Before Terrorism: Distribution and Abundance of African Elephant (*Loxodonta africana*) in Sambisa – Amshaka Game Reserve, Bornu State, Nigeria

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ABSTRACT

Studies was undertaken to derive information on the abundance, as well as the distribution of African elephants in the Sambisa-Amshaka Game Reserve. For the purposes of the study, the reserve was divided into zones that were then compared. The results reveal that Sambisa-Amshaka Game Reserve holds an ample population of both resident and migratory elephant throughout the year. A total number of 132 elephant groups were sighted during a drive of 29350 m. There is, therefore, a 95% certainty that the true population size lies between 60 and 70 confidence limits, and there is no significant difference P>0.05 between the zones in both elephant composition and distribution. In addition, 190 species woody plants were found browsed by elephant in the study area. Other grasses and forbs were also browsed. The problem facing elephants in the study area includes farming activities during the dry season that block the route the migratory elephants pass through, and also the drying up of rivers. We conclude that if the elephant herd is maintained in the reserve, eco-tourism based on elephant watching will yield economic benefits to the game reserve, the state and the Nation at large. Adequate protection of the elephant species in the reserve is therefore recommended.

Keywords: Abundance, Distribution, Elephant, *Loxodonta africana*, Sambisa, Game Reserve

1. INTRODUCTION

The distribution of wild animals refers to the broad geographic limit in which the species may be found more or less permanently established (Berger, 2001). Wild animal distribution is can be global, local, regional or even seasonal and can also be regarded as the frequency of coming in contact with a said animal. According to Stiling, (2002), the distribution of threatened and endangered species such as elephant differs among biomes. Accurate assessment of larger mammal populations is crucial for the success of environmental monitoring programs and wildlife management strategies. The monitoring of wild animal population programme such as elephant is also essential in order to measure progress and plan for future conservation action, it is important in revealing the characteristics of a habitat, and it is indeed necessary to determine whether the utilization of the animal resources is truly sustainable or not (Berger, 2001).

In Sambisa - Amshaka game reserve the present population number of elephant is not certain and the population dynamics are unknown. Also the reason for their yearly movement, their behavior and general ecology present a matter of speculations. There is therefore need to start the research on elephant at Sambisa - Amshaka game reserve by looking at their distribution and abundance as this will help in taking some management decisions on elephant conservation in the area. The objectives of this study include, to determine the abundance of African elephant in the study area, asses the distribution of African elephant in the study area, asses the present in and exit route of African elephant in the study area and to examine the effect of African elephant in the study area (Mbaya and Malgwi, 2010; Archie, 2006; Hanks, 1973; Evans, 2008; Woolley, 2008; Aarde, 1998, 1999; Eltringham 1977).

2. THE STUDY AREA

The Sambisa - Amshaka game reserve is located in the southern part of Borno State between latitude 11°30'N and longitude 13°20'E - 13°37'E and lies between Gouoza and Bama local government area. Sambisa- Amshaka game reserve covers approximately 250 km². It was the combination of two contiguous northern and southern Sambisa- Amshaka native authority forest reserve and was gazetted as game reserve in 1977, the reserve is popular for its reasonable diversity and abundant wildlife species. Commonly sighted mammals are the primates (baboons and monkeys), gazelle, antelope, hare, squirrel and duiker. Birds include guinea fowl, ostrich, francolin, village weavers and Abyssinian ground hornbill.

3. MATERIALS AND METHOD

Study Design

Reconnaissance Survey

A Reconnaissance survey was carried out in the study area prior to the detailed study to identify communities' that makes up Sambisa- Amshaka game reserve,

Method

Transect method according to Jolly, (1969) Norton-Griffiths, (1978) was employed. Line transect was constructed in the study area. A 40 X 40 km area was established in each zone, within the zones, 4 sub zones of 10 X 10km was constructed using measuring tape and ranging poles for proper measurement and alignment and also to pegged out each of the six zones. The project was carried out for a period of six (6) months. December- May 2010. Each site was visited five (5) days in the month. Period of visit was between 7:00 am – 10:00 am in the morning.

Data Collection Techniques

Elephant Inventory

Both direct and indirect method of census was used. Line transects of 10×10 km in length was established in each of the 4 sub zones in the study area. The researcher and two field assistants aided with binoculars, moved along transects at a vehicle at a maximum speed of 10 km/ hour stopping at intervals to observe and count the elephants when sighted. The following information was recorded, sex of species, number of individuals of the species, dung piles, tracks, feeding signs, sighting distance and species activities when first sighted.

Data Analysis

The objectives were achieved using descriptive statistics (tables, chart, and graphs). Also the method described by Norton-Griffiths (1978) was used to calculate the abundance of elephant in each and all habitat zone. The method is mathematically stated thus;

Total Population $\acute{Y} = R \cdot Z$

where:
R = estimate of average density of elephant per unit area
R = <u>total animal counted</u>

     Total area searched

$R = \Sigma y \div \Sigma z$

S_y^2 = Variance between animal counted in all units.

$S_y^2 = {}^1/n\text{-}1 \ (\Sigma y^2 - (\Sigma y)^2/n)$

S_z^2 = Variance between the area of all sample units.

$S_z^2 = {}^1/n\text{-}1 \ (\Sigma z^2 - (\Sigma z)^2/n)$

S_{zy} = Co-variance between animals counted and the area of each unit.

$S_{zy} = {}^1/n\text{-}1 \ (\Sigma z \, y - (\Sigma z) \cdot (\Sigma y)/n)$

Population variance

$$Var(\grave{Y}) = \frac{N(N-n)}{n} \cdot (S_{y^2} - 2 \cdot R \cdot S_{zy} + 2 \cdot R \cdot S_{zy^2})$$

Population standard error $\mathbf{SE} = \sqrt{\mathrm{Var}(\acute{Y})}$

95% confidence limit of $(\acute{Y})$

$\acute{Y} = \pm \mathbf{t \cdot SE(\acute{Y})}$

t = n -1 degree of freedom

where: N = total number of units from which sample was drawn
        Z = area of census zone
        n = number of units sampled
        z = area of each sample unit
        y = number of elephants counted in each sample unit

4. RESULTS AND DISCUSSION

From the result and from the study carried out the number of elephants species counted is totaled 3928. The average population density is 655 species/40 km^2. Therefore the total population of elephants censured in all the unit area = 24550 elephants/250 km^2. The result is presented in the tables, chart, and graphs below.

Table1. Estimation of the elephant population in the study area

| Stages	Calculation variables	Result
1	Total population	= 24550 Elephants/250 km^2
2	Variance between animal counted in all units.	Var. = 2571530.67
3	Variance between the areas of all sample units.	= 266666666.67
4	Co-variance between animal counted and the area of each unit.	= 30900266.67
5	Population variance	Var($\acute{Y}$) = - 4066
6	Population standard error SE = $\sqrt{\mathrm{Var}(\acute{Y})}$	= 64
7	Confidence limit of ($\acute{Y}$)	= 69.74 ± 64.61
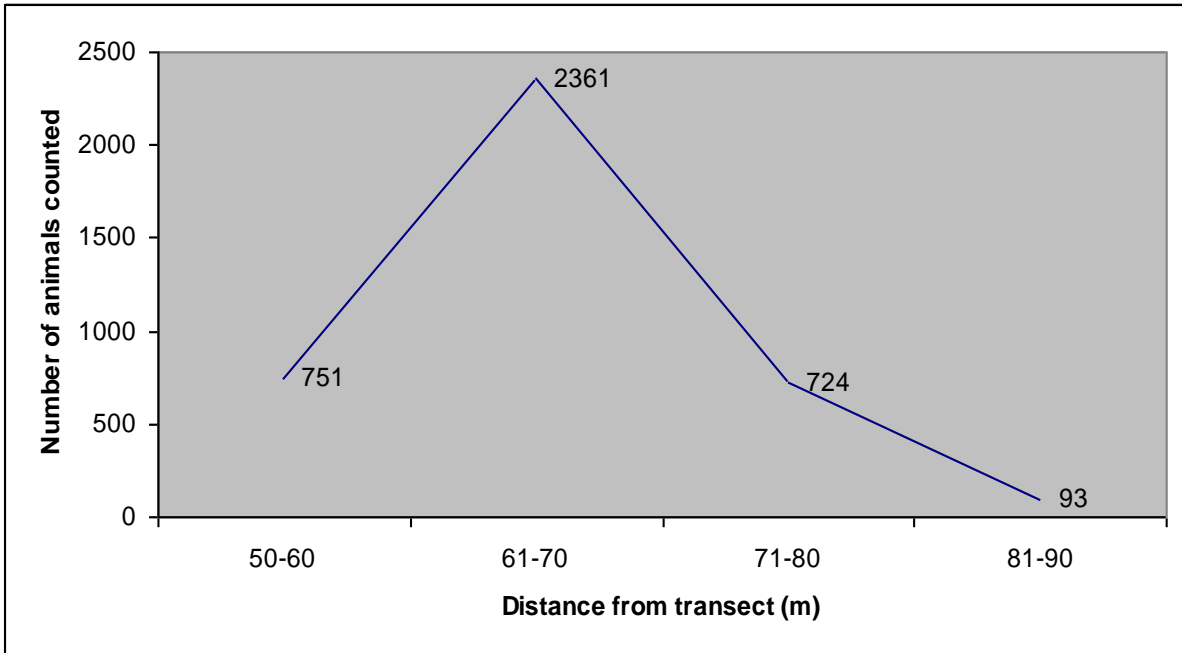
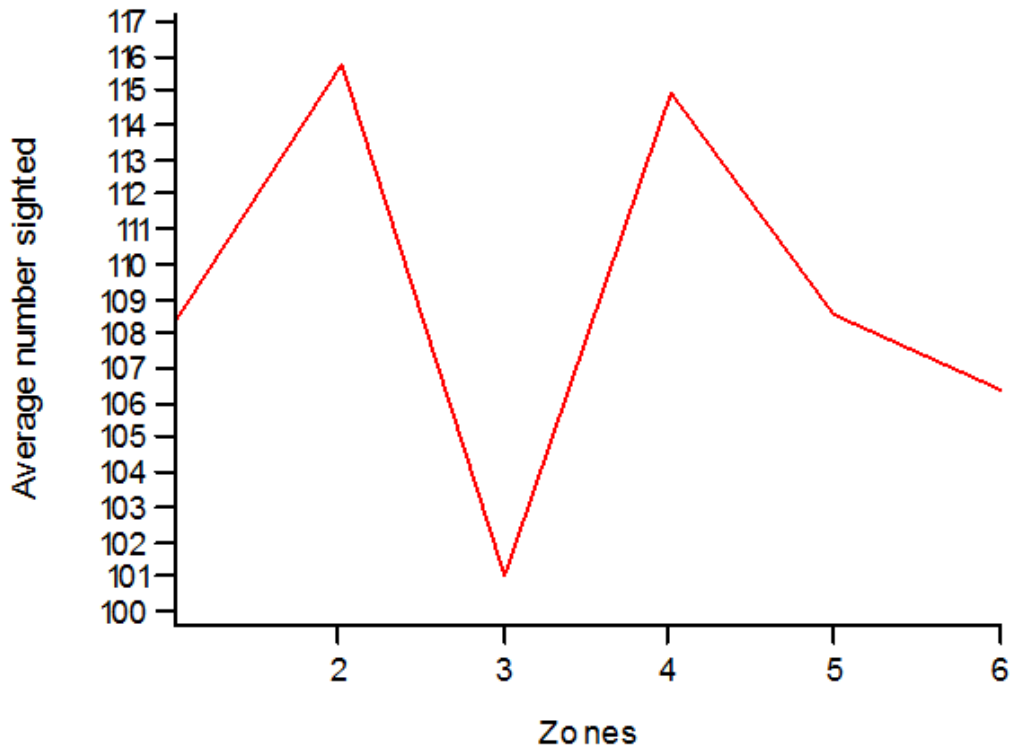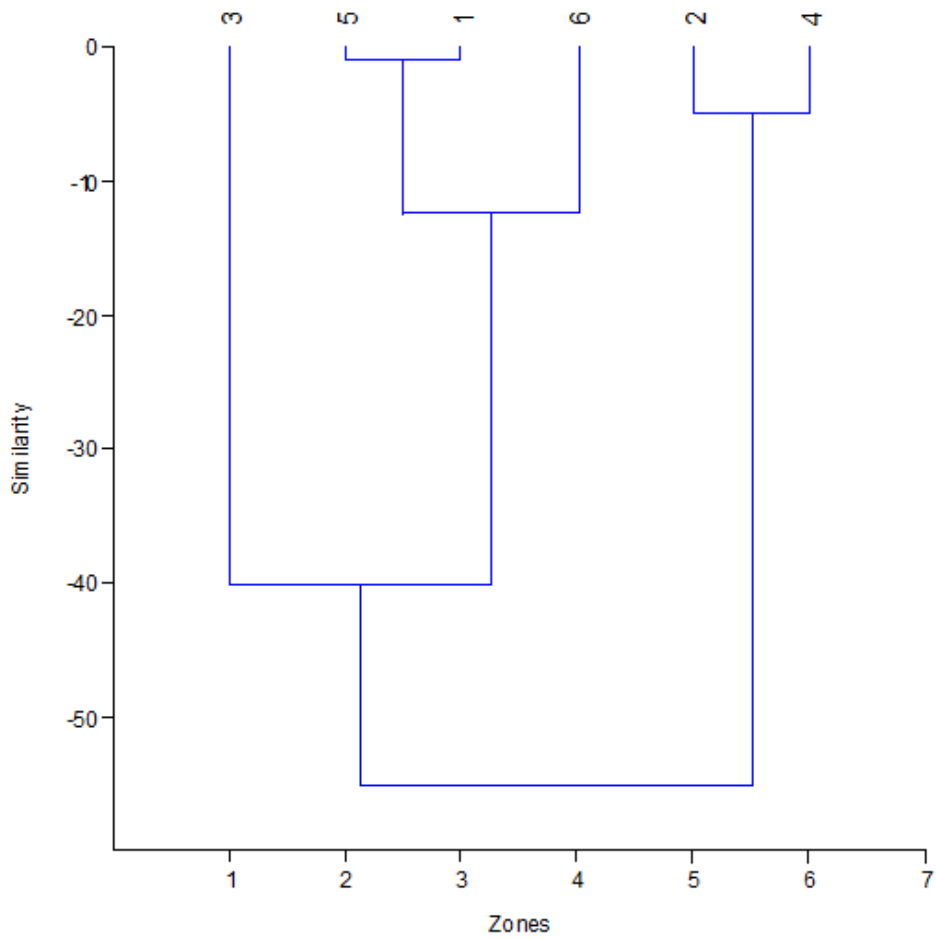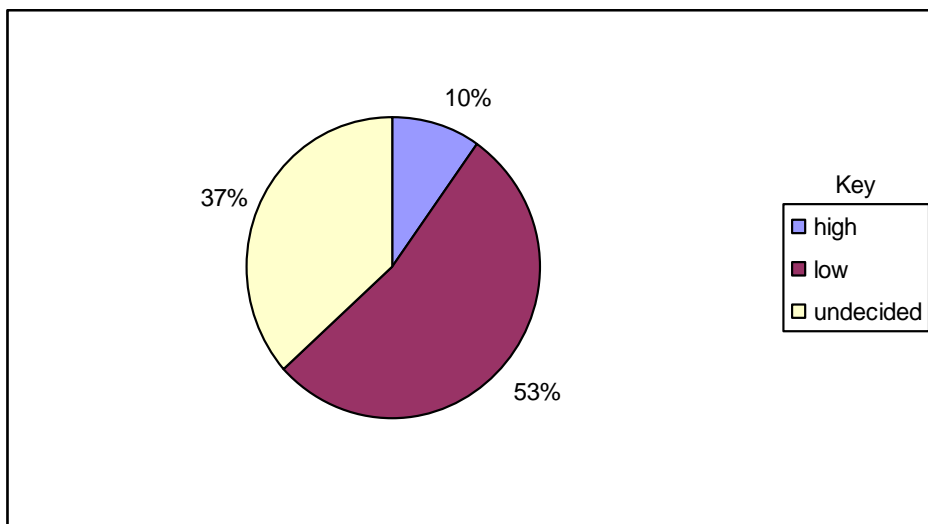**Fig. 1.** Distance from the transect (m)

Fig. 2. Average number of elephant sighted in the zones

Fig. 3. The similarity in elephant distribution between the zones

Fig. 4. Respondents opinion on the present status of elephant species (%)
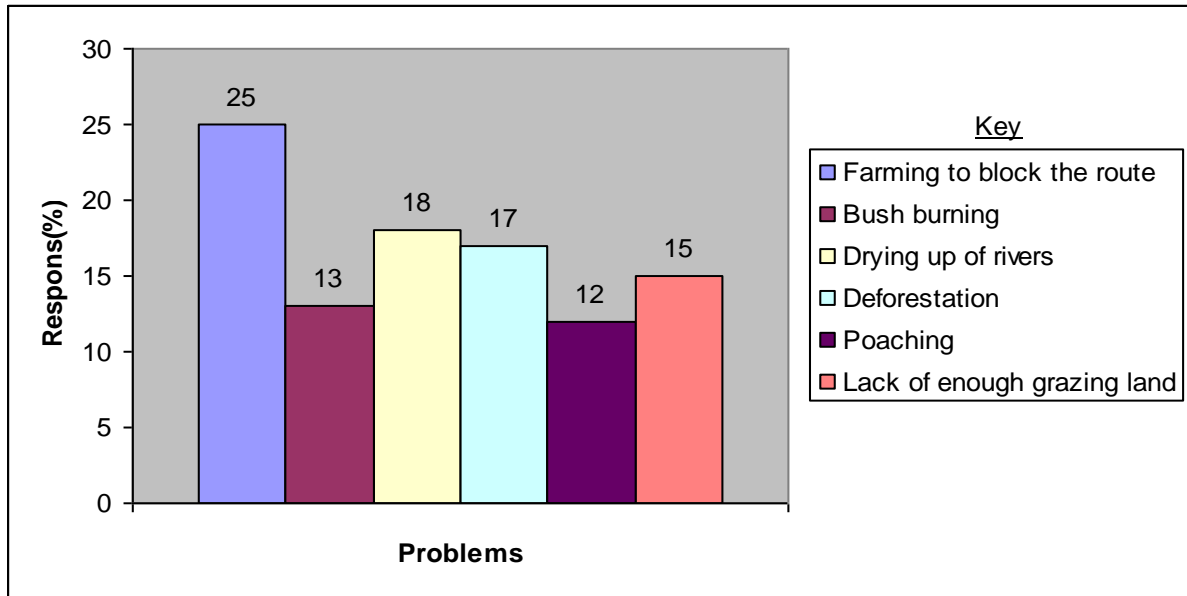
Fig. 5. Problems facing elephant in the study area (%)

5. DISCUSSION

In this study six habitat sites were identified in Sambisa- Amshaka game reserve, they are, Askira-uba (zones 1), Bama (zones 2), Biu (zones 3), Gujuba (zones 4), Gwoza (zones 5), and Konduga (zones 6). Each of these habitats contains ample number of both resident and migratory elephant throughout the year. The habitats provides wildlife habitat that is suitable for African elephant conservation, offering an ideal condition for their survival. Although there is little destruction of trees as a result of their feeding habit, which involve feeding on flowers, fruits, leaves or whole plant and they also have preference for water and salt lick.

From the result gathered, the estimate from the transects shows that individual transect tend to cluster around the mean (655), there is little variation between the transects as indicted by the total population co-variance having a negative value (Var($\acute{Y}$) = -4066). The result on the abundance of elephant indicates that the true population lies within a narrow range, having a low confidence limit. There is therefore a 95% certainty that the true population size lies between 60 and 70 confidence limit. The result is therefore a precise and accurate estimate of elephant population in the study area (Jolly, 1969; Norton-Griffiths, (1974). There is no significant difference P>0.05 between the zones in both elephant composition and distribution. The distribution of the elephant indicates that they are clumped in distribution having very high variances even with the high number of zones. A total number of 132 elephant group were sighted covering a total distance of 29350 m. The average sighting distance is 0.004497 m. Hence all the zones are of great ecotourism potential and ecological importance towards elephant conservation. The presence of high number of dung's also proves the presence of elephant in the area. Elephant dung's were seen in the zones showing that elephant is present in large numbers. Therefore proper management actions need to be taken in order to save African elephant and as well as minimize their migration to other country.

The findings on the visibility profile (i.e. distance from the transect) (m) indicates that at a distance between 60-70 m, 2361 animals were counted being the highest, while 93 animals were counted at the distance between 81-90 meters, Fig 1. Hence the visibility profile for elephant at the study area (Sahel savanna) is best at the distance between 60-70 m meters.

The findings on the similarity in elephant distribution between the zones as shown in Fig. 3 shows that Askira-uba zones and Gwoza zones are similar with high elephant composition, while Bama zones and Gujuba zones are similar with also high elephant composition. Biu zones are less in elephant composition.

The findings on the present in and exit route of African elephant indicates that the migratory elephant species enters the game reserve through the access routes established by elephants in all the communities present around the reserve. These are Wulaji, Kaleri, Kazaram, Maiwa, Bulamari, Yadzaran, Adamari, Kwambali, Waran, Yinagu, Delli and Gwozo community routes. The elephant also follows the same route back while leaving and they all converge at a point at the boundary called Damboa boundary, from where they will move down to Waza Game Reserve in Cameroon.

The findings on the impact of elephant activities in the reserve shows that a total of 190 species woody plants were found browsed by elephant in the study area, other grasses and forbs were also browsed. Among the tree species utilized include *Acacia seyal* having 149 feeding activities taken place at the tree crown level were they feed on the foliage, while 32 of the trees were felled. Some herbaceous climbers and grasses utilized include *Oryz* spp. and *Panicum* spp, here most of the elephant activities and dung's are being seen. The most favoured trees utilized by the elephant include *Balanites spp, Tamarindus* spp, *Ziziphus, Sterculia setigera* and *Acacia* spp. A total of 104 trees were felled during the study period and most of them were not eaten such as *Prosopis africana*, *Anogeissus leucarpus* and *Combretum.* Tree debarking by the elephant in the study area was rampant. A total of 135 trees were seen having the bark removed. Tree debarking ranged from complete bark removal to only a slight scratch on *Mitragyno* spp, *Combretum* spp and *Anogeissus leocarpus*, some of the scratching and teeth impression are a sign of tusk rubbing and testing. Hence elephants are regarded as ecosystem engineers, through their browsing activities they destroy small trees and shrubs when browsing and can change woodland habitats into grass land, while ungulates that graze the grasses are fevoured by the elephant activities (Stiling, 2002).

The major occupations of the inhabitants includes farming, civil servants and hunting, the people depends on hunting wild animals for their livelihoods and they also hunt elephant in other to get the tusk which yield much money to them. The people stated that the present status of elephant species in the reserve presently is very low, the reason they give is that the number they use to see in the years past is higher than the present numbers, hence a lot of work need to be done by government to ensure the survival and protection of elephant species so that they will not leave Nigerian territory permanently.

The problem facing elephant in the study area as shown in fig. 5 indicates that farming activities during the dry seasons is the major problem as these activities blocks the route the migratory elephant passes through into the reserve. Other problems include drying up of rivers during the dry seasons as well as poaching of elephant. This confirms Stiling, (2002) report that the destruction of habitat by herdsmen, constriction of elephant range due to expansion of human population and lack of proper law enforcement has lead to the decline of elephant during the last century. Poaching was very rampant during the study period. A total of 1455 elephants were found killed by poachers during the study period. As the elephant

were passing in the night they feed and destroy farm crops on their way, these result to conflict between the people and the elephant. The hunters among them kill the elephants, while the elephants also retaliate by killing humans. Excessive hunting and bush burning has exterminated the few remaining elephants in most Nigerian protected areas.

The findings on the respondents' opinion on the solutions suggested by the respondents on the problems facing elephant in the study area indicates that the people wants government to provide them an alternative site for farming, stop giving license to hunters, employ poachers as vigilantes and stop revenue collection from firewood collectors.

6. CONCLUSION

The Sambisa - Amshaka game reserve is in a healthy condition to support the conservation of elephant in all the study area both the south east and south north zone of the reserve with its diverse habitat offering ideal condition. Although tree destruction is still recorded at a low level but there is evident that if proper and adequate protection is not taken, there might be an increase in tree total damage in the near future. In a nut shell if the elephant herd is maintained in the reserve. Eco-tourism based on elephant watching to yield economic benefit to the game reserve, state and the nation at large will be achieved. Base on this study we therefore recommend that, indiscriminate killings of elephant and other wildlife in the area should stop. Also government should provide fund for supporting trans-boundary investigation and collaboration on elephant migration.

References

[1] Berger, (2001). Elephant distribution, The African elephant. Bridging the great rift east and south Africa, 2001. *International and environment law* 13(12), 417-461.

[2] Jolly, J.M. (1969). Sampling methods for aerial censuses of wildlife populations. *East African Agriculture and Forestry Journal* 34, 46-49.

[3] Mbaya, Y.P. and Malgwi, H. (2010). Species list and status of Mammals and Birds in Sambisa game reserve, Borno State. *Nigeria Journal of Research in Forestry, Wildlife and Environment,* Vol. 2, no 1, p. 135

[4] Norton-Griffiths, M. (1974). The numbers and distribution of large mammals in Ruaha National Park, Tanzania, *E Afr. Wildl. J.* 13, 121-140.

[5] Norton-Griffiths, M. (1978). Counting Animals. Handbook on techniques currently used in African wildlife ecology No 1. (Edited by J.J. Grimsdell). AWLE, Nairobi. pg 33.

[6] Stiling, P. (2002). Ecology theories and applications. 4th edition Prentice Hall of India private Ltd New Delhi 110001, pg 300

[7] Elizabeth A. Archie, Thomas A. Morrison, Charles A.H. Foley, Cynthia J. Moss, Susan C. Alberts. Dominance rank relationships among wild female African elephants, *Loxodonta Africana. Animal Behaviour* Volume 71, Issue 1, January 2006, Pages 117-127

[8] J. Hanks, J. E. A. McIntosh. Population dynamics of the African elephant *(Loxodonta africana). Journal of Zoology* Volume 169, Issue 1, January 1973, Pages 29–38

[9] M. J. Owens, D. Owens, Early age reproduction in female savanna elephants (Loxodonta africana) after severe poaching, *African Journal of Ecology*, 2009, 47, 2, 214

[10] Kate E. Evans, Stephen Harris, Adolescence in male African elephants, Loxodonta africana, and the importance of sociality, *Animal Behaviour*, 2008, 76, 3, 779

[11] Leigh-Ann Woolley, Robin L. Mackey, Bruce R. Page, Rob Slotow, Modelling the effect of age-specific mortality on elephant Loxodonta africana populations: can natural mortality provide regulation?, *Oryx*, 2008, 42, 01

[12] Rudi Aarde, Ian Whyte, Stuart Pimm, Culling and the dynamics of the Kruger National Park African elephant population, *Animal Conservation*, 1999, 2, 4, 287

[13] Ian Whyte, Rudi Aarde, Stuart L. Pimm, Managing the elephants of Kruger National Park, *Animal Conservation*, 1998, 1, 2, 77

[14] S. K. Eltringham, The numbers and distribution of elephant Loxodonta africana in the Rwenzori National Park and Chambura Game Reserve, Uganda, *African Journal of Ecology*, 1977, 15, 1, 19