea level in the mountains and about 200m to 600m in the valleys and a surface area of 97,667 ha. It is situated toward the western boundary of the region which stretches along the international border between Cameroon and eastern Nigeria. The main rivers that flow through this area are the rivers Ivin, Menchum, and Kimbi. All of these join the Kasina-la, which flows into Kasina-la State, Nigeria. The figure 1 shows the map allocation of the BBAW in Menchum Division, North West Region of Cameroon.

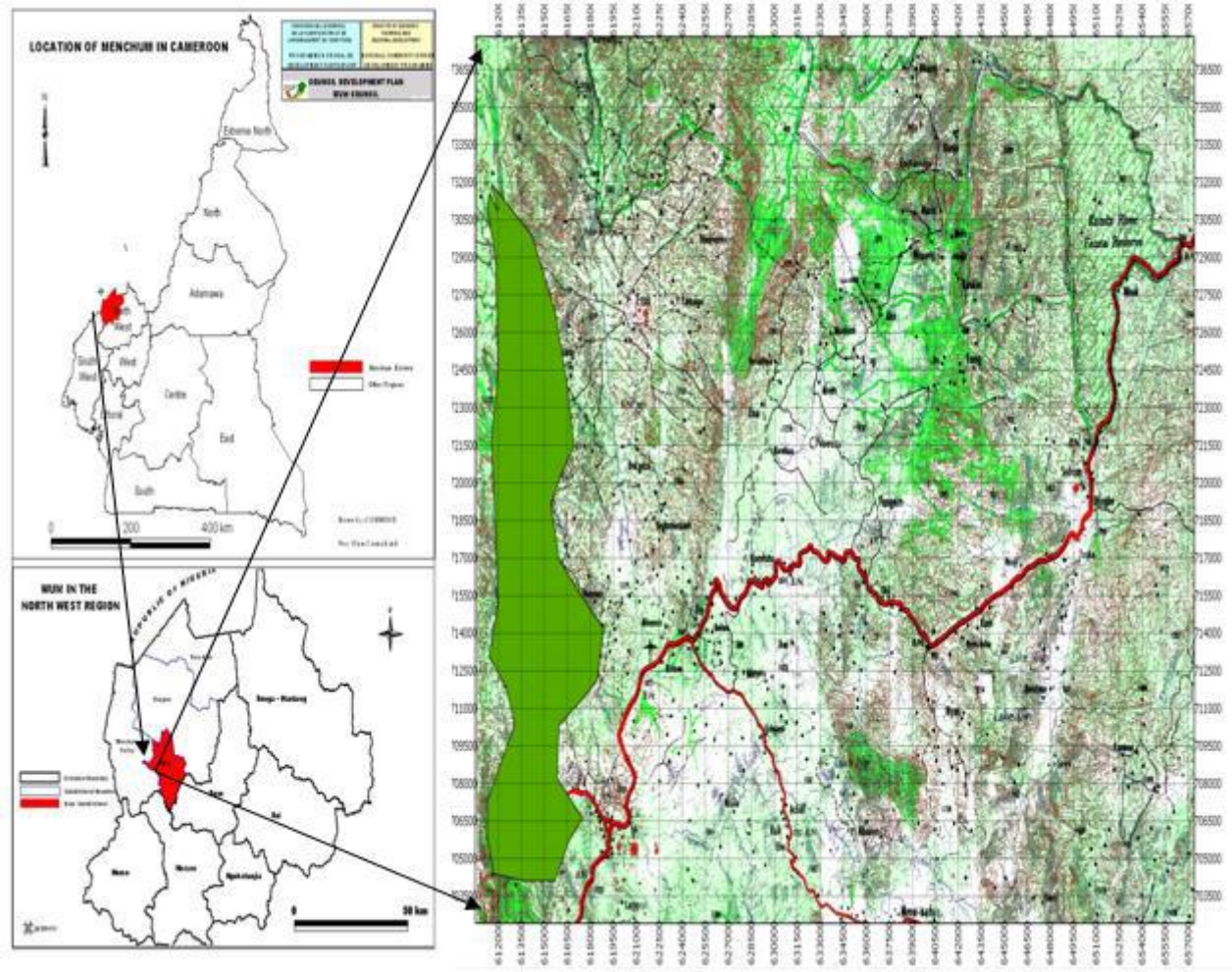

Fig.1: Map of Cameroon showing location of the BBAW in Menchum Division

This area constitutes a significant portion of the Bamenda highlands montane forests. It harbours important large mammal species such as Gorilla, Chimpanzee, Buffalo, Olive baboon, Drills, Putty-nosed monkey, White monkey, Mona monkey, Red eared guenon, Bush pig, Bush buck, Duikers, Leopard, Hyena, Hippopotamus and others some of which are classified by IUCN Red data book list as threatened species and by the Cameroon Wildlife law as critical endangered species (MINFOF, 20010). This area possessed wide variety of birds' species most of which are highly endanger in the IUCN red list of endangered species. Among these birds species a few of them include Banner manna's turaco, pied crow, gray headed sparrow, swallow, collared sunbird, spectacle weaver, owls, hawk, barn owl, osprey, scaly francolin, giant king fisher, and martial eagle (COMINSUD, 2011), which are clear indicators proving the high biodiversity richness of the study area. This area equally contains trees species such as Sapelli, Iroko, Obeche, Pygeum, and Mahogany. Some important plant species such as *Ficus spp* are harvested and used in traditional medicine especially by those who do not have access to modern health facilities. BBAW also provide many non timber products such as very rich honey, djansang, bush mango,

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biter cola, bush pepper, fire wood, charcoal and other which are of great benefit to the local community (COMINSUD, 2011).

2.2. Data collection

Data collection to estimate the abundance and distribution of large mammal's species with respect to human activities was undertaken using the recce survey method (White and Edward, 2000). The zone was subdivided into quadrates of 1.5 km x 1.5km. Inside each sampled quadrate, a recce of 1500m long was established. Thirty eight (38) recces of 1.5km long oriented in a random manner were walked within the study area making a total effort of 57km recce as shown on the sampling plan (Figure 2: Appendix 1). Recces walk, cross major drainage features (shrub savannah', 'open low shrubs' and 'open to closed woody vegetation or thickets') in order to sample a representative proportion of all vegetation types. The exact positions of signs observed in the field were determined by the use of a GPS GARMIN 10 *Euon*. A digital camera was used to take photographs of animal and human signs while and a Binocular of mark Nikon were use to observe or view animal away from the recce.

Recces were walk by a team of five persons, consisting of a leader, observers, one field assistants, one laborer and one local hunter. The leader was responsible for reading the bearing, searching for animal signs and recording data. The observer focused on the ground, in search for signs such as dung, foot prints and tracks as well as looking upward for detecting direct observation of animals and other signs (such as nests). The hunter was responsible for identifying tracks and dung of different animal species in cases where identification was difficult. The field assistant remains on the correct compass bearing check for terrestrial signs of animal presence and concentrates attention in the trees, looking for nests and primates while the labourer was responsible for opening the bush ahead along the compass bearing with the help of a machete. Data on all large mammal sightings, vocalizations and signs (dung, nest, tracks, carcasses, furs, footprints and food remains) were recorded on a data collecting sheet. All human signs, village sites (used or disused), cutlass cut, regularly used human trails, honey extraction, snare line (active or abandoned), gun shots, camp sites (active or abandoned), fire places, current or past agricultural activity, bark striping for medicine, sites where nuts have been cracked open, used batteries, shotgun shells, cigarette packets, hunting, fishing, logging, and fruits gathering along transect were also recorded on a data collecting sheet.

2.3. Data analysis

Field data sheets were decoded and information entered into Microsoft excel. The observations were grouped according to the different mammal species and type of anthropogenic activity. Relative densities were calculated manually since the number of indices encountered did not attain 60 for all species to use DISTANCE programme. The Encounter rate (ER) = Total number of objects or signs observed divided by the length (L) of transect (in kilometer). **ER= N /L**

Where: **N =** Number of objects/signs observed

Lt = Length of recce (Km)

This permitted us to estimate the relative abundance of animal population and signs of anthropogenic activities. The GPS points of chimpanzees, buffalos and other large mammal's species indicators and human activities recorded per quadrant were exported to Arc View computer program 3.3 and geo-referenced to produce different spatial distribution maps. The classes of encounter rate were then defined in order to group similar quadrates and represent zones of different concentrations. Different color bands and corresponding color intensities were used to represent different encounter rates on the distribution maps. This permitted the definition of important zones for mammal's species like (chimpanzee, buffalo) in order to determine management strategies for their conservation. Regression analyses were carried out to test the relationship between the encounter rate of large mammals and anthropogenic activities. Encounter rates of these two variables were exported to SPSS to produce fitted Regression line.

III. RESULTS

3.1. Relative abundance and spatial distribution of species

Following recce-surveys method, 14 large mammals' species were recorded in the study site resulting from indirect observations (dung, voices, and nest) and direct sighting (Table 1: Appendix 2). The family of cercopithecinae has more species richness (*Cercopithecus nictitans Cercopithecus aethiops, Erythrobus patas*, *Papio Anubis*, and *Cercopithecus mona)* follow by the family of Bovidae with four different species (*Cephalophus monticola, Tragelaphus scriptus Syncerus caffer, and Cephalophus dorsalis*). This result contrasts those of (Wum council, 2012) in the Wum Municipality, North West Region –Cameroon in which 29 large mammal species were reported to inhabit this area.

3.1.1. The indices of species identify in the BBAW

Walking along human and buffalo trails, many indices were indirectly or directly identify. For the 14 large mammals' species observed in the study area, sums of

138 indirect signs were identified and 31 large mammals were directly observed (Table 2: Appendix 2). Generally, large mammal species were identified through eight (8) biological indices (dung, foot prints, tracks, food remains, resting or nursing sites, carcass, nest and voices). Thirty one (31) large mammals were seen directly either single or in group of 2 to 8. The most observable biological indices were dung (34) followed by footprints (32) and then tracks (30). For indices registered by individual large mammal species, buffalos had the highest field observed indices (40) followed by blue duikers (22) and chimpanzees (20) (Table 2: Appendix 2).

3.1.2. Encountered rate of sighted of species in the BBAW

The sighting of gorilla, chimpanzee and buffalo was carried out along side other large mammal's species in which a total of 31 animals were counted from 8 sighted different species and group into 2 main families *Bovidae* and *Cercopithecinae* (Table 3: Appendix 2). The Vervet monkey had the highest encounter rate of 0.14 sighting per km whereas Buffalo and Blue Duiker had the least encounter rate of 0.04 sighting per km. No direct observation of Gorilla or Chimpanzee was recorded. From the results, two groups of placenta mammals, the herbivorous placenta mammals and tree climber placenta mammals were identified (Table 3: Appendix 2). This result contrasts those of (Fonkwo et al., 2011) in the Bakosi landscape area South West Region of Cameroon who sighted 5 species, three of which were herbivores and two primate species.

3.1.3. Encountered rate of indirect signs of the species in the BBAW

A total of fourteen (14) species of large mammals signs were recorded belonging to eight (8) families (Table 4: Appendix 2). In terms of species richness, the family of Cercopithecinae recorded the highest species number of five (5) species follow by the family of Bovidae with four (4) species. Result stipulate that buffalos have the highest relative abundance with an encountered rate of 0.35 signs per km follow by chimpanzees with an encountered rate 0.26 signs per km. No Gorilla *(Gorilla gorilla)* sign were observed. Blue Duiker *(Cephalophus monticola)*, Putty-nosed monkeys (*Cercopithecus nictitans)* and Leopard *(Pamthera pardus)* were the least abundant species with each having an encounter rate of 0.02 signs per km. The overall mean encounter rate of indirect indices of these species was estimated to be 0.2 signs per km (Table 3: Appendix 2). Comparing the overall Relative Density of these species (0.2 signs per km) with that of (Nkemnyi et al., 2012) 0.64 signs per km, indicate that, one would identify less than one large mammal signs for every kilometer walked in the study area. According to the result, the study area have high number of species richness fourteen (14) grouped into eight (8) families as compare to that (PSMNR-SWP, 2008) in the Nguti Council Forest, South West Province –Cameroon who registered eight (8) species grouped four (4) families.

3.1.4. The Spatial Distribution of Chimpanzee and Buffalos Species

Generally, habitat requirements such as river courses, salt licks, vegetation, resting sites and less anthropogenic activities are some of the factors which affect the abundance of species distribution in an area (Tsi et al., 2006). The spatial distribution map of Chimpanzee species, which is the only species found in the family of Pongidea whose signs were identified due to the absence of gorilla signs, shows that the relative density of Chimpanzees are high in the Northern section ($0.41 < ER < 0.60$) and average in the northwest of the study area ($0.21 < ER < 0.40$). Low relative density of Chimpanzees ($0.01 < ER < 0.20$) were equally observed in the northwest and southeast zones of the study area (Figure 3: Appendix 1). Equally, the relative density of Buffalos was high in the northwest, northeast and southeast sections of the study area ($0.11 < ER < 0.20$). Low relative density of Buffalos ($0.01 < ER < 0.10$) were equally observed in the northwest and southeast of the study area (Figure 4: Appendix 1).

3.2. Encounter rate and spatial distribution of anthropogenic

The continuous increase in population follow by poverty increment, have led to the excessive exploitation of forest and non-timber products such as forest trees for timber and household items, hunting for bush meat, rituals and festivals and land for crops cultivation and animal rearing. As such the harvesting of these natural resources leaves signs which were recorded to assess the impact of anthropogenic activities in relation to large mammals in the BBAW. All signs of anthropogenic activities recorded in the study area were grouped into six main activities in a decreasing order: all activities associated to hunting (wire traps, hunting camps, hunters tracks, hunting stones and gun shells cartridge) registered the highest encountered rate of 0.42 signs per km. Follow by faming activities (farmer's camps, corn farm, cocoa farm, cocoyam farm, groundnuts farm, palm tree plantation) with an encountered rate of 0.25. Grazing, logging, bush fire and construction recorded 0.12, 0.09, 0.07 and 0.05 signs per km respectively (Figure 5: Appendix 1). Similar results were obtained by (Fonkwo et al., 2011) in the Muanenguba proposed Integral Ecological Reserve where hunting signs were the most frequent. The analysis

suggests a total mean encounter rate of 0.24 signs per km (that is about one signs per km). This result contrasts those of (Nkemnyi, 2011) in the Lebialem-Mone Forest Landscape, Cameroon, where a mean encounter rate was above 0.5 signs per km of all human activities recorded.

Generally, anthropogenic activities were reducing as observers move toward the northern directions of the BBAW with a corresponding increase in large mammals sighting. That is human activities in the study area, were generally decreasing from south to north as large mammals sightings abundance increase. Equally recce with the fewest large mammals signs have the greatest recorded human activity. The signs of anthropogenic activities were high in the southern section of the study area ($0.31 < ER < 0.40$), few in the northwest ($0.11 < ER < 0.20$) and equally low in some areas of the Northern and southern ($0.01 < ER < 0.10$) sections of the study area (Figure 6: Appendix 2).

3.3. Effects of anthropogenic activities on the distribution of species

In order to show the effect of anthropogenic activities on the distribution of large mammals, using the encounter rates of large mammals' species and human activities, the coefficient of determination R^2 was calculated. Result shows that there is a significant relationship ($R^2 = 0.773$) between the encounter rate of large mammals and anthropogenic activities with (F (d.f. = 1, 4) =13.640, P = 0.012). This means that, the effect of anthropogenic activities on the distribution of large mammal's species in the study site is high since 77.3% of variation in the encounter rate of large mammals was provoked by anthropogenic activities. Reason suggested for this may be increases in hunting techniques, a shift from food crops to cash crops farming and population growth.

IV. DISCUSION

All the large mammals' species that were encountered in the study site resulting from indirect observations (dung, voices, and nest) and direct sighting following recce-surveys method were classified into seven different families. Base on the family observation, it is evidence of it diversified habitat, the availability of different food preferences which enable each species to maintain a particular ecological niche. The low number or absence of other mammal's signs could be that these mammals scarcely visit these areas. Signs may have been degraded or wash away by late rains or destroyed by other animal movement due to seasonal variation. Absence of other animal's carcass could mean no germ or disease attacked them or they were not attacked by carnivores. The presence of thick vegetation probably makes it difficult to see these signs couples with the fact that the study was focus on the identification of particular species such as gorilla, chimpanzee and buffalo signs. The low number of non- sighted species could be due to the fact that in some cases movements were done in the wind ward direction in which these high sensitive mammals easily hide themselves or escape from the slightest noise or odour. Moreover, most of the animals could be nocturnal or rare in this area.

Considering the fact that, the dung, tracts, feeding remains or any other index of a species surveyed within a particular area at a precise time may have been produced by the same mammal, in other to avoid double counting of species, only one type of index that is peculiar to a particular species was used to obtain the encountered rate of that species in the study area. The high encounter rate of buffalos and chimpanzees could be due to suitable habitat such as shrub savanna with many gallery forests which habours different variety of fruits, grass, resting sites as well as many streams and rivers which are necessities for animal's diversity. The low encounter rates of the other species could have been due to intense hunting activities especially for traditional rituals and festivals as well as for food. For instance many hunters were encountered in several occasions with fresh or dried meat of different mammal's species in their hunting camps and in the nearby villages. The absence of gorilla signs can either be due to limited time of sighting or due to the roughness of the relief that makes further penetration difficult as well as the fact that they are rare in this area.

Understanding the distribution of large mammals species, permits researchers to locate areas of high biological diversity by targeting specific areas for protection or areas to allow improved management (Tsi et al., 2006).With the exception of gorilla in which no sign was identified, others large mammal's signs were generally located in the study site at different encounter rate. This varies may be as a result of different preferences for resources and the level of human disturbance. For instance, in less disturbed areas, the probabilities of encountering large mammal's signs were highest. Area in which large mammal's species were less encountered could be areas experiencing secondary growth due to corridor loss, bias destruction, hunting and logging. Equally areas covered with high agricultural practices and grassy vegetation gave the lowest encounter rate. Probably because of habitat fragmentation and degradation due to agricultural expansion, interlinked movements of pastoralist's especially wild bush burning to counter pasture maturation. Generally, habitat requirements such as river courses, salt licks, vegetation, resting sites and less anthropogenic activities are one of the factors which affect the abundance of species distribution in an area (Tsi

et al., 2006). The concentration of chimpanzee, buffalo and other large mammals in the northern area of the study site is suggested to be due to the availability of many tree fruits, a wild range of habitat, many streams and rivers, availability of diverse shrubs and grass species which provide enough water, and resting site and permit them to hide from poachers. While their low observation in other areas is suggested to be due to expansion of agricultural land, intense hunting and competition for pasture land with cattle grazers.

The harvesting of these natural resources, leaves signs which were recorded to assess the impact of anthropogenic activities in relation to large mammals in the study site.The high overall mean encounter rate of hunting (0.42 signs per km) in this study site may be due to the fact that hunting is carried out through the year. The availability of hunting equipment at very cheap prices as well as the high cultural value attached to hunting (such as birth and death ceremonies, rituals practices as well as chieftaincy tittles) suggests the high encounter rate of hunting. Agricultural activities amongst these anthropogenic activities gave a mean encounter rate of 0.25 signs per km. This activity is one of the major occupations of the indigenous people and the main causes of habitat fragmentation and degradation within the study area. Most of these activities are carried out along valleys through bush fallowing method. Reasons suggested for this could be that most of the area even though savannah, are very hilly with the exception of some plains. As such the steep rough slopes makes it difficult to cultivate and are equally infertile as most of the top fertile soils are easily wash away during heavy rains and dump in the valleys most of which are forested. The strenuous topography had make the local people believed that areas cover by forest are very fertile when cleared and burnt. Grazing is also a common anthropogenic activities mostly carried out by Mbororos whose main occupation is cattle rearing. Being a wide savanna and the possibility of having many sources of water from streams and rivers and all year round pasture for the survival of cattle especially during the dry season are suggested facts encouraging pastoralist in carrying out effective transhumance. Surveys inventory equally identified logging areas most of which are carried out by the local communities for construction and for making furniture. Some of the timber is being sold at the regional and to local Nigeria traders. Uncontrolled rampant bush fire were identified and are mostly cause by grazers to allow shoot out new pastures to feed their cattle and by hunters to chase out animals from thick bushes.

The spatial distribution of anthropogenic activities, show that, anthropogenic activities were reducing as observers move toward the northern directions of the study site with a corresponding increase in large mammals sighting. That is human activities in the study area, were generally decreasing from south to north as large mammals sightings abundance increase. Despite the steep rough topography and the inaccessibility of the study site, the distance from the village to the northern part as well as the strenuous means of transportation of bush meat which is mostly carried on head, there is high intensity of hunting activities in the northern site. This is due to the availability of an illegal market in Iso and Beleng made up of mostly Nigerian trader. These traders supply hunting materials such as, short guns of one to five ranks. The present of many different kinds of cartridges for instant cartridge 66, 32g used to kill duikers, monkeys and other small mammals, cartridge BB, 34g used to kill bush buck, olive baboons and other medium size mammal, and cartridge 99, 36g specialized to kill leopard, hyena, gorillas, chimpanzees, buffalos and other large mammals. Equally the high availability of snare wires arranged in inches of 3, 6-8, and 15-20 to trap animals of sizes duikers, bush buck and buffalo respectively sold at relatively cheap prices through black marked business. They equally encourage continuous increase in bush meat prices due to competition, thus intensifying hunting. The presence of many domestic dogs greatly encourages group hunting especially during the dry seasons. The wide use of "gamaline and arata bomb" through food substances to poison these large mammals is a serious threat. In these areas, large mammals such as gorillas, chimpanzees and buffalos are highly demanded for their hands, legs, heads, skulls, skins and/or the whole animals for use during traditional rituals and festivals. They are equally hunted for food, medicinal purposes and commerce. Primate capture either for pets or kept in preparation for sacrifices to shrine is a predominant aspect highly practice by the natives of these areas. The high concentration of agricultural activities in the southern region of the studying area is probably because of its gentle slopping topography, and accessibility to farms. Furthermore, it can be due to it closeness to the villages and the increasing human population. Grazing dominate the central region of the black bush area of Waindow simply because it the site in which the local elites demarcated for pastoralist thereby separating the agricultural land from the grazing land.

V. CONCLUSION

This study, reveal the presence of 14 large mammal's species with no gorilla sign recorded in the areas surveyed. Buffalos and Chimpanzees were the most abundant species with the highest encounter rate of 0.35 and 0.26 signs per km respectively. The overall mean encounter rate of large mammal's species in the study

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area was estimated to be 0.2 signs per km. In other words, one would identify less than one mammal signs for every kilometer walked in study site. Therefore, the study area even though poor in species number and species richness contains important flagship species such as chimpanzee and buffalo. Large mammals were spatially distributed in almost all the parts of the study area. The relative densities of Buffalos and Chimpanzees species were high in the northern region. Anthropogenic activities include intensive hunting, poor farming method, over grazing, illegal logging and wild bush fire. Among these activities hunting appears to be the most prevalent activity because of its high encounter rate of 0.42 signs per km. The anthropogenic activities shows an average effect on the abundance and distribution of large mammals species when plotted together with the encounter rate of large mammals through regression analyses (R^2 =0.773). Furthermore, the overall area has been neglected due to its relative isolation and has lead to increasing encroachment by Nigerian's traders and grazers thus high level of threat to the remaining chimpanzees and buffalos in the study site. As such, conservation attention is an immediate priority for the survival of these fast declining species. That is, it is very necessary to rapidly employ conservation strategies that can help to urgently conserve the remaining chimpanzees, buffalos and other species in the study area.

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APPENDIXES

Appendix 1: Figures

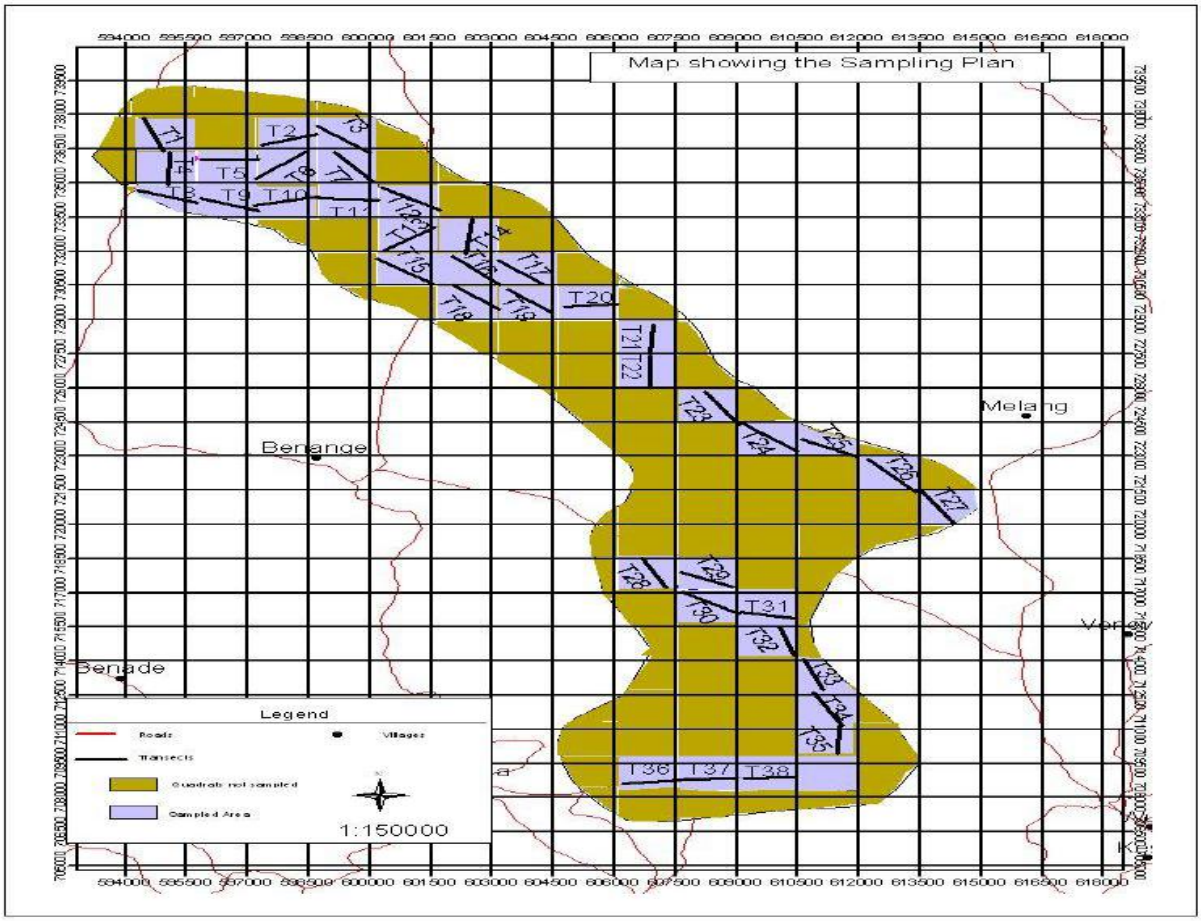

Fig.2: GIS Map showing representation of recces for animal inventory in the study area

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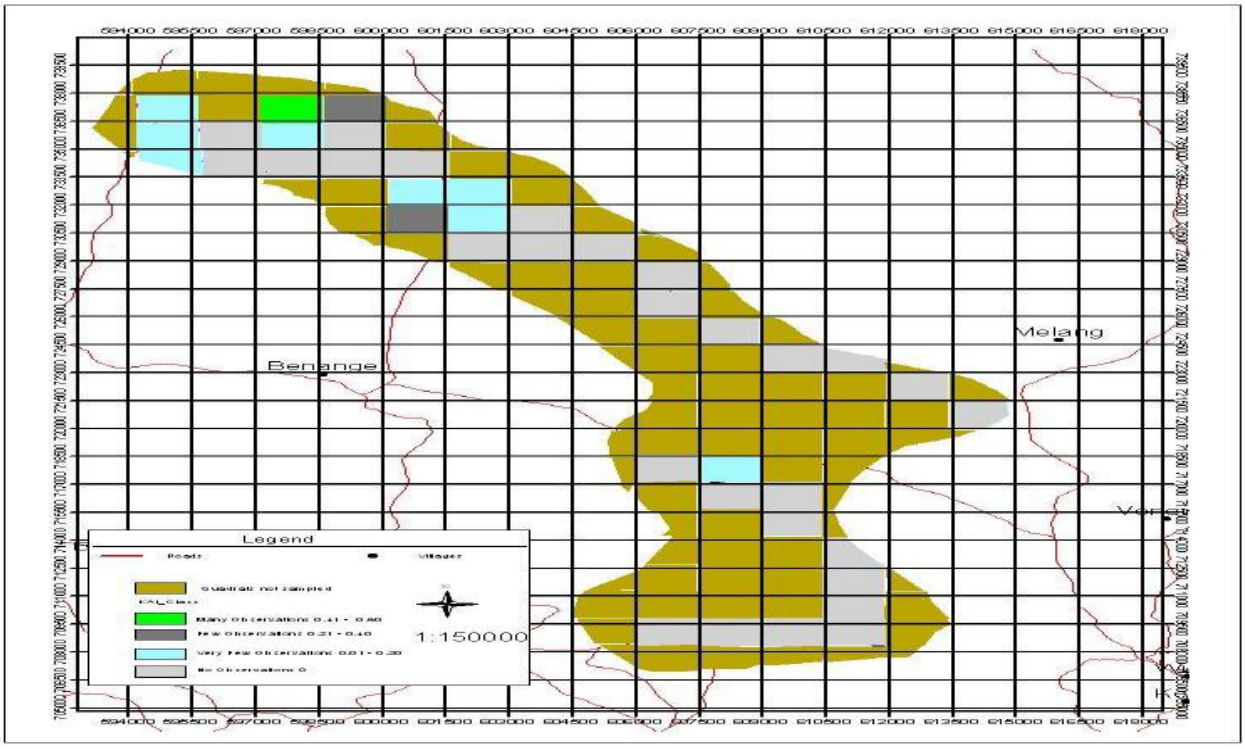

Fig.3: Spatial distribution of Chimpanzee (Pan troglodytes ellioti) in the study site

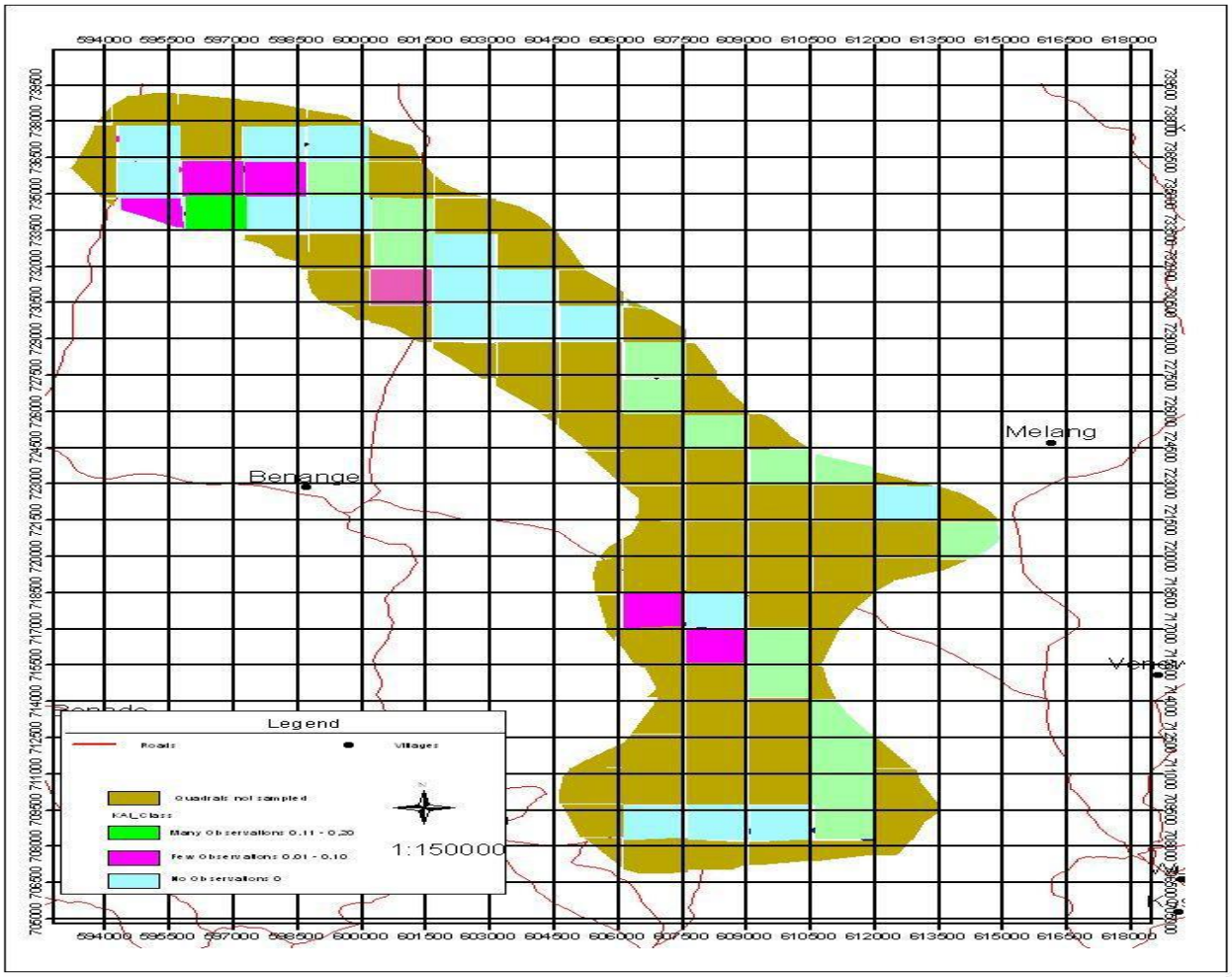

Fig.4: Spatial distribution of Buffalo (Syncerus caffer) in the study site

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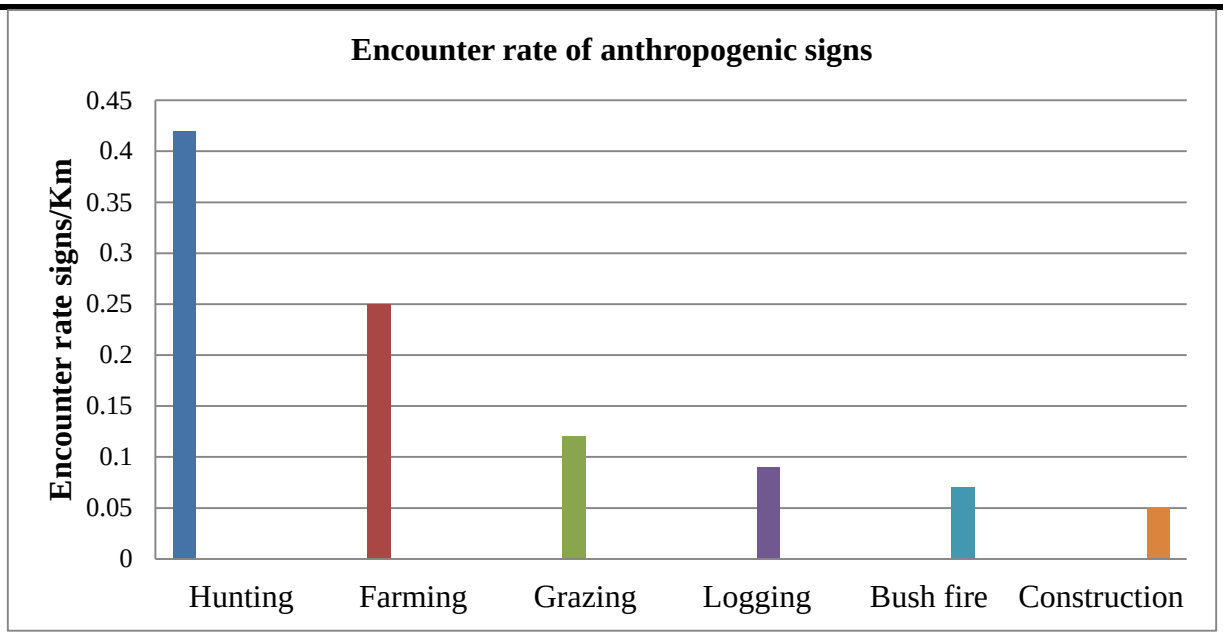

Fig.1: Relative abundance of anthropogenic activities in the study site

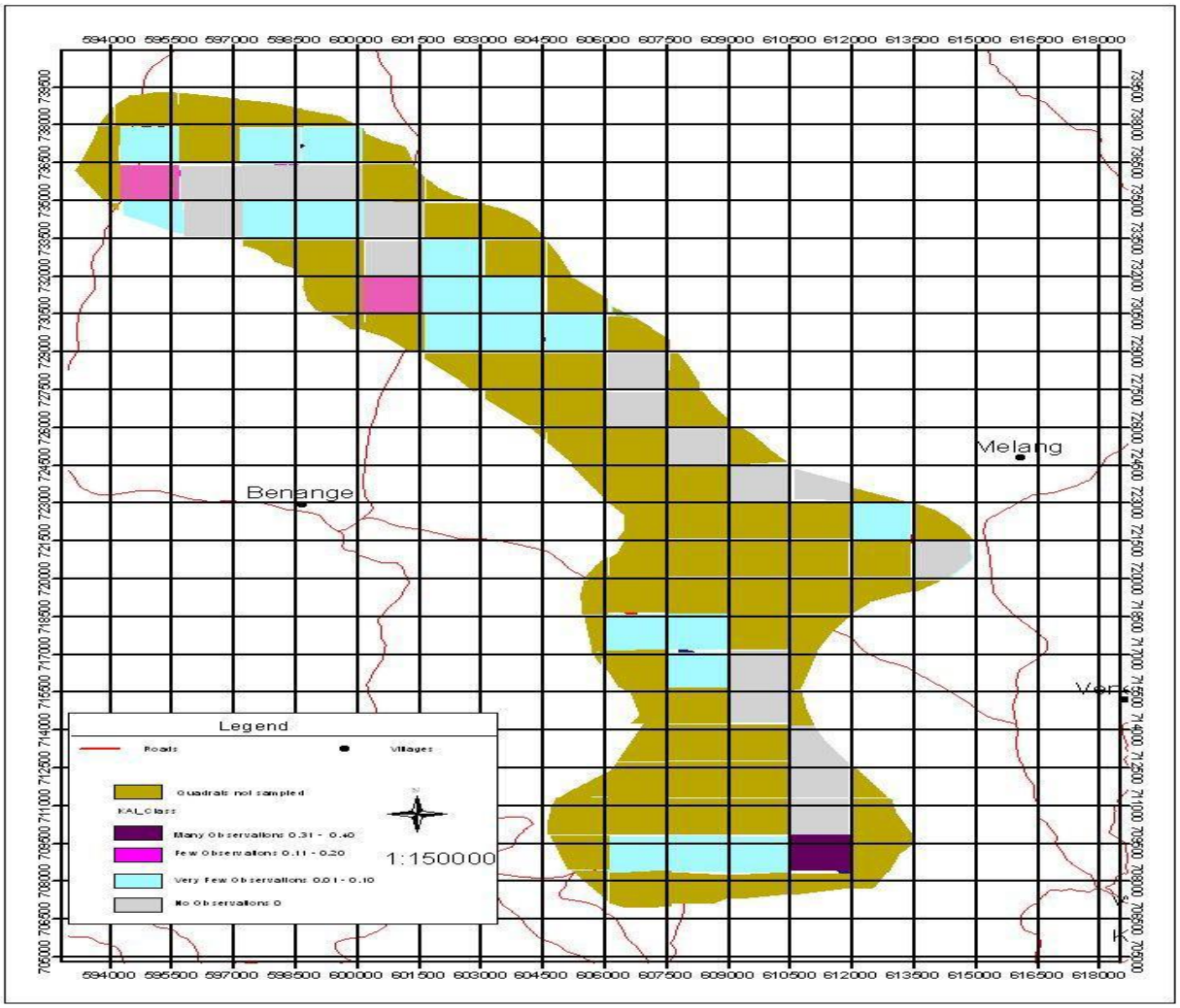

Fig.6: Spatial distribution of anthropogenic activities in the study site

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Appendix 2: Tables

Table.1: Large mammal species recorded in the BBAW

Family	Common Name	Scientific Name
Bovidae	Blue duiker	*Cephalophus monticola*
	Bushbuck	*Tragelaphus scriptus*
	Red duikers	*Cephalophus dorsalis*
	Buffalo	*Syncerus caffer*
	Defassa waterbuck	*Kobus defassa*
Feilidae	Leopard	*Pamthera pardus*
Suidae	Red river hog	*Potamochoerus porcus*
Canidae	Red fox	*Vulpes vulpes*
Viverredae	Africa civet	*Vuverra civetta*
Cercopithecinae	Putty-nose monkey	*Cercopithecus nictitans*
	Vevet monkey	*Cercopithecus aethiops*
	Patas Monkeys	*Erythrobus patas*
	Olive Baboon	*Papio anubis*
	Mona Monkey	*Cercopithecus mona*
Pongidae	Chimpanzee	*Pan troglodytes*

Table.2: Indices of large mammal species identified in the BBAW

Species	IO								DO	Total
	D	FP	T	FR	RN	N	C	V		
Blue duiker	1	3	2	/	/	/	/	/	2	8
Bush buck	3	4	7	/	/	/	/	/	1	15
Red duiker	2	9	6	1	/	/	1	/	3	22
Buffalo	20	8	9	/	1	/	/	/	2	40
Chimpanzee	/	/	3	/	/	15	/	2	/	20
Leopard	/	/	/	/	/	/	1	/	/	1
Red fox	3	2	/	/	/	/	/	/	/	5
Red River Hog	2	4	/	5	1	/	/	/	/	12
Africa Civet	3	2	/	/	/	/	/	/	/	5
Olive Baboon	/	/	/	1	/	/	/	2	4	7
Patas Monkeys	/	/	2	1	/	/	/	/	/	3
Mona Monkey	/	/	/	2	/	/	/	2	5	9
Putty nosed monkeys	/	/	1	1	/	/	/	1	6	9
Vervet monkey	/	/	/	4	/	/	/	1	8	13
Total	34	32	30	15	2	15	2	8	31	169

Legend: Indirect observation (IO), Direct observation (DO), dung (D), foot prints (FP), tracks (T), food remains (FR), resting or nursing sites (RN), nest (N), carcass (C), voices (V), and /= no observation

Table.3: Encounter rate of large mammal species sighted in the BBAW

Common Name	Family	Scientific Name	SP	TDC km)	ER
Buffalo	Bovidae	*Syncerus caffer*	2	57	0.04
Bush Buck	Bovidae	*Tragelahus scriptus*	1	57	0.02
Red Duiker	Bovidae	*Cephalophus dorsalis*	3	57	0.05
Blue Duiker	Bovidae	*Tragelahus scriptus*	2	57	0.04
Olive Baboon	Cercopithecinae	*Papio anubis*	4	57	0.07
Mona Monkey	Cercopithecidae	*Cercopithecus mona*	5	57	0.09

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Putty-nosed monkeys	Cercopithecidae	*Cercopithecus nictitans*	6	57	0.11
Vervet monkey	Cercopithecidae	*Cercopithecus aethiops*	8	57	0.14

Legend: encountered rate (ER), total distance covered (TDC), species population (SP**)**

Table.4: Encounter rate of indirect signs of large mammal species

Common Name	**Family**	**Scientific Name**	**TNI**	**TDC** (km)	**ER**
Buffalo	Bovidae	*Syncerus caffer*	20	57	0.35
Bush Buck	Bovidae	*Tragelahus scriptus*	3	57	0.05
Blue Duiker	Bovidae	*Cephalophus monticola*	1	57	0.02
Red Duiker	Bovidae	*Cephalophus dorsalis*	2	57	0.04
Leopard	Felidae	*Pamthera pardus*	1	57	0.02
Red fox	Canidae	*Vulpes vulpes*	3	57	0.05
Red river hog	Suidae	*Potamochoerus porcus*	2	57	0.04
Africa civet	Viverredae	*Viverra civetta*	3	57	0.05
Gorilla	pongidae	*Gorilla goirlla*	/	57	/
Chimpanzee	Pongidae	*Pan troglodytes*	15	57	0.26
Olive Baboon	Cercopithecinae	*Papio anubis*	2	57	0.04
Patas Monkeys	Cercopithecidae	*Erythrobus patas*	2	57	0.04
Mona Monkey	Cercopithecidae	*Cercopithecus mona*	2	57	0.04
Putty-nosed monkeys	Cercopithecidae	*Cercopithecus nictitans*	1	57	0.02
Vervet monkey	Cercopithecidae	*Cercopithecus aethiops*	4	57	0.07
Min					**0.350**
Max					**.020.**
Mean					**2**

Legend: encountered rate (ER), total number of indices (TNI), total distance covered (TDC), when 0.1< ER < 0.5= low observation, < ER > 0.5 =High observation, and / = no observation

Appendix 3: Field pictures

Picture 1: Chimpanzee nests

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Picture 2: Buffalo dung

Picture 3: Duiker Carcass

Picture 4: Patas monkey skin

Picture 5: A Rotten Duiker

Picture 6: Roasted Duiker

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Picture 7: Roosted Olive Baboon and Bush Buck ready for market

Picture 8: Killed python

Picture 9: A young capture Velvet Monkey

Picture 10: Cartridges (66-32g)

Picture 11: Cartridges (BB-34g)

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Picture 12: Cartridges (OO-38g)

Picture 13: Wire snares

Picture 14: Duiker trap

Picture 15: Buffalo trap

Picture 16: Hunter's sleeping rocks

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Picture 17: Logging