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International Journal of Current Research
Vol. 3, Issue, 09, pp.001-004, September, 2011

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFECTS OF AGRICULTURAL PRACTICES ON THE DISTRIBUTION OF WESTERN HARTEBEEST (*Alcelaphus buselaphus*) IN OLD OYO NATIONAL PARK, NIGERIA

***Akinyemi, A. F. and Kayode, I. B.**

Department of Wildlife and Fisheries Management, University of Ibadan, Nigeria

ARTICLE INFO

Article History:
Received 14th May, 2011
Received in revised form
17th June, 2011
Accepted 28th July, 2011
Published online 17th September, 2011

Key words:
Agricultural practices,
Distribution,
Old Oyo National Park,
Relative density,
Western Hartebeest.

ABSTRACT

This study is aimed at investigating the effects of the agricultural practices of the rural people bordering the Old Oyo National Park on the distribution of Western Hartebeest (*Alcelaphus buselaphus*) within the park. The study area was carried out in Marguba, Sepeteri and Yemoso ranges out of the five ranges of the park. Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) methods and structured questionnaires were used to collect information on the issues about their agricultural activities within and around the park. Animal census was carried out using line transect method to determine the distribution pattern of Western Hartebeest in Sites 'A' and 'B' within the park. Site 'A' represents the core zones of the park without human activities, while site 'B' represent areas of the park with human and agricultural activities. Chi-square tests, T distribution paired test, ANOVA and percentages were used as statistical tools to analyse the data collected. Thirty five percent of the farmers have their farms around the park boundary, 30% close to the park boundary, 20% were located inside the park while only 15% were far from the park. The systems of land preparation for planting employed are fire (32.5%), human labour (40%) and tractor (27.5%). Fire is used by the respondents for hunting (25%), clearing farmland (40%), gathering honey (20%) and regeneration of fresh grasses (15%). Therefore, there is no significant difference (P >0.05) in the purposes of using fire by the respondents. The mean population relative density of Western Hartebeest is 0.07group per kilometer. Site 'A' and 'B' have population density of 0.08 and 0.06 respectively. The mean solitary individuals at both sites are the same, which is 0.05. The T distribution paired test showed significant difference (P<0.025) in the distribution of Western Hartebeest in both sites. It is recommended that since majority of the rural dwellers are illiterates, conservation education in term of extension service should be carried to them and modern techniques of agriculture such as planting of hybrids with high yield quality, pest and disease resistance should be introduced to the farmers in the support zone of the park to prevent farmers from encroaching into the park in search of fertile land.

INTRODUCTION

High species richness and biomass of mammalian herbivores are supported by the African savannas (Prins and Olff, 1998; Olff *et al*., 2002). Environmental factors (Klop and Prins, 2008), annual savanna fires (De Bie, 1991), and human activities (Steidl and Powell, 2006) are the important determinants of the mammalian herbivore community on these savannas. Excessive manipulation of the environment by man for his needs is the most prevalent factor affecting habitats and consequently wildlife populations (Ebewele, 1991). Human activities that pose threats to national parks in Nigeria include illegal grazing/overgrazing, deforestation, uncontrolled bush burning; high population rate and illegal hunting (Agbelusi, 1994). Asibey and Child (1990) noted that land-clearing for agriculture, uncontrolled logging and gathering of firewood are also causes of threats to wildlife in Nigeria. The effects of human activities that affect wildlife and their habitats are manifested at all ecological scales, from short-term changes in the behaviour of an individual animal through local extirpations and global extinctions (Chapin *et al*., 2000). The decrease in the population of ungulates are believed to have been affected by human activities which brought about habitat clearance, change in vegetation or habitat cover and reduction of available area caused by agricultural development, urban spread (Jallow *et al*., 2004). In Niokolo Koba National park, a decrease in the population of western hartebeest was observed to be critical due to human activities which led to the change in the ecosystem (Mauvais and Ndiaye, 2004).

Corresponding author: akinyemi_wildlife@yahoo.com; ifykay999@yahoo.com

Serious concerns exist about environmental and ecological degradation from modern agriculture (Freemark, 1995). Agriculture affects species diversity directly and indirectly leading to or beyond the bricks of extinction. The most important agricultural activity influences that have caused the extinction or endangerment of species are the effect of introduced predators, competitors or diseases, and habitat loss or conversion. Old Oyo National Park was chosen for this study in view of many farmers and cattle rearers that settle in the park region and its proximity to regions of extensive agricultural practices. The effect of unsustainable agricultural practices on conservation of the ecosystem of the park was studied so as to provide useful information to the management of the park. The objectives of this study are therefore to:

i. identify the level of agricultural encroachment into the park
ii. evaluate the impact of agricultural activities on the ecosystem of the park
iii. highlight the distribution of Western Hartebeest inside the park

MATERIALS AND METHODS

Area of Study

The study was carried out in Marguba, Sepeteri and Yemoso ranges of Old Oyo National Park. It has a total land mass area of 2 512 km^2 and located between latitudes $8^0$15` and $9^0$00`N and longitudes $3^0$35` and $4^0$42`E. The park is located in the northern part of Oyo State. It has five patrol ranges namely: Marguba, Sepeteri, Yemoso, Oyo-Ile and Tede ranges. The park is characterised by a dry season (November - March) and a wet season (April – October), with rainfall between 1,100 and 1,350 mm/year. The four dominant vegetation communities in the park are: (i) forest and dense savanna mosaic woodland (ii) dense and open savanna mosaic woodland (iii) dense savanna woodland (iv) open savanna woodland. The park is situated in a transition vegetation zone between mixed deciduous rainforest ecosystem in the south and open savannah woodlands in the north (Adeola 1995). The park is rich in many and different fauna and flora species.

Method of data collection

The first aspect of this study was carried out by administering structured questionnaires on the villager bothering the park, while the second aspect involved field survey. Forty scripts of structured questionnaires were administered in each of the three villages randomly selected among the 300 communities that fall within three ranges of the park. These three villages were chosen based on their geographical location within the five patrol ranges of the park. Group interview was carried out to obtain broad sense of local view on some issues about the park. Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) methods were also employed. Field survey was carried out to determine the distribution of Western Hartebeest in the park.

Sampling Survey

The past experience gathered while working in the studied area gave a background for the field survey. Hence, the following were predetermined to aid sampling procedure:

a) the areas of highest concentration of Western Hartebeest within the park
b) two heterogeneous study sits were chosen, which are: Site 'A' – areas without the impact of agricultural practices and Site 'B' - areas with the impact of agricultural practices
c) both dry and raining seasons were used for the sampling survey. Raining season sample collection took place from 26 July to 19 August 2008 while that of the dry season was 10 January to 14 February 2009; which was 25 days for each season.
d) straight line transects of 3.2 km were laid at each of the studied sites as described by Rogers (1975)
e) the transects were constructed along the zones and pegged at intervals of 50 meters (Dunn 1993) and vegetation cover allowance for edge effect was made to ensure accuracy
f) the team of the survey was at the maximum of four persons to minimize noise making that could chase the animals away
g) at the beginning of each transect, survey records of the following standard items records were made: location, date, time at the beginning and end of the survey and weather.
h) observation period along the transect was not longer than 10 minutes

At each place of sighting the animals, the following information was recorded on the standard population data sheet:

1. distance from the point of detection to the transect
2. sighting distance of the animal to the observer at the moment of detection
3. time of initial and final sightings
4. location of the observer along the transect
   sighting angle
5. height of the animal first detected
6. activities and behaviour of the animals on the first detection (e.g. grazing, running, resting)
7. categories of sighting group e.g. solitary etc
8. types of habitat

Each line transect was monitor during 25 consecutive days to determine the accuracy of the result. A precision standard was used to determine the confidence limit. The precision of an estimate is 95% confidence limit expressed as the percentage of estimated mean i.e.

$$\text{Percentage of precision} = \frac{95\%\ \text{Confidence limit}}{\text{mean number of group}} \times 100$$

Each transect count was carried out between 06:30 and 13:00 in the morning and between 16:30 and 18:30 in the evening on a daily basis. This was done to determine the population structure, herd size composition and habitat utilization. We determined the number of hartebeest, sex, relative age, structure of group, activity of focal animal, vegetation type, tree composition as well as canopy and ground cover where the animals have been sighted.

Statistical Analysis

All data collected were subjected to appropriate statistical analysis depending on the nature of the study. Duncan's

multiple range tests (1955) was used to draw conclusions on various parameters studied within both sites 'A' and 'B'. Relative density, percentages and ANOVA were used as statistical tools to analyse the data collected. Relative density of hartebeest was calculated following Amusa (2010):

$$\text{Group Relative Density} = \frac{\text{Group sighted}}{\text{Number of days} \times \text{Total distance}}$$

Total Individual Relative Density

$$= \frac{\text{Number sighted}}{\text{Number of days} \times \text{Total distance}}$$

Testing for difference between population of Hartebeest between both sites 'A' and 'B'

$$T_y \; df = \frac{\pi A - \pi B}{\sqrt{\frac{s^2 a}{n}}}$$

RESULT AND DISCUSSION

From the interviews, it was observed that most of the rural dwellers living around the park areas are illiterate (75%), a few have secondary education (16.7%) while 8.3% have primary education (Table 1). Education is a key to knowledge, and since the majority of the respondents are not educated, the importance of the park might not really be appreciated. They exploit and encroach into the park without appreciating the consequences of their inimical actions. Lameed (1995) also discovered that the primary features of people living in the park region are wide spread poverty and illiteracy rarely conducive to conservation of natural resources.

Table 1. Educational background of the respondents

Level of education	Frequency	Percentage (%)
Primary Education	10	8.3
Secondary Education	20	16.7
Tertiary Education	0.0	0.0
Illiterate	90	75
Total	120	100

The level at which farmers encroach into the park on the basis that there is no clear-cut boundary demarcation is represented on Table 2. 35% of the farmers have their farms around the park boundary, 30% close to the park boundary, while 20% of the farmers have their farms located inside the park (i.e. they have encroached into the park; Table 2). Only 15% of the farmers have their farms far from the park (Table 2). This indicates that activities of most farmers (85%) might affect wildlife in the park; 20% of the farmers have encroached into the park and altered the habitat which is very crucial to the ecological requirements of the western hartebeest. Mauvais and Ndiaye (2004) reported that critical decrease in the population of western hartebeest in Niokolo Koba National park, Senegal was due to human activities.

Table 2: Location of the farms near or in Old Oyo National park

Location of Farms	Frequency	Percentage (%)
Park boundary	42	35
Close to the park boundary	36	30
Inside the park	24	20
Far from the park	18	15
Total	120	100

The various systems of land preparation for planting employed by the farmer respondents are presented in Table 3. The use of fire (32.5%), human labour (40%) and tractor (27.5%), are the systems of land preparation for planting employed by the various farmers (Table 3). Since fire and human labour have higher percentages than the use of tractor, hence slash and burn land preparation are common. The implication of this is that when farmers set fire on the dried fuel matter, the wild fire uncontrollably spreads to the park and destroys the ecosystem.

Table 3: System of cultivation of land by the farmers

System of clearing land	Frequency	Percentage (%)
Use of fire	39	32.5
Human labour	48	40.0
Tractor	33	27.5
Total	120	100

There is no significant difference (P >0.05) in the purposes of using fire by the respondents (Table 4). Fire is used for hunting (25%), clearing farmland (40%), gathering honey (20%) and regeneration of fresh grasses (15%). The indiscriminate bush burning has being giving the protected area's managers sleepless nights. Hunters, farmers and herdsmen use fire for their selfish ends. Agbelusi (1994) avers that setting of the park's vegetation on fire causes wild fire and devastates large portion of the park's vegetation.

Table 4: The reasons for using fire by the various Respondents

Uses of fire	Frequency	Percentage (%)
Hunting purposes	30	25
Clearing farmlands	48	40
Gathering honey	24	20
Regenerating new grasses	18	15
Total	120	100

(P>0.05)

Site 'A' (i.e. core area without agriculture) contains mean population relative density of 0.48 in a mean group of 0.08 while site 'B' (i.e. area with human and agricultural activities) contains 0.26 mean relative population density in a mean group of 0.06. The mean solitary individuals at both sites are the same, which is 0.05. T distribution paired test on the distribution of both transects show that there was a significant difference (P < 0.025) between the two populations. Therefore, the population in site 'A' is greater than that of site 'B'. The mean relative density from the two sites is 0.07 Hartebeest per kilometre. The difference in the population distribution of western hartebeest indicates that the population hartebeest in the core area of the park that is not affected by agricultural practices (i.e. Site A) is higher than areas where agricultural activities take place. This might be as a result of the disturbances of their habitat and vegetation loss in areas where agricultural activities take place.

Table 5: Relative density of Western Hartebeest at both sites in Old Oyo National Park

Site	Number of groups (No of group/days/km)	Number of solitary individuals (No of hartebeest/day/km)	Mean number of individuals per group
A	0.08	0.05	0.48
B	0.06	0.05	0.26
Total	0.14		
$\bar{x}$	0.07		

(P<0.025)

CONCLUSIONS

In Old Oyo National Park, most of the rural dwellers living around the park areas are illiterate (75%), therefore conservation has no basis in their system. The rural people depend on the park resources for their livelihood; they farm around the park boundaries and inside the park. The effects of farm encroachment are habitat alteration, loss of genetic diversity, displacement and local migration of wildlife species. Hartebeest therefore tend to concentrate in the core zone of the park where they are less prone to disturbance factor such as agriculture. This study establishes the fact that in the core area of the park, the population density of Western Hartebeest is 0.08 groups per kilometer as against 0.06 in the other parts of the park. This undisturbed zone of the park covers the area between Ibuya and rivers Ogun, Iwawa, Ayinta, Ohu and Oope. The disturbed areas of the park covers area between the park boundary and Oyo-ile relics, river Tessi, Garba and Iwa up to Bokolori, Banin, Bolounduro, Apata Oloko, Abaja, Gbeu and Ahunbado.

Recommendations

The following recommendations are made to enhance park protection and conservation activities by the park management in order to minimise agricultural encroachment by villagers adjacent to the park:

- modern techniques of agriculture such as planting of hybrids with high yield quality, pest and disease resistance should be introduced to the farmers in the support zone of the park to prevent the farmers from encroaching into the park
- since majority of the rural dwellers are illiterates, conservation education in term of extension service should be carried to them so as to imbibe the culture of conservation for sustainable development
- park boundaries should be clearly demarcated to guard against the unusual excuses of park encroachment for no clear-cut boundary demarcation.

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