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Research Article

Hunting for Bushmeat Threatens the Rich Wildlife of Korup National Park in Cameroon

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Abstract

Studied bushmeat hunting in the southwest (cluster E) of the Korup National Park (KNP) to identify the various poaching methods, quantify bushmeat, and identify the various hunting routes and to elucidate the key factors of poaching within this protected area. To achieve this task, purposeful and random sampling methods were used for the selection of target communities and respondents for questionnaires administration. Socio-economic surveys that included interviews, focus group discussions, guided questionnaires, and biological survey methods were used to estimate the quantity of bush meat harvested, species preferences, different bush meat routes and poaching methods. A total of 2,252 animals has been recorded with the most hunted species in the group of mammals being (pangolin) *Phataginus* sp. (150), (putty-nosed monkey) *Cercopithecus nictitans* (111), (great blue turaco) *Corythaeola cristata* (134), and (dwarf crocodile) *Osteolaemus tetraspis* (70). The main poaching tools in order of importance were shotguns (36.2%) followed by wire snares (31.7%). The main bush meat route identified was between the southwestern area of KNP and Nigeria through Ekong Anaku village. The main poaching factors were the inadequate source of income generating activities and high demand for bush meat in neighboring Nigeria. In parallel to the socio-economic benefits of this sector and its impact on rural population, the sustainable management of these threats in this area needs to be managed so as to guarantee the food security of local populations. For this, the successful monitoring and management of bushmeat extraction and trade in this park is to necessitate a collaboration approach with Cross River National Park to ensure a full control. It also requires the development of the alternatives sources of income to communities around the park.

Keywords

Korup National Park, Cluster E, Communities, Questionnaires, Hunting, Bush Meat

1. Introduction

About 15.4 per cent of the earth's surface is covered by protected areas and most international and national conservation policies revolve around these vital ecosystems. These protected areas play an important role in the conservation of biodiversity, the maintenance of genetic resources, the protection of ecosystem functions, ecotourism and preservation of natural and cultural heritage [41]. But most of these protected areas, especially national parks face a lot of pressure

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with increasing population from surrounding villages principally for Non-Timber Forest Product (NTFPs) collection and bush meat hunting. In the Congo Basin, illegal hunting and bushmeat trade pose a serious threat as they lead the overexploitation of wildlife species to meet the demand of urban markets [21, 27]. Also, several millions of people within the Congo Basin moist forest region still depend on wildlife as a direct source of protein [44]. Recent estimates of annual rural and urban bushmeat consumption gives an annual bushmeat offtake for Central Africa somewhere between 1.6 and 11.8 million tones [9].

Hunting by humans for bushmeat, is one of the primary threats to large-bodied vertebrates in many protected areas in African forest [3, 17, 35]. Rising consumer demand for bush meat, due to human population growth and increasing per capita wealth, has led to dramatic increases in harvest rates, thus leading to a crisis for the population of many several species [4]. Overhunting can have cascading effects through an ecosystem, altering forest structure and composition, and affecting nongame species [43]. Anthropogenic pressures, particularly hunting for the bushmeat trade, are driving wildlife species toward extinction in west and central African forests [11, 1].

Korup National Park (KNP) is one of Africa's oldest rainforest (over 60 million years old) and has been designated as one of the two Africa's Pleistocene Refugia [24]. This area is also reported to harbour almost 25% of all African primates, and is thus considered a very important site for primate conservation [36]. It is characterised by its high level of species diversity and endemism. Mammals consist of about 33 families and a total of 161 different species. The park also harbours 55 species of bats, 47 species of rodents [38], 410 bird species recorded so far in 53 families [37], 82 species of reptiles and 92 species of amphibian. Most of this splashy species are vulnerable and endangered, and their populations are decreasing due to increasing illegal hunting in and around the park [19, 18]. Likewise, this park is facing a drastic increase of illegal hunting which is encouraged by the fact that the communities in and around the park are very poor and depend on the forest for their livelihoods and food system. Infield revealed that hunting provides about 120 kg of bush meat for each person per annum in the park villages [15].

However, According to Bobo et al, some of the previously known species may have become locally extinct or critically endangered [7]; among these are the leopard (*Panthera pardus*), *Piliocolobus preussi*, the golden cat (*Caracal aurata*) and the giant pangolin (*Smutsia gigantea*) [6, 7]. If strict conservation measures are not taken, more wildlife species will go extinct in the area. This situation poses serious challenges to the park conservation service which is currently unable to mitigate illegal activities as the number of park rangers is inadequate (15 agents) to cover a total surface area of about 126,000 hectares; added to this the management and anti-poaching systems ineffective [33] and the armed conflict that is ongoing in the western side of Cameroon. This work provided information to the anti-poaching unit of Korup National Park, and conservation partners to exploit more strategies to bridge illegal hunting in this park. We hypothesized that there was a variation in the different poaching methods used by poachers in the KNP. Therefore, we predicted that the greatest quantity of wildlife species harvested occurred according to the high demand for consumption. According to Mbun & Nguemwo, hunting for bushmeat trade poses a threat due to the overexploitation of wildlife species to meet the demand for traditional medicine in urban and international market [27].

2. Methodology

2.1. Study Area

2.1.1. Localization

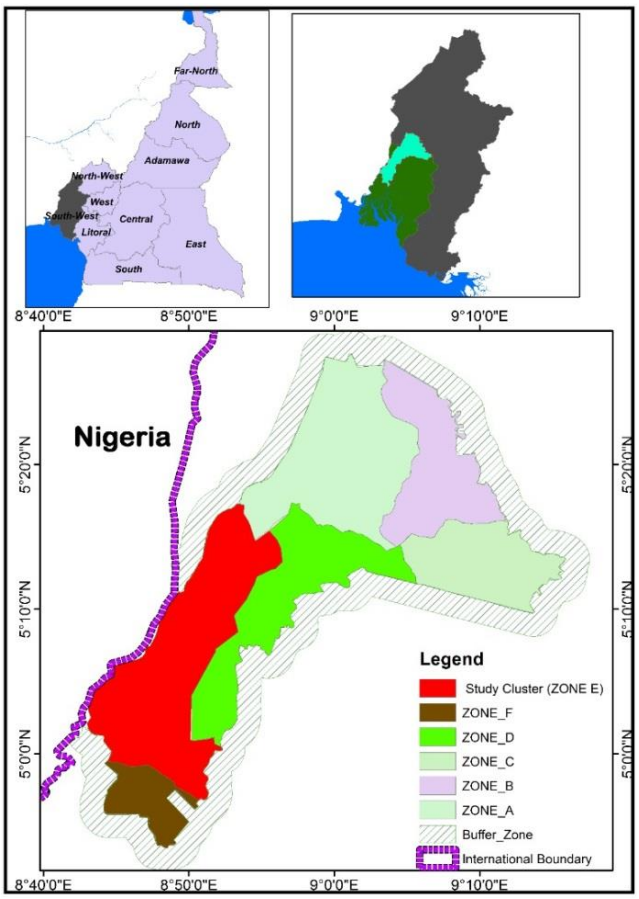

Figure 1. *Map of Korup National Park with study zone.*

This study was conducted in Korup National Park, located in the South West Region of Cameroon, between 537,033 and 604,360 North latitude, and 468,134 and 531,643 East longitude (UTM Zone 32N). It is located in Ndian Division, precisely in Mundemba Subdivision. The population is made

up of the six clusters namely, cluster A, B, C, D, E and F, but we concentrated our work on cluster E which is the largest one with a surface area of 34,897.22 hectares (Figure 1) [29, 8, 7, 30].

2.1.2. Geophysical Attributes

The Korup climate is characterised by two seasons: one dry season from November to mid-March and one wet season from mid-March to October; the wettest months are July and September. The total rainfall is estimated at 5,000mm per annum [45, 2]. The mean annual relative humidity is 83%, the mean daily maximum is 98% and the minimum is 66%. The mean annual temperature is about 25 ℃ with August and February being the coldest and hottest months respectively. The mean annual maximum temperature is 30.2 ℃ [13]. KNP is the only extensive forest of western central Africa that originally spread from the Niger Delta eastwards to Cameroon and south through Equatorial Guinea and Gabon. It is located at the center of the Guinea Congolian forest refugium [25, 26]. About 3,500 vascular plants are found within the KNP of which 5% are narrowly endemics [39]. More than 30% of the 620 species of trees and shrubs recorded are endemics. There is no evidence of any major historical influence by man and in the southern part of the park; the forest is therefore likely to be primary. Despite the stress on the ecosystem, the forest has a biomass and production equivalent to other African forests [31]. Korup contains four different forests associations. These were originally described by [20]: Atlantic Biafran Forest, Swamp forest, Piedmont forest and Submontane forest.

2.1.3. Fauna

KNP harbors a quarter of all Africa's primate species and represents a particularly important site for primate conservation. Eight diurnal primates have been recorded in Korup including Chimpanzee, Drill, Pruess's Red Colobus, Red-capped mangabey, Red-eared monkey, Putty-nosed monkey, Mona monkey and the Crowned monkey. It is home to a number of species that occur widely throughout the Guineo-Congolian forest such as the forest elephant (*Loxodonta cyclotis*) and forest buffalo (*Syncerus caffer nanus*). It also harbors species of a much more restricted distribution such as the Giant otter shrew (*Potamogale velox*), Calabar angwantibo (*Arctocebus calabarensis*), drill (*Mandrillus leucophaeus*), and the critically endangered Preuss's Red Colobus monkey (*Piliocolobus preussi*). Fishermen on the southern Munaya River have reported the presence of the hippopotamus (*Hippopotamus amphibious*) and claim that Manatee (*Trichechus senegalensis*) may be found in the deep stretches of the Akwen gorge, a little north of the Park boundary [36].

2.2. Data Collection

2.2.1. Determination of the Different Poaching Methods Used by Poachers

Cluster (E) which was selected out of the six includes Ekon, Erat and Akpasang villages. This cluster was purposively choose the cluster because it was the major safe cluster accessible from Nigeria (Cross River) due the ongoing crises. Also this cluster was suspected to be one of the highest cluster where bush meat is being trafficked due to its proximity to Nigeria through footpaths with no control point. During three months from April 2022 to June 2022 in the three villages (Ekon, Erat and Akpasang), a number of research methods were deployed and involved socio-economic surveys that included interviews, focus group discussions, guided questionnaires, and field observation as well as biological survey methods which such as guided recces. Purposive sampling method was used to select the target population (hunters, bushmeat vendors, farmers). Here the target population was stratified according to the sex, age groups, occupations, social status (especially the chiefs) before been accessed. A total of 163 questionnaires (Ekon = 51; Erat = 71; Akpasang = 41) accompanied by interviews and focus group discussions were used. The number of villages in and at the periphery of the park with a total population of over 5000 inhabitants and Cluster E with 3 villages who solely depend on the park's resources for their livelihoods was gotten from Final Project Report of Action for Primates Conservation Project, Korup National Park, Cameroon [16]. To reduce reporting bias, much effort was put in establishing relations of trust with the informants, including using of Pidgin English and sometimes the local dialect (translator guide), and ensuring participants' anonymity.

2.2.2. Estimation of the Quantity of Wildlife Species Harvested

To obtain the necessary data for this investigation, we used socio-economic surveys (interviews, focus group discussions, guided questionnaires) to estimate the quantity of bush meat harvested and species preferences. Wildlife species identification guide was also used: this was a document produced by the bio monitoring team of PSMNR-SWR (Programs for Sustainable Management of Natural Resources) to help identify different wildlife species within national parks in southwest region of Cameroon. We used this specie guide in the field for community members to identify if they are poaching them. The guise also was used to differentiate similar harvested species like; yellow backed duiker (*Cephalophus silvicultor*), Ogilby's duiker (*Cephalophus ogilbyi*) and bay duiker (*Cephalophus dorsalis*). The telescope with cards containing some images of some endangered wildlife in Korup National Park was used alongside this specie guide. Data collection was designed according to the months (April,

May and June) with each month been divided into four weeks and each week divided into two according to market days (Mondays and Fridays). These days were identified as the days when bushmeat leaves the 3 target community to Nigeria through Ekong Anaku since majority of the bushmeat traders reside there. We conducted surveys weekly in each market day and we chose at random each village in the area and asked each adult about the main activity performed during the two previous days. When hunting was not reported as the main activity, the specifically asked whether the person went hunting during those two days in the area. For each hunting expedition, the local name of game killed, the hunted group (category of the animal), and the number of animals has been recorded. To avoid double counting, for any game killed, each prey has been attributed to one hunter for expedition. To restricted the estimated bushmeat harvested to hunter because these provide information on actual numbers of individuals harvested at a known site (village), whereas bushmeat traders provide less explicit data because knowledge of the actual numbers of individuals harvested is lost or change along the commodity chain [10]. Others information's on animal's offtake was directly from hunters on their return from hunting expeditions, especially at the forest gate.

2.2.3. Investigation of the Different Bushmeat Routes and Markets in and out of the Area

Questionnaires were administered, field observation, focus group discussion as well as interviews were carried out with the participants with specific questions on the bush meat routes and markets within the southwest of KNP, from the responses with the help of some community members, the GPS coordinates within the study area (Ekon, Erat, Akpasang, Ekonganaku and Mundemba) has been recorded. These coordinates were registered and permitted to map the bushmeat routes within the southwest part of Korup National Park. The guided recce survey method was mainly used

2.2.4. Elucidating the Factors to Poaching and Alternative

To elucidate the push factors to poaching and alternative in Korup National Pak, information's were collected with the Semi-structured interviews comprised of open-ended qualitative questions were carried out the target population (hunters, bushmeat vendors, farmers). Target population selection was based on their knowledge about our study interest. Also, the focus group discussions and key informant interviews in each village according to the factors to poaching and alternative plan was conducted.

2.3. Data Analysis

Twenty seven questions were used on the questionnaires, interviews and focus group discussions. Themes covered were (1) Poaching methods, (2) quantity of wildlife species hunted, (3) bush meat rout and markets, (4) push factors and alternatives to poaching (Annex 1). The data resulting from questionnaires, field observation, interviews and focus group discussions with the target population were arranged in different in folders, keyed into excel 2013 spreadsheet. These data collected were analyzed separately and only quantitative statistics were used to compare the changes in knowledge and attitude score in each village according to sex, age groups, occupations, social status. Basic frequencies were calculated for all categorical data and appropriate charts produced using R statistical software version 3.6.1. Cross tabulations and clustered graphs was also conducted in an attempt to identify confounding variables. The analysis and interpretation of these data have focused on calculations of frequencies. The GPS coordinates using Geo processing tools of Arc GIS version 10.7 for a map of the bush meat rout within the KNP.

3. Results

3.1. Characteristics of the Respondents

A total of 163 participants responded to the questionnaires, including 110 males (67.5%) and 53 females (32.5%). Women were les represented because they were not as engaged in poaching related activities as men, but rather in farming and NTFPs collection. regarding respondents activities, farmers were the most represented (32.5%), followed by poachers (29.4%) and bushmeat traders (14.1%). Most participants especially men combined farming and poaching, and their engagement in each of these activities depended on the seasons. Some respondents preferred not to say openly they are poachers. As far as the marital status was concerned, 80.4% of the responded were married with 41.7% of them having 6-10 children and 15.3 % having 11-15 children. This revealed to be a factor to poaching. Regarding the age range, 49.7% of the respondents were aged between 21 and 30, followed by those between 31 and 40 (39.9) which is an active age with people more involved in poaching. A great number of these participants (51.5%) had not been to school with just 6.1% having an Ordinary and Advance level certificate (Table 1).

Table 1. *Characteristics of the respondents in the KNP.*

Variable	Category	N	%
Gender	Male	110	67.5
	Female	53	32.5
Occupation	poaching	48	29.4
	bush meat trader	23	14.1
	Farmer	53	32.5
	Others	39	23.9
Marital status	married	131	80.4
	Single	4	2.5
	Divorced	5	3.1
	Separated	23	14.1
Number of children	0-5	64	39.3
	6-10	68	41.7
	11-15	25	15.3
	>15	6	18.4
Age	21-30	81	49.7
	31-40	52	31.9
	>40	30	18.4
Religion	Christianity	107	65.6
	Islam	4	2.5
	African Tradition	35	21.5
	Free thinker	17	10.4
Level of education	No Level	84	51.5
	FSLC	53	32.5
	SSD	16	9.8
	GCE O/L	10	6.1
	Total	163	100

3.2. Poaching Methods Used in KNP

Hunters used moderns hunting methods including shotguns and wire snares (Figure 2), as well as traditional methods including dogs, machetes, nets and hands to catch animals in KNP. As shown in figure 3, bushmeat harvesting was mostly achieved by the use of guns (36.2 %) followed by wire snare (31.7%). Only few respondents affirmed that they use traditional methods (dogs, machetes, nets and hands) in their hunting activities. Two types of wire snare traps were identified to be used by poachers in this area including free traps and barrier traps. But among the two methods, free trapping was more used than barrier trapping because the former is easier to set and less time consuming, unlike the latter which takes more time and is limited to small mammals. However, 40.9 % of the respondent affirmed that they usually combine both methods. According to the respondents, combining both methods increase their hunting success than using just a single method of poaching. The respondents further explained that they mostly combine wire snare with shotguns in the raining season as it is easy to and clearly see animal footprints and trails so as to know where to set their wire snares. From interviews with the participants, bushmeat harvesting in the study area was mainly done in the national park (93.8%), and most farmers within the area were also poachers (86.3%).

A B

Figure 2. *(A), picture of a dame gun used by poachers in KNP; (B), picture of a trap using wire snare in KNP.*

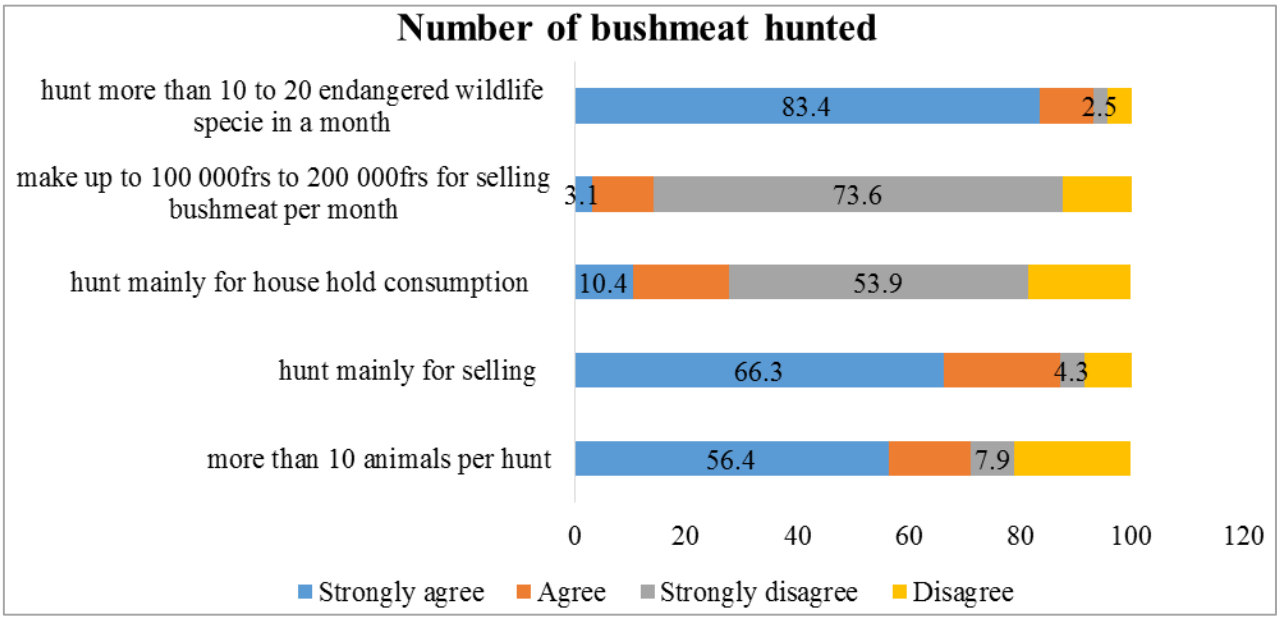

Figure 3. *Quantity of bush meat harvested in southwest of KNP.*

3.3. Quantity of Bushmeat Harvested in KNP

Figure 4 shows that 83.8% of the target communities mainly go hunting in KNP, the main purpose being to sell (66.3%), against 10.4% of respondent who declared to eat part of their products. 56.4% of these hunters declared to kill up to 10 animal species per trip, but yet, only 3.1% of these hunters declared to make up to 100,000 to 200,000 FCFA per month. Table 2 shows the quantity of some target wildlife species harvested in the target communities (Ekon, Erat, Akpasang) for a period of three months (April, May and June). During that period, up to 2252 animals including threatened species were harvested from the southwestern part of KNP with the most hunted group being the mammals (724) (Figure 5), mostly represented by pangolins (*Phataginus* sp.) (150). There was no record of killing of elephants and hippopotamus. Among primates the putty-nosed monkey (*Cercopithecus nictitans*) was the most hunted (111) with the least being Gorilla (*Gorilla gorilla*) (34). In the group of reptiles, the Dwarf crocodile (*Osteolaemus tetraspis*) was the most hunted (70) and the least hunted was the Slender snouted (*Mecistops cataphractus*) (29). Birds were also hunted, mostly represented by the great blue turaco *Corythaeola cristata* (134)

while the least poached was Crowned eagle (*Stephanoaetus coronatus*) (57). According to the village, Ekon has the highest number of animals hunted 885 (39.3 %) followed by Erat 871(38.7%) and Akpasang 496 (22.02%) (Table 2).

Table 2. *Quantity and species harvested in the southwest (cluster E) of KNP.*

Species hunted (common names)	Local names (DUROB)	Scientific names	April	May	June	Total N (%)
mammals						
Elephant	Enyi	*Loxondonta africana*	0	0	0	0
Buffalo	Ewoka	*Syncerus caffer nanus*	4	5	5	14 (0.6)
Otter shrew	Kingchung	*Potamogale shrew*	21	9	25	55 (2.4)
Water chevrotain	Yurd	*Hyemoschus aquaticus*	4	4	6	14 (0.6)
Pangolin	Yarng	*Phataginus* sp.	41	45	64	150 (6.7)
Hippopotamus	Enyi a mini	*Hippopotamus amphibious*	0	0	0	0 (0.0)
Bay duiker	Iku	*Cephalopus dorsalis*	10	8	16	34 (1.5)
Yellow backed duiker	Chonga	*Cephalopus silvicultor*	21	19	31	71 (3.2)
Ogilbys duiker	Enhom	*Cephalopus ogilbyi*	24	41	51	116 (5.2)
Bush pig	Inyeyei urum	*Potamochoerus* sp.	30	34	44	108 (4.79)
Northern needle clawed	Kabia	*Euoticus pallidus*	9	10	18	37 (1.6)
Primates						
Chimpanzee	Konou	*Pan troglodytes*	26	35	45	106 (4.7)
Gorilla		*Gorilla gorilla diehli*	8	12	14	34 (1.50)
Drill	Etom	*Mandrillus leucophaeus*	38	18	36	92 (4.1)
Red colombus monkey	konumwok	*Colobus bodius preussii*	39	31	38	108 (4.8)
putty-nosed monkey	Ekpok	*Cercopithecus nictitans*	26	35	50	111 (4.9)
Red eared monkey		*Cercopithecus erythrotis*	13	8	17	38 (1.7)
Mona monkey	Enkei	*Cercopithecus mona*	25	22	21	68 (3.01)
Reptiles						
Forest Tortoise	Koun ka mini	*Kinixys* sp.	20	11	16	47 (2.1)
Slender snouted crocodile	Chong	*Mecistops cataphracus*	6	8	15	29 (1.3)
Giant lizard	Uran	*Vanarus niloticus*	28	30	33	91 (4.04)
Dwarf crocodile	Kawa	*Osteolaemus tetraspis*	20	20	30	70 (3.1)
Birds						
Crowned eagle	Enyam	*Stephanoaetus coronatus*	15	25	17	57 (2.5)
Grey parrot	Irum	*Psittacus erithacus*	25	35	43	103 (4.6)
Great blue turaco	Onkurm	*Corythaeola cristata*	40	42	52	134 (5.9)
Yellow casqued	Ekorn	*Ceratogymna elata*	33	41	55	129 (5.7)
Other species			31	75	98	204 (10.7)
Total			642	676	934	2252

Table 3. Quantity of bush meat harvested per month and village.

Community	April	May	June	Total
Akpasang	138 (21.5)	157 (23.2)	201 (21.5)	496 (22.02)
Erat	258 (40.2)	253 (37.4)	360 (38.5)	871 (38.7)
Ekon	246 (38.3)	266 (39.3)	373 (39.9)	885 (39.3)
Total	642 (28.5)	676 (30.01)	934 (41.5)	2252
Mean	22.9	24.2	33.1	

3.4. Different Bushmeat Routes Within the Southwest (Cluster E) of KNP

Bushmeat routes analysis showed that the major bush meat route from the southwest part of KNP (cluster E) is the road linking cluster E to Nigeria passing through Ekong Anaku village (73% of bush meat route used) followed by the road linking Mundemba to Ekon (5.5%) (Figure 4). In addition to this, the main bushmeat market was found to be in Nigeria (78.5%) with the majority of bush meat vendors mainly Nigerians (78.5%), followed by local buyers who are mainly the local duelers. Figure 6 also showed that across Korup National Park (thick green) and Cross River National Park (light green). The major bushmeat routes (indicated in thick black arrows) leave this cluster to Ekong Anaku which is under the Cross River National Park, and the minor bush meat tracks are linking to Mundemba (indicated with light red arrows).

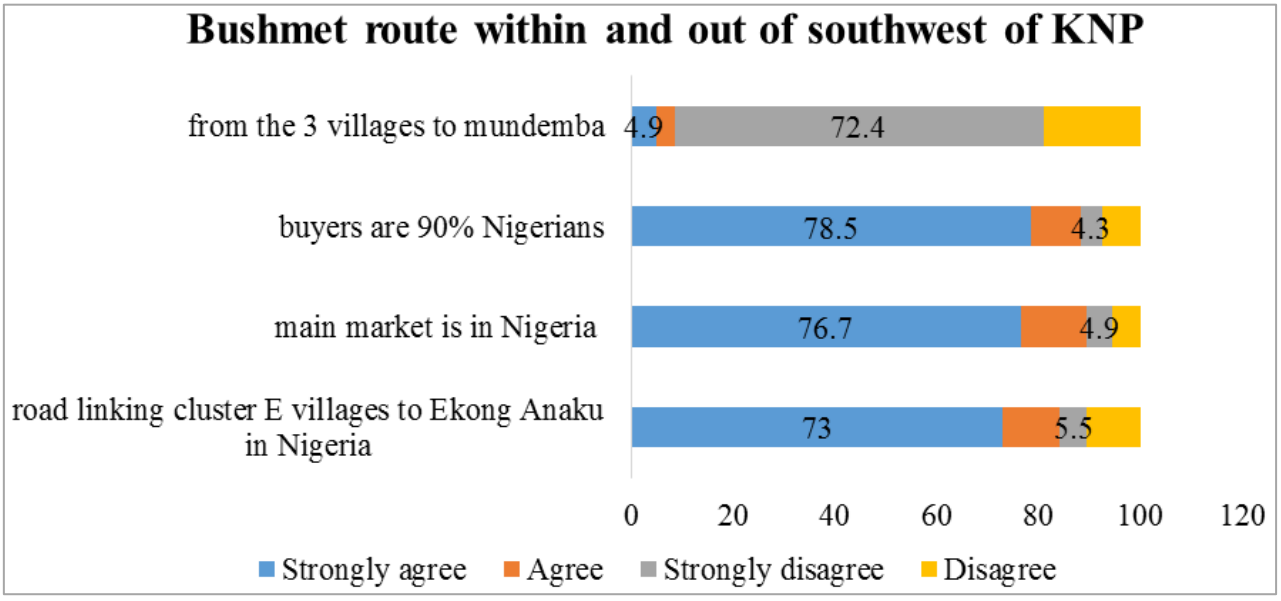

Figure 4. Different bush meat rout in the southwest of KNP.

A B

Figure 5. *Harvested endangered species in KNP (A); Harvested primate in KNP (B).*

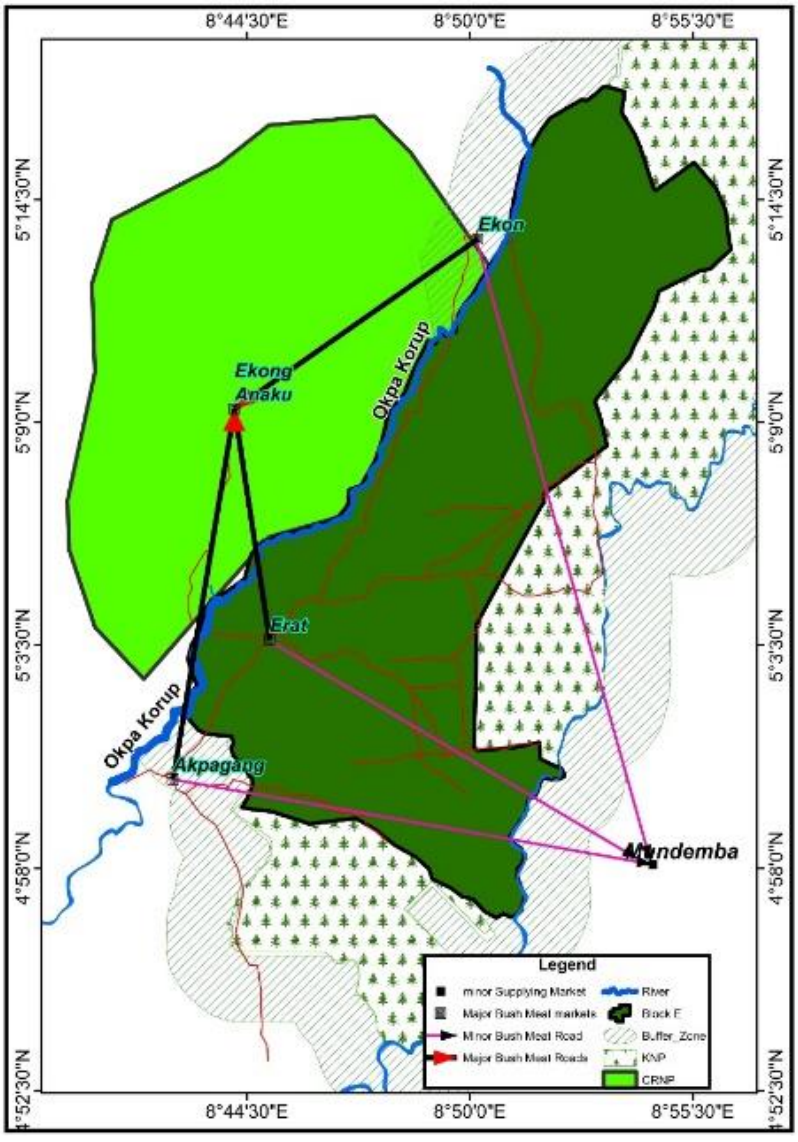

Figure 6. *Map showing bush meat rout in southwest of KNP.*

3.5. Factors of Poaching in the KNP

From analysis of push factors to poaching, inadequate sources of income was the main key factor given by community members involved in poaching activities (77.9%). It was followed by the outbreak of the socio political crisis ongoing in the region since 2017 (76.1%). Community members said that park rangers stopped their regular patrols which now gave them a free entrance into the park to poach. And according to them, their poaching rate has really increased since 2017. Also, high demand for bush meat in neighboring Nigeria has also orchestrated an increase rate of poaching within the southwest sector of Korup National Park (Figure 7).

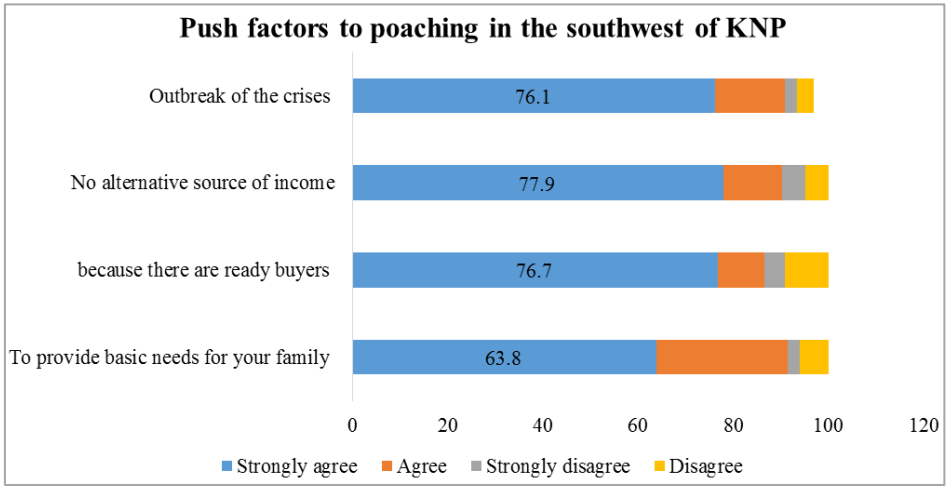

Figure 7. *Factors to poaching in the southwest of KNP.*

4. Discussion

4.1. Poaching Methods

Weapons used by poachers were found to have varying impacts on the quantity of bushmeat harvested. Two types (guns and wire snares) were observed to be the most commonly and widely used weapons in the study area. This is in line with the results of the study carried out by Fuashi et al who worked on evaluating of poaching and bushmeat offtakes in the Ebo Forest Reserve (EFR), Littoral Region, and Cameroon [12]. Guns were recorded as the highest killer of wildlife in KNP while wire snares came second. Bobo et al also noted that the use of the shotgun was more important as compared to snares [5]. This increasing use of shotguns by different hunters in many area negatively impacts wildlife, especially small diurnal monkeys which are relatively easy targets for shotgun hunters due to their social organization [42]. Willcox & Nambu observed that there is a gradual shift from traditional practices towards the use of modern sophisticated weapons by poachers in many African forests [40]. Thus, increasing local, national and international demand for bushmeat is driving increasing commercialization of illegal hunting, which in turn is resulting in the discarding of traditional taboos on the use of bushmeat or the killing of certain species, the non-respect of traditional hunting seasons and hunting methods in favour of more efficient techniques [22]. According to Willcox & Nambu, the frequent use of the guns in bushmeat harvesting was highly encouraged by the fact that harvests from the gun attracted a higher market price than that from traps [40]. Buyers prefer bushmeat harvests from guns to harvests from traps because of consumers' preference for the odorless bushmeat resulting from gun killing [14]. Nguiffo & Talla also confirmed that bush meat harvest from traps are most often associated with odor due to the fact that animals caught by traps stay overnight before removal allowing odor development from microbial action [32].

4.2. Quantity of Bush Meat Harvested

Pangolin was typically the most frequently hunted species in KNP during this study period. This can be attributed to the fact that pangolins are not offensive and are easily captured even with the hands. It high rate of poaching is mainly due to its high demand for consumption because of its good taste and for the use of its scales in traditional medicine and rituals including spiritual protection, financial ritual and protection from witchcraft. However, [28] in their study of bush meat off takes in the Korup National Park observed that brush-tailed porcupines and blue duikers were species of high consumer preference. Mbun & Nguemwo, noted that bushmeat trade poses a threat due to the overexploitation of wildlife species to meet the demand of urban markets (national and international) and for products used in traditional medicine in international

market like the Chinese and other East and Southeast Asian markets [27]. No signs of elephants and hippopotamus hunting was found, which can be attributed to the fact that there are no more elephant hunters in the target communities, most of the hunters being migrants leaving Nigeria on special occasions, at times accompanied by local hunters. In the case of hippopotamus it can be due to the fact that there is no more evidence of hippopotamus in this part of the park. Primates were observed to be the second group of animals preferred by poachers in the area, with about 523 of these species harvested within 3 months. As Okiwelu et al put it, primates are not only killed for their food value but also for their medicinal and traditional value [34]. The third group were birds with up to 423 harvested mainly for their feathers, crest, head and legs which has high demand in neighboring Nigeria for traditional medicine and rituals; they are also used for consumption., Both Ekon and Akpasang villages has the highest number of animals hunted. This can be attributed to the fact that Ekon and Erat are mainly focusing on poaching because they have inadequate income generating activities and their proximity to the park, while Akpasang are more into fishing since they have a big river for this activity and are mainly engaged in illegal timber exploitation with an easy means of transportation (river) on like the other two villages with mainly non navigable rivers.

4.3. Different Bush Meat Routes Within the Southwest (Cluster E) of KNP

Based on field observations and findings, we realized that there were many bushmeat routes in the southwest cluster of KNP as affirmed by Macdonald et al when they put identified KNP as the centre of a thriving bushmeat trade [23]. The main bush meat route in the southwest part of the park is that linking the cluster E to Nigeria passing through Ekonganaku. This is in accordance with the KNP Management plan of MINFOF as it explains that from the south sector, the main bushmeat transit routes was Mofako-Bima, Massaka, Mokango, Ngenye and Esoki to Akoh through Ekoneman-Ojong, Ajaman and Okuri or on Fridays to Ekongnaku (Nigeria) through Erat. Bushmeat also reaches Ekongnaku from Ekon I, mainly because of its nearness to the cluster, added to the fact that the other footpath linking the cluster to Mundemba has check points of forestry law enforcement agents and militaries [30]. Therefore, for the vendors to succeed smuggling bushmeat from Mundemba to other cities in Cameroon, it will cost them much risk and money for transport, hence they prefer to sell in Nigeria passing through the footpaths which avoid check points and are safer. Also, the number of vendors from Nigeria are high mainly because to engage in bush meat trafficking, one needs to have a fix capital for buying and transporting through head load, and most of the local population in the target villages don't have that money. So, they prefer to buy in smaller quantities, then supply to the international buyers from Nigeria who have more financial resources. This explains why these international buyers have taken over the bushmeat market in the area and also determines the prices of bushmeat according to the seasons. These buyers also pre-finance local buyers and major hunters in the target communities to supply bushmeat since there is a very high demand in cities within Nigeria for consumption, traditional rituals and traditional medicine.

4.4. Push Factors for Poaching

Community members said that park rangers limited their usual patrols since the socio political crisis in the two English speaking Regions of Cameroon (Northwest and Southwest) started in 2017 and this has given the hunters a free access into the park. According to some poachers, their poaching rates has greatly increased as they can now access all the hotspots in the park without any threats from the park law enforcement service. They also made us to understand that as a result of inadequate sources of income generating activities within their communities they are bound to increases poaching to meet up their rapidly increasing family size. The high demand for bushmeat in Neighboring Nigeria has also played a major role in increasing poaching rate within the southwestern area of Korup National Park. According to the KNP Management plan of the MINFOF, even though harvest bushmeat is primarily for the commercial purposes, bushmeat is culturally preferred over domesticated sources of meat as food and protein source, and its acquisition, distribution and use is deeply entrenched in local cultures and economies [30].

5. Conclusion and Recommendation

Poaching is a major problem in Cameroon biodiversity core zones due to poverty level in the communities living around protected areas. Most household income and protein sources are from bushmeat hunting and trade. This study focused on the bushmeat hunting methods, quantities, routes and key factors in the southwestern part (Cluster E) of Korup National Park. It has revealed that the major poaching method used in the area is the shotguns, followed by wire snares and other traditional hunting methods (nest, dogs, hand cash). The study also showed that there is a significant increase in poaching of endangered wildlife species which are being sold mainly in Nigeria passing mainly through Ekong Anaku village under the Cross River National Park. The inadequate income generating activities, an increase in the population (family size), the high demand for bushmeat in Nigeria, the ineffective law enforcement and poor patrol staff supervision mainly attributed to the outbreak of the Anglophone crises since 2017, and the inadequate community involvement in park management and decision making were the major causes of poaching in the area. Therefore, there is an urgent need for the Ministry of Forestry and Wildlife through the park conservation service with its partners to increase conservation attention

on this park in order to avoid the extirpation of its wildlife species. To address the poaching problem and to enhance and sustain wildlife management, efforts should be made at the national level to support wildlife conservation policies (socially, politically, and economically). The park conservation service and its partners should increase their support for sustainable income generating activities to the benefit of the local communities. Through these alternative activities, the community members can feed their large families and fulfill their economic needs. Likewise, community members also should be trained as local rangers to assist the limited number of park rangers to ensure effective patrols in all the angles of the park. With this, the community members will be more involved in park management and reduce their implication in poaching activities.

Abbreviations

KNP: Korup National Park
NTFPs: Non-Timber Forest Product
PSMNR-SWR: Programs for Sustainable Management of Natural Resources

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Conflicts of Interest

The authors declared no conflicts of interest.

References

[1] Abernethy, K. A., Coad, L., Taylor, G., Lee, M. E., & Maisels, F. (2013). Extent and ecological consequences of hunting in Central African rainforests in the twenty-first century. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 368: 20120303.

[2] Astaras, C. (2009). Ecology and Status of the Drill (*Mandrillus leucophaeus*) in Korup National Park: Implications for Conservation. PhD dissertation, Georg-August-University of Göttingen. 287p.

[3] Bennett, E. L., & Robinson, J. G. (2000). Hunting for sustainability: The start of a synthesis In: Hunting for sustainability in tropical forests, pp. 499519. Eds. J. G. Robinson and E. L. Bennett. Columbia University Press, New York.

[4] Bennett, E. L., Blencowe, E., Brandon, K., Brown, D., Burn, R. W., Cowlishaw, G. U. Y., Davies, G., Dublin, H., Fa, J. E., Milner-Gulland, E. J., Robinson, J. G., Rowcliffe, J. M., Underwood, F. M., & Wilkie, D. S. (2007). Hunting for consensus: reconciling bushmeat harvest, conservation, and development policy and Central Africa. *Conservation Biology*, 21, 884–887.

[5] Bobo, K. S., Kamgaing, E. O. W., Kamdoum, E. C., & Dzefack, Z. C. B. (2015). Bushmeat hunting in southeastern Cameroon: magnitude and impact on duikers (*Cephalophus* spp.). *African Study Monographs*, 51, 119–141.

[6] Bobo, K. S., Ntumwel, C. B., & Aghomo, F. F. M. (2012). Hunter's perception on uses of Preuss's red colobus *Procolobus preussi* and red-capped mangabey *Cercocebus torquatus*, and related conservation issues, in the Nkwende Hills area, southwest Cameroon. *Life Sciences Leaflets*, 8, 28−34.

[7] Bobo, K. S., Ntumwel, C. B., Aghomo, F. F., & Ayemele, K. G. A. (2017). The Conservation Status of Two Threatened Primates in the Korup Region, Southwest Cameroon. *Primate Conservation*, (31): Published electronically prior to print.

[8] Butynski, T. M., & Kingdon, J. (2013). Procolobus preussi Preuss's red colobus. In: The Mammals of Africa, Vol. 2, T. M. Butynski, J. Kingdon and J. Kalina (eds.), pp. 134–136. Bloomsbury Publishing, London.

[9] Coad, L., Fa, J. E., Abernethy, K., & Vliet, N. Van. (2019). Towards a sustainable, participatory and inclusive wild meat sector, Bogor, Indonesia: CIFOR. doi: 10.17528/cifor/007046.

[10] Cowlishaw, G., Mendelson, S., & Rowcliffe, J. M. (2005). Structure and operation of a bushmeat commodity chain in southwestern Ghana. *Conservation Biology*, 19, 139-149.

[11] Fa, J. E., & Brown, D. (2009). Impacts of hunting on mammals in African tropical moist forests: a review and synthesis. *Mammal Review*, 39(4), 231-264. http://dx.doi.org/10.1111/j.1365-2907.2009.00149.X

[12] Fuashi, N. A., Ekane, M. M., Engongwie, J., & Zeh, F. A. (2029). An evaluation of poaching and bushmeat off takes in the Ebo Forest Reserve (EFR), Littoral Region, Cameroon. *Journal of Ecology and the Natural Environment*, 11(2), 14-25.

[13] Gartlan, J. S. (1985). The Korup Regional Management Plan: Conservation and Development in the Ndian Division of Cameroon. A WWF Report supported by WWF, Gland, Switzerland. IUCN/WWF Project 3206 and Earthlife Foundation, London. Publication #25-106 of the *Wisconsin Regional Primate Research Centre*,

[14] Iddi, M. M., & Eivin, R. (2010). Bush meat hunting in Serengeti, Tanzania: An important economic activity to local people. *International Journal of Biodiversity and Conservation*, 2(9), 263-272.

[15] Infield, M. (1988). Hunting, Trapping and Fishing in Villages Within and on the Periphery of the Korup National Park. Paper no. 6 of the Korup National Park Socio-economic survey, WWF Publication 3206/A9.6. WWF Godalming UK. International Union for Conservation of Nature (IUCN). (1994). Guidelines for Protected Area Management Categories, IUCN, Gland and Cambridge.

[16] Korup Rainforest Conservation Society (K. R. C. S). (2013). Final Project Report of Action for Primates Conservation Project, Korup National Park, Cameroon. Project No: 0184812.

[17] Koulagna, K. D. (2001). Problematique de la Viande de Brousse au Cameroun. In BCTF Collaborative Action Planning Meeting Proceedings. Edited by: Bailey N., D.; Eves, H., E.; Stefan, A. and Stein, J., T. Bushmeat Crisis Task Force. Silver Spring, MD. 319p.

[18] Lawson, K., & Vines, A. (2014). Global impacts of the illegal wildlife trade. The costs of crime, insecurity and institutional erosion. Chatham House, London, UK.

[19] Lawson, S., & MacFaul, L. (2010). Illegal logging and related trade: indicators of the global response. Chatham House (The Royal Institute of International Affairs), London.

[20] Letouzey, R. (1985). Notice de la carte phytogéographique du Cameroun au 1: 500 000. Institut de la carte Internationale de la Végétation, Toulouse.

[21] Lindsey, P. A., Nyirenda, V. R., Barnes, J. I., Becker, M. S., & McRobb, R. (2014). Underperformance of African Protected Area Networks and the Case for New Conservation Models: Insights from Zambia. *PLoS ONE*, 9(5), e94109. http://doi.org/10.1371/journal.pone.0094109

[22] Lindsey, P., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R., Eves, H., Henschel, P., Lewis, D., Marnewick, K., Mattheus, J., McNutt, J. W., McRobb, R., Midlane, N., Milanzi, J., Morley, R., Murphree, M., Nyoni, P., Opyene, V., Phadima, J., Purchase, N., Rentsch, D., Roche, C., Shaw, J., van der Westhuizen, H., Van Vliet, N., & Zisadza, P. (2015). Illegal hunting and the bush-meat trade in savanna Africa: drivers, impacts and solutions to address the problem. FAO, Panthera/Zoological Society of London/Wildlife Conservation Society report, New York. 79 pages.

[23] Macdonald, D. W., Johnson, P. J., Albrechtsen, L., Dutton, A., Seymour, S., Dupain, J. E. F., Hall, A., & John, E. F. A. (2017). Association of Body Mass with Price of Bushmeat in Nigeria and Cameroon. *Conservation Biology*, 25(6), 1220–1228.

[24] Maley, J. (1991). The African rain forest vegetation and Paleo-environments during late quaternary. *Climatic Change*, 19, 79-98.

[25] Maley, J. (1996). The African Forest – main characteristics of changes in vegetation and climate from the upper Cretaceous to Quaternary. *Proceedings of the Royal Society of Edinburgh*, 104B, 31-73.

[26] Maley, J., & Brenac, P. (1998). Vegetation dynamics, paleo-environments and climatic changes in the forest of western Cameroon during the last 28,000 years. *BP Review of paleo-botany and palynology*, 99, 157-187.

[27] Mbun, C. M., & Nguemwo, B. S. (2021). Assessment of Species in Bushmeat Trade in Cameroon and the Republic of the Congo, Yaoundé, Cameroon. TRAFFIC Edition. Yaoundé, Cameroon and Cambridge, UK.

[28] Melle, E. M., & Nkwatoh, A. F. (2012). The Indiscriminate Trapping of Wildlife for Consumption and Economic Interest in Korup National Park, South West Region, Cameroon. *International Journal of Current Research in Biosciences and Plant Biology*, 3(7), 33-39.

[29] Ministry of Forestry and Wildlife. (2008). Management Plan for the Korup National Park and its Peripheral Zone (2009−2013). MINFOF, Cameroon. 138pp.

[30] Ministry of Forestry and Wildlife. (2017). Management Plan for the Korup National Park and its Peripheral Zone (2017-2021). MINFOF, Cameroon. 145pp.

[31] Newbery, D. M., Alexander, I. J., & Rother, J. A. (1997). Phosphorus dynamics in a lowland African rain forest: the influence of ectomycorrhizal trees. *Ecol Monogr*, 67: 367–409.

[32] Nguiffo, S., & Talla, M. (2010). Cameroon's wildlife legislation: local custom versus legal conception. Pg 14-16.

[33] Oates, J. F. (2011). Primates of West Africa: A Field Guide and Natural History. *Conservation International, Arlington*, VA. 556p.

[34] Okiwelu, S. N., Ewurum, N., & Noutcha, M. A. E. (2009). Wildlife Harvesting and Bushmeat Trade in Rivers State, Nigeria: -I- Species Composition, Seasonal Abundance and Cost. *Scientia Africana*, 8(2), 1-8.

[35] Parliamentary Office of Science and Technology (POST) (2005). The bushmeat trade. Parliamentary Office of Science and Technology, London. file:///C:/Users/Onokurhefe/Downloads/POST-PN-236.pdf Redford KH (1992). The Empty Forest. *Bioscience* 42, 412-422.

[36] Reid, G. M. (1989). The living waters of Korup rainforest: A biological survey report and recommendations with emphasis on fish and fisheries. WWF report 3206-A8: 1. Gland, Switzerland, World Wildlife Fund.

[37] Rodewald, P. G., Dejaifve, P-A., & Green, A. A. (1994). The birds of Korup National Park and Korup Project Area, Southwest Province, Cameroon. *Bird Conservation International*. 4, 1-68.

[38] Scholes, A. J. (1989). Bats and Small Mammals Survey of Korup National Park. Operation Raleigh Expedition, Korup National Park, Cameroon.

[39] Thomas, D. (1995). Botanical Survey of Rumpi Hill and Nta Ali. Report to Korup Project.

[40] Willcox, A. S., & Nambu, D. M. (2007). Wildlife hunting practices and bushmeat dynamics of the Banyangi and Mbo People of Southwestern Cameroon. *Biological Conservation*, 134, 251-61.

[41] Worboys, G. L. (2015). 'Introduction', in G. L. Worboys, M. Lockwood, A. Kothari, S. Feary and I. Pulsford (eds) Protected Area Governance and Management, pp. 1–8, ANU Press, Canberra.

[42] Wright, J. H., & Priston, N. E. C. (2010). Hunting and trapping in Lebialem Division, Cameroon: bushmeat harvesting practices and human reliance. *Endangered Species Research*, 11, 1–12.

[43] Wright, S. J., Zeballos, H., & Dominguez, I. (2000). Poachers alter mammal abundance, seed dispersal and seed predation in a Neotropical forest. *Conservation Biology*, 14, 227–239.

[44] Ziegler, S. (2009). Application of food balance sheets to assess the scale of the bushmeat trade in Central Africa. *Pre-print from Traffic Bulletin*, 22(3), 105-116.

[45] Zimmermann, L. (2000). A comparative study of growth and mortality of trees in ceasalp dominated lowland African rain-forest at Korup, Cameroon.