Conservation Status of Elephants (*Loxodonta africana* Blumenbach, 1797) in Kamuku National Park, Nigeria

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Abstract: As an endangered species, the conservation of African Elephants in their natural habitat and across their historical ranges is of very high priority wherever they occur to ensure the survival of the remaining isolated wild populations. Ever more, the survival of the elephant continues to be threatened by fragmentation and degradation of their natural habitat, poaching for ivory and human-elephant conflict. In this study, we examined the conservation status of Kamuku elephants and identify the threats to their existence with a view to providing information that would assist planning for potential conservation interventions for this species in the study area. Systematic survey of the elephants was conducted to cover both rainy and dry seasons from April, 2010 to February, 2011 using the Line Transect Survey Method (Barnes and Jensen, 1987) and the Short-cut or Reconnaissance ("recce") Method (Barnes, 1988). In addition, qualitative data on the range of local peoples' understanding and knowledge of elephant conservation status in and around the Park were collected through Focus Group Discussion (FGD) and Interview Schedule (IS) involving elders, farmers' group and youths from support zone communities. Descriptively, data were analyzed using charts, histograms, tables and crosstabulations. To identify correlations, common responses were analyzed with Pearson Chi-squared (2) and Bivariate correlation. Overall estimates of elephant population revealed that there were about thirteen (13) individuals, with probably four (4) to six (6) adults/sub-adults and three (3) to two (2) young ones within the area. There is no significant variation in seasonal sightings of elephants for both rainy and dry seasons (Pearson 2 = 0.884, df =1, p > 0.05). Similarly, number of elephants sighted by respondents through the Interview Schedule does not correlate with the season of the year (r = -0.083). The survey also exposed the presence of threats against elephant routes, ranging and dispersal areas. A widespread trait of all the threats to the elephant population is habitat loss and fragmentation. For effective protection of the elephants a number of conservation recommendations were proposed.

Keywords: African Elephants; Conservation status; Elephant population; Threats; Corridors.

INTRODUCTION

The African elephant (*Loxodonta Africana* Blumenbach, 1797) belongs to the family *Elephantidae* in the order *Proboscidae* (Stuart and Stuart, 1997). According to Stuart and Stuart (*op. cit*.), elephant comprises six families, five of which are extinct. The only surviving family, *Elephantidae* contains two genera; *Loxodonta africana*, the African elephant and *Elephas maximum*, the Asiatic elephant. The African Elephants are further sub divided into two viz; the African bush/savannah elephant (*Loxodonta africana africana*) and the African forest elephant (*Loxodonta africana cyclotis*). Elephants hold a special place in the cultural traditions of African people. They are a symbol of wisdom and are famed for their memory and intelligence.

The African elephants are the world's largest terrestrial mammal. They inhabit a wide variety of habitats, ranging from the arid semi-deserts through the woodland savannah to the dense humid forests. They are an important "keystone", "flagship" and "umbrella species" for conservation, research and tourism. They also play a key role in the ecology of forests and savannas by influencing the structure of both the plant and animal communities and dominating the biomass in the habitat they occupy. The economic value of elephant tourism and elephant products is also significant (Barnes, 1996; Berger, 2001; Bulte *et al*., 2003).

Today, the African elephants are currently endangered in much of their ranges. In 1989, the African elephant was placed on Appendix I of the Convention of International Trade in Endangered Flora and Fauna (CITES), as a result of the data showing population decline on the African continent as a whole. For West Africa, elephant species are at present found in just 35 isolated populations, containing approximately 4,784 individuals (IUCN, 2003). More disheartening is that only 11 of the 35 populations are thought to contain 100 or more elephants. In actual fact, the picture of African elephant range in the present day is one of scattered, fragmented population south of the Sahara Desert.

As an endangered species, the conservation of African Elephants in their natural habitat and across their historical ranges is of very high priority wherever they occur to ensure the survival of the remaining isolated wild populations. Moreover, as habitats are becoming more fragmented and degraded, it is essential to keep accurate and up-to-date information on size and distribution of population for habitat monitoring and providing conservation and management plans for the species. The survival of the elephant continues to be threatened by fragmentation and degradation of natural habitat, poaching for ivory and human-elephant conflict.

In Kamuku National Park, north western Nigeria, small but viable population of the savannah elephants occurs. These elephants are highly migratory and often maraud to surrounding unprotected areas. Despite this fact, no accurate estimate of elephant population exists for Kamuku National Park. In this study, we examined the conservation status of Kamuku elephants and identify the threats to their existence in the area. The intent of our study is to provide information to assist planning for potential conservation interventions for this species in the study area.

Materials and Methods

Description of Study Area
Kamuku National Park (KNP) is located in Birnin Gwari in Kaduna State, North-western Nigeria. It is geographically situated on longitude 10_0 45_1 N and latitude 06_0 30_1 E covering an estimated area of $1,120km_2$ (Figure 1). The Park, originally gazetted as Birnin Gwari Native Authority Forest Reserve in 1936 was upgraded to the status of a National Park in May 1999.

KNP lies within the basement complex region of Nigeria. The soils are shallow ferruginous loams and clays with areas of overlying laterite. The terrain is largely flat, rising gradually eastwards to the Birnin Gwari Ridge (with highest altitude of about 610m), which forms part of the eastern boundary. Elevation is least, averaging 380m around the Mariga River valley on the southwestern boundary. Annual rainfall in the area average 1,150 mm with the rainy season occurring between May and October. Temperature ranges between 25_0c -35_0c for most part of the year with a generally high humidity. The vegetation is characterized by both Guinea and some transitional Sudan Savanna, representing one of the best remaining blocks of Sudan-Guinea Savanna vegetation in the country's protected-area system. KNP is one of Nigeria's Key Biodiversity Areas with an enviable biodiversity profile. Small but

viable populations of elephant *Loxodonta Africana* (EN), roan antelope *Hippotragus equinus* (LR/cd), water buck *Redunca redunca* (LR/cd) and western hartebeest *Alcelaphus buselaphus* (LR/cd) occur in the Park, as do small numbers of lion *Panthera leo* (VU). While the bulk of management efforts centre on protecting the Park's large mammal fauna, KNP also provides a unique opportunity to conserve large tracts of intact Guinea and some transitional Sudan Savanna, an increasingly threatened habitat. In addition, some major tributaries of the river Kaduna, which is vital for domestic and industrial activities within the region, have their source inside the Kamuku National Park.

Historically, the Park has some cultural significance with two major tribes, the Gwaris and the Kamukus. Traditionally, both are mainly farmers with minority being hunters, pastoralists, expert craftsmen, weavers, pottery makers and blacksmiths. Pockets of other tribes such as the Hausa, Fulani, Yoruba, Ibo, Kataf, Kanikon, Jaba, Marwa and Kogoro are also found in the area as settlers. Few now work in the modern sector including private and public organizations. Several settlements form the Support Zone Communities of the Park with an estimated population of 30,400 inhabitants (KNP, 2010). Major threats to conservation activities are hunting, illegal cattle grazing and a lack of management plan since establishment in May 1999 (Ezealor, 2002)*. Kamuku National Park is placed in World Conservation Union (IUCN) Management Category II i.e. Protected Area managed mainly for ecosystem protection and recreation.

Methods
Systematic survey of the Kamuku elephants was conducted to cover both rainy and dry seasons in April, 2010 to February, 2011. Surveys were carried out at the two main ranges of the Park- Doka and Dagara as well as surrounding villages and farmlands. We relied on the knowledge of locals and experienced rangers for selection of transect lines and recce. The survey procedures adopted for the study were the Line Transect Survey Method (Barnes and Jensen, 1987) and the Short-cut or Reconnaissance ("recce") Method (Barnes, 1988) described below:

At each sampling location the survey team moved on a road and walked 500m into the woodland on a compass bearing perpendicular to the direction of the road. Starting at the 500m point, a 1-km transect was cut and marked on the same compass bearing. Every elephant dung pile detected from the transect line was recorded. The perpendicular distance from the transect line to each dung pile was also measured to the nearest centimeter with a tape measure as well as distances along the transect.

These measurements were taken with a view to estimating elephants density in the area, but due to low encounter rate the idea was discarded.

For our recce survey; the survey team was split into two at the end of every transect; each then walked

50 m perpendicular to the transect at opposite direction. Moving in single file, the team followed the path of least resistance while attempting maintain a general compass bearing opposite thatof the transect. All recce walks also spanned 1 km. Dung observations were made as on transects, but no distance measurements was recorded.
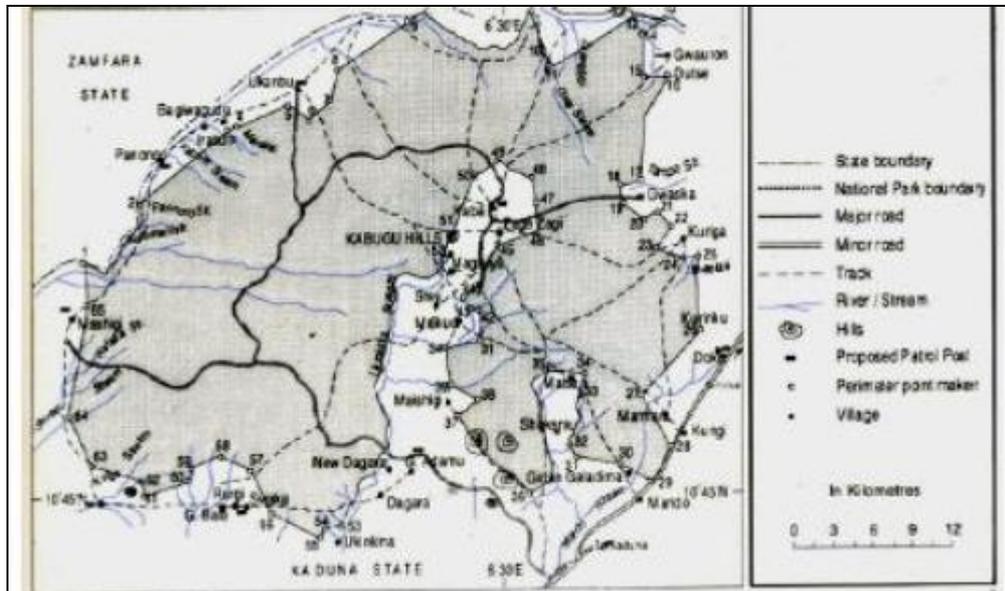

Figure 1: Map of Kamuku National Park showing the supports zone communities
The Park now has the most recent management plan (dated 2010) in the country's protected-area system.

In effect, there were two aspects to the data collection: One was the finding and recording of dung piles along the transect; the other was the categorization of dung piles decay state following the description of Barnes and Jensen (1987; Table 1). Recent footprints, trails, playground and mud bath site of Elephants were also observed and geo-

referenced using GPS handset to obtain data on the locations for mapping, while diameter of footprints were measured in order to be able to determine the age as well as group size. Vegetation type and general habitat observations of survey sites were also noted.

Table 1: Dung decay categories as devised by Barnes and Jensen (1987)

Stage	Description
A	Boli intact, very fresh, moist, with odour.
B	Boli intact, fresh but dry, no odour.
Ca	Some of the boli have disintegrated but more than half still intact
Cb	Less than 50% of the boli are distinguishable, the rest have disintegrated.
D	All boli completely disintegrated; dung pile now forms an amorphous flat mass.
E	Decayed to the stage where it would be impossible to detect at 2m in the undergrowth; it would not be seen on a transect unless directly underfoot.

In addition to both the transect and recce survey, qualitative data on the range of local peoples' understanding and knowledge of elephant conservation status in and around KNP were collected. We elicited information through Focus Group Discussion (FGD) involving elders, farmers' group and youths from each of the communities. Respondents were drawn from Kakangi, Dagara I, Dagara II, Bugai, Goron dutse, Kuiga I, Kuiga II, Gwaska and Nabongo communities. Interview schedule (IS) was used to extract information among these groups of respondents (Gadd, 2005). A total of forty-seven respondents were involved. Efforts were made to keep the interview uniform so that whatever bias was present would be consistent throughout. The IS included a mixture of open ended and fixed-response questions. Both the open ended questions and the fixed-response questions were used to elicit information and extensive discussions of some of the issues faced in the conservation of the elephants in KNP.

Data Analysis

For analysis, responses from the qualitative inquiry were entered verbatim into Microsoft Excel spreadsheets. When many people repeated answers, they were categorized and tallied. Thereafter, descriptive statistics such as charts, histograms, tables and cross- tabulations were used to examine responses. To identify correlations, common responses were analyzed with Pearson Chi-squared (χ^2) and Bivariate correlation analysis using Statistical Package for Social Sciences (SPSS, 2006). Due to inadequate nature of elephant dung data obtained, no detailed analysis was conducted for estimation of elephant density, and instead dung and footprints measurements were calculated as simple index of abundance and compared between locations.

RESULTS

Status and Distribution of Elephants in Kamuku National Park

Within the Doka range, dung and footprints of elephants were found around Budungu stream; open woodland with Isoberlinia spp dominant. Dung piles decay state were within D and E (Old and decayed dung pile) while footprint diameters were around 0.41m, 0.36m and 0.38m. For the Dagara range, dung and footprints were found within a fadama ground; open woodland with no specific plant species dominance. The dung piles decay state were also within D and E (Old and decayed dung pile) while footprint diameters were around 0.35m and 0.31m.

For survey around villages/farmlands, fresh dung, footprints, trails and play ground of elephants were found in Gwaska village/farmlands only. The major crops within the farms are; guinea corn, maize, cassava, cowpea, rice and groundnut. There were indications of clipping, uprooting and trampling of crops by elephants. The farmlands where elephant indices occurred were also very close to a major river in the Gwaska area, river Kumunanu. Footprint diameters range from 0.17m to 0.49m. Overall estimates of elephant population from dung and footprint diameter measurements revealed that there were about thirteen (13) individuals, with probably four (4) to six (6) adults/sub-adults and three (3) to two (2) young ones within the group (Table 2).

Meanwhile, more indices of elephant occurrence were found in the Doka range and its surrounding farmlands compared to the Dagara range. The Gwaska, Goron-dutse, Nabango and Kuyambana junction were also found to be important migration routes for the Kamuku elephants. Figure 2 shows the geo-referenced areas where signs of elephants were recorded.

Local people Insight on status of elephants around Kamuku National Park and its Environs

All (100%) respondents involved in the qualitative data collection had seen elephants in and around Kamuku National Park. Out of this, nineteen respondents (40.43%) sighted elephants in 2009 while only one respondent sighted them in 2010 (Table 3). Elephants in and around KNP are often sighted beginning from the month of August/September through to November/December. Elephants were, however, reportedly sighted more in Septembers (40.43%) than other months of the year corresponding to the period when most agricultural crops get matured and are ready for harvesting in the area (Figure 3). Meanwhile, there is no significant variation in seasonal sightings of elephants for both rainy and dry season (Pearson χ^2 = 0.884, df =1, p > 0.05). Similarly, number of elephants sighted by respondents does not correlate with the season of the year (r = -0.083). Mean elephant group size was 13.89 + 8.50 with the highest figure of 30 recorded in January 2010. Only one respondent reported the sighting of lone elephant in the area.

Table 2: Data Collected from Transects and Recce Survey

Site	Coordinates	Elevation	Observation on Transect line	Observation on Recce line	Dung piles decay state	Footprint Diameter	Estimated No. of Elephant and precise location of indices
Doka Range (Goron dutse track)	N10$_o$ 56´32.1´´ E06$_o$ 34´03.1´´	516.1m	Dung and Footprints around Budungu stream; open woodland with Isoberlinia spp dominant	Dung	D and E (Old and decayed dung pile)	0.41m 0.36m 0.38m	3 (N 10$_o$ 55´ 58.9´´: E 6$_o$ 33´37.6´´) (N 10$_o$ 54´ 37.5´´: E 6$_o$ 32´38.4´´)
Doka Range (Nabango junction)	N10$_o$ 55´ 28.3´´ E 06$_o$ 34´58´	505.7m	Nil	Nil			
Dagara Range (Dandama track)	N10$_o$ 45´22.8´´ E06$_o$ 22´19.8´´	426.1m	Dung and Footprints within a fadama ground; open woodland with no specific plant species dominance	Nil	E (Old and decayed dung pile)	0.35m 0.31m	2 (N 10$_o$ 44´ 20.5´´: E 6$_o$ 21´21.6´´)
Dagara Range (Dandama track)	N10$_o$ 44´ 22.7´´ E06$_o$ 21´20.7´´	426.1m	Nil	Nil			
Gwaska Village/ Farmlands	N10$_o$ 56´ 53.0´´ E06$_o$ 35´04.8´´	507.0m	Trails and playground were observed in the farmlands close to Sabongari	Nil	A (Dung intact, very fresh, moist with odour)		N 10$_o$ 56´33.4´´: E 6$_o$ 34´ 58.2´´
Gwaska Village/ Farmlands	N10$_o$ 56´ 53.0´´ E06$_o$ 35´ 36.0´´	488.0m	Dung and Footprints	Nil	A (Dung intact, very fresh, moist with odour)	0.26m 0.32m 0.49m 0.43m 0.45m	5 (N10$_o$ 54´3$_0$.3´´: E 6$_o$ 34´ 14.2´´)
Gwaska Village/ Farmlands	N10$_o$ 44´ 22.7´´ E06$_o$ 2´ 20.7´´	426.1m	Dung and Footprints close to river Kumunanu	Nil	A (Dung intact, very fresh, moist with odour)	0.30m 0.17m 0.29m	3 (N10$_o$ 53´2$_0$.5´´: E 6$_o$ 34´ 10.1´´)

Figure 2: Map showing areas where signs of elephants were recorded during the survey

Table 3: Local People Insight on status of elephants around Kamuku National Park and its Environs

Last time sightings of elephants	Number of people who reported sightings	Average Number of elephants sighted
2001	1	4
2002	1	10
2005	1	2
2006	4	11
2007	11	17
2008	9	14
2009	19	13
2010	1	30
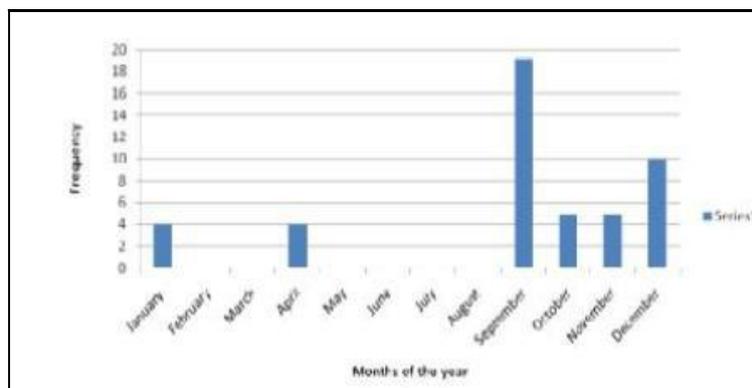
Figure 3: Frequency of elephant sightings around Kamuku National Park across months of the year

Further, 67% of respondents (Figure 4) indicated awareness about the existence of dead elephant route/habitat within the project area. The list of these areas is presented in table 3. Reasons adduced for dead elephant route/habitat include anthropogenic activities and socio-economic developments as well as siltation of water bodies in the areas mentioned (Figure 5).

Trend in Elephants Population in the Last Five Years
Most respondents (83 %) believe that elephant population has been on the increase in the last five years (Figure 6). The growth in elephant population is attributed to reproduction success, park protection efforts, access to food from neighbouring farmlands access to water from the Gulubi River and immigration from other areas (Table 5). By contrast, 15 % of survey respondents consider elephant population to have fallen in the last five years. Disturbance from anthropogenic activities was ascribed as a major factor in the declining trend. Other factors were socio- economic development, inadequate access to water, migration and the need to establish new territory by the elephants. Nevertheless, there was more likelihood to accept that the Kamuku elephant population is on the rise when we consider number of elephants sighted and last time sightings of elephants by respondents (see table 2).
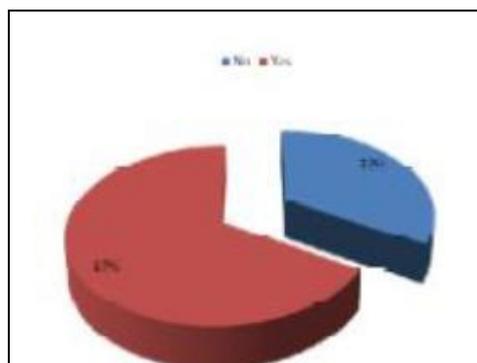

Figure 4: Awareness about the Existence of dead elephant route/habitat

Table 4: Areas of Dead elephant route/habitat around Kamuku National Park

Area	Closest Community
Old Goron dutse	Gwaska
Gudungu stream	Gwaska
Kabago	Gwaska
Raffi-Kango Pasalla	Kuiiga II
Yakoma (Kuiga I)	Kuiga I
Pasalla area	Kuiga I
Matseri	Kuiga I
Raima	Bugai
Kango	Dagara II
Tsonim kura	
Old Dagara	
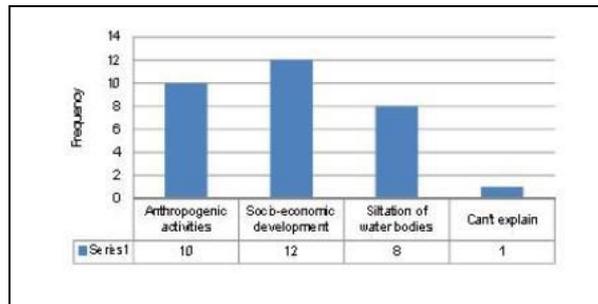
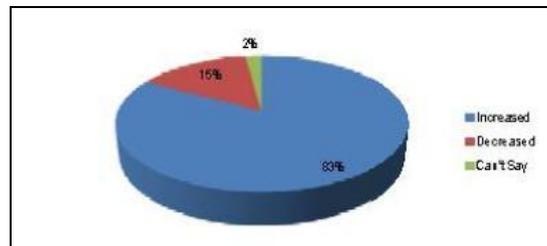Figure 5: Reasons adduced for dead elephant route/habitat

Figure 6: Perceived trend in elephant population in the last five years

Table 5: Reasons for perceived trend in Elephant population in the last five years

Reasons for increased trend in population	*Freq	Reasons for decreased trend in population	*Freq
Park patrol/protection	18	Need to establish new territory	1
Reproduction success	24	Disturbance from anthropogenic activities	4
Access to food from farmlands	11	Socio-economic development	2
Access to water from Gulubi River	3	Inadequate access to water	1
Immigration from other areas	3	Emigration to neighbouring	1

*multiple responses were allowed.

389

DISCUSSION

The study obtained information on the current conservation status of the Kamuku elephants through multiple field surveys and via interviews with local people. Interviewees were representative of multiple ethnic groups and castes. Most of the elephant indices were observed in the Doka range and Gwaska village/farmlands. Elephant indices and mud baths were also found around bodies of water. The estimate of thirteen individuals as probable number of elephants in and around the Park agrees with the mean elephant group size computed from the qualitative data collected. Elephants in and around KNP are often sighted beginning from the month of August/September through to November/December. This may be due to the presence and abundance of farm produce, as well as the availability of water pools around these periods. However, there is no variation in seasonal sightings of elephants for both dry and wet season. There is also no correlation in the number of elephants sighted by local residents with the season of the year. These could be due to the high migratory nature of the elephants. Migration involves the movement of animals across long distances, from one part to other in search of food, breeding site, security or water (Nahonyo, 2004).

Meanwhile, local residents have varying opinion on whether elephants in the area were increasing or decreasing, but the likelihood to accept that the Kamuku elephant population is on the rise was more. Nevertheless, general observations in the course of the project revealed that the biodiversity of KNP is under threat for exactly the same underlying reason as its surrounding landscape which has been ravaged by host of human activities. From field observation during the survey and accounts of local people, a number of threats to habitat and elephant conservation could be identified. They include slash and burn agriculture, pastoralism, poaching, increased settlements and habitat encroachment due to rising human population in the area.

Conservation Recommendations

Based on our findings in the course of this project, the following recommendations are proposed for conservation and management of elephants in and around Kamuku National Park:

1. There is the need to provide water holes and construction of earth dams for stable water supply for the animals;

2. There is also the need for habitat improvement as well as restoration of preferred food resources of the animals in and around the park;

3. In the meantime, elephants route need to be protected from various anthropogenic activities such as bush burning, farming, livestock grazing, fuelwood exploitation and logging within the project area;

4. It is important to identify and understand the movement patterns of the elephants, as well as their resource needs and availability along migration routes. The migration routes also need to be identified and geo-referenced by the Park management authorities. Efforts should thereafter be made to cordon off these places from all form of human activities. Elephants often migrate through defined corridors. There is thus, the need to ensure that the routes and habitats used by the animals are protected in line with the Bonn Convention to which Nigeria is a signatory;

5. The last-mentioned point is very relevant to the current move of the Park management authorities to discuss with relevant stakeholders on the need for trans-boundary joint patrol activities and sensitization campaign within the the Kuyambana Game Reserve and its support zone communities in Zamfara State. This is very significant towards ensuring the viability of the Kamuku elephants as the game reserve and other areas have been identified as important haven of the elephants. This is also important so as to develop a coherent strategy for the conservation and management of the species;

6. There is also the need for continuous sensitization, support and empowerment of local people through community initiatives outside protected areas in the landscape to ensure they participate in the conservation and protection of wildlife and natural resources.

CONCLUSIONS

This project has provided a methodical insight into the conservation status of the Kamuku Elephants. Among others, the survey revealed that elephants with mean group size hovering around thirteen (13) individuals traverse the Kamuku National Park (KNP) area. The survey also exposed the presence of threats against elephant routes, ranging and dispersal areas. A widespread trait of all the threats to the elephant population is habitat loss and fragmentation. For effective protection of the elephants and other wildlife species in the area, therefore, there is still extra need for unrelenting patrols, imposition of stiffer penalties and firm enforcement of all Park laws with a view to curbing the menace of habitat loss and fragmentation. More so, conservation of wildlife species can only occur if their habitats are well maintained.

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