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# The Evaluation of Habitat Preference of Hartebeest Antelopes (*Alcelaphus buselaphus*) in Bouba- ndjidda National Park, North Region, Cameroon

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**ABSTRACT:** *Identifying the quality and preference of different habitat types are crucial for developing conservation strategies of a targeted wildlife species. Herbivores are known to select habitats that provide maximum forage intake. The availability of preferred habitat determines the spatial and temporal distribution of herbivores in savanna woodland ecosystems. Understanding habitat preference of a targeted wildlife species is crucial for developing effective management strategies. Hence, the objective of this study was to examine the importance of various habitats to the hartebeest population in the national park. Research data was collected on animal-group activity through observation. The observed animal-group activity was recorded on check-sheets alongside some ecological parameters. The survey showed a significance between the antelope-group size and behavior $X^2$ = 5.441 df=3, P<0.05. Nonetheless, the survey witnessed animal-group size ranging from 1-5 (22%) and 6-10 (78%) respectively. More so, antelopes' movement recorded a significant activity 70% compared to feeding 20%, rest 7% and drinking 4% respectively. There was a significance between antelope-group behavior and vegetation $X^2$ = 9.723 df=6, P<0.05. Three vegetation types were considered during this study, grassland 48%, shrub-land 45%, and forest patches 7% respectively. This study observed the hartebeest antelopes feeding on grass vegetation 93% and lower branches of shrubs 7% due to their large body sizes. Also, there was a significance between landscape and hartebeest-group behavior $X^2$ = 34.371 df=9, P<0.05. Antelope-group behavior was predominantly recorded in flat landscape areas 55% than slope 30%, hill 11%, and flood plains 4% respectively. Furthermore, landscape recorded a significance on vegetation types $X^2$ = 3.332 df=6, P<0.05. Bouba ndjidda national park is rich in wildlife population such as antelopes, hence, more study is needed to be done to understand the population dynamics and behavior of the hartebeest antelopes. Unfortunately, the wildlife population in the national park does not have a rich database research reference compared to other national parks in sub Saharan Africa region.*

**KEYWORDS:** preferred habitat, hartebeest, management strategies, antelope group,

## INTRODUCTION

Effective management of multi-species ungulate populations requires knowledge of the habitat requirements of the individual species and should take cognizance of the existence of interspecific competition. The extent of resources available must also be quantified to prevent environmental degradation. The relationship between animal and habitat plays a crucial role in the ecology of any species. The association between a herbivore and its habitat not only encompasses the availability of preferred food plants and their particular growth stages in its home range, it is also intimately linked to other features of the habitat (Pienaar 1974). In the last three decades, numerous studies have been conducted of mammalian herbivores in relation to their environment. These range from qualitative observations of the types of habitats used by particular ungulate species or assemblages to more complex quantitative investigations that attempt to explain why such habitats are used (Williamson 1990, Funston et al. 1994). Studies aimed at establishing the habitat preferences and other ecological requirements of herbivorous animals are particularly important for the conservation of vulnerable species (Ben-Shahar 1990).

Identifying the quality and preference of different habitat types are crucial for developing conservation strategies of a targeted wildlife species (Illius & Gordon 1992; Rapp 2017). Herbivores are known to select habitats that provide maximum forage intake (Martínez-Freiría et, al. 2016), while reducing predation risk (Rapp (2017). There are several factors that can determine the spatial and temporal distribution of herbivores in savannas ecosystems. These include the availability of resources (Ogutu et, al. 2014), predation risk (Rapp, 2017), fire (Sankaran et,. Al. 2008), vegetation height and cover (Laca et, al. 1992), human presences and livestock density (Fritz et, al. 1996). Since a habitat type may not always have adequate resources, the trade-offs between costs and benefits associated with searching and utilizing forage can limit herbivore selection (Arsenault & Owen-Smith (2008). Moreover, spatial variation in relative availability of different habitat types may result in dissimilar habitat selection among individuals of the same species (Klop et, al. (2007).

In savanna grassland, where there is a cyclic rainfall, fire is used as one of the most important habitat management tool for herbivores (Klop & van Goethem 2008). Understanding how wildlife species respond to fire effects is crucial, particularly for endangered species that have limited range (Eby et, al. 2014). Fire effects grass height, which in turn effects habitat preference of herbivores (Riginos & Grace (2008). Previous studies (Massé & Côté, 2009) have identified the trends of large grazers' habitat preference in response to grass height and post-fire effect on vegetation. Herbivores could optimize their daily forage need where they are able to access the preferred grass heights (Drescher et, al. 2006). There is a general consensus that grass height has a major influence on the spatial and temporal distribution of herbivores, and resource partitioning among herbivores could also occur through differential selection of grass height (Hempson et, al (2015).

In African savannas, frequent burning of grass influences the habitat selection of herbivores due to impacting forage quality and reducing predation risk (Burkepile et, al. 2013), and it is a key element in predicting habitat selection by specific species. Fire plays a determinant role in the ecology and evolution of grassland ecosystems (Van Langevelde et,al. 2003), and has historically, and still today, been used as a tool for managing grassland vegetation (Parrini & Owen-Smith, 2010). Post-fire regrowth of grass influences the dry season habitat use of many herbivore species (Parrini & Owen-Smith, 2010). However, there have been arguments among ecologists how burning affects habitat selection of large body-sized herbivores.

Small body-sized herbivores might prefer burned areas more than large body-sized herbivores due to differential preferences in relation to forage quality (Wilsey, 1996). However, another study revealed that fire does not have relationship between body size and use of burned areas (Klop et, al. 2007). Several studies (Hassan & Rija, 2011; Wagner 2009) found that decreasing fire frequency increases vegetation cover and tree densities, which in turn decreases visibility and the subsequent ability of herbivores to detect and escape from predators. As a result, herbivores may avoid areas with relatively denser vegetation cover or spend more time in those areas for vigilance rather than foraging (Hassan & Rija, 2011). Hence, herbivores foraging in burned areas may represent either acquiring quality forage or avoiding predators.

Swayne's hartebeest (Alcelaphus buselaphus swaynei) is a large body-sized herbivore weighing between 100 and 200 kg (Mamo et, al, 2012). It was once widely distributed in Ethiopia, Somalia and Djibouti (Datiko & Bekele 2011), but currently its range is confined in two protected areas: Senkele Swayne's Hartebeest Sanctuary and Maze National Park in Ethiopia (Mamo et, al. 2012; Lewis &Wilson 1979) and listed as endangered sub-species by IUCN Red list (IUCN SSC, 2019). Seasonal burning is used as a habitat management tool in the national parks, but how the Swayne's hartebeests respond to post-fire effect and grass height preferences in different seasons remain untouched. Despite its small area, the Park has different habitat types (Mamo et, al. 2012). While hartebeest are known to be grazers (Casebeer & Koss, 1970), there may be conditions that enforce Swayne's hartebeests to utilize bush-land and forest habitats in different seasons.

## MATERIALS AND METHODS

### Description of Study Area

Bouba ndjidda national park is located in the northern region of Cameroon near the Chadian border, between latitude 8°37′ and 8°37′ N and longitude 14°39′ and 14°39′ E. It was created in 1932 as a wildlife reserve and became a national park in 1968. It covers an area of 220,000 ha. (Michael, 2009) and has the Sudano-guinean climate characterized by two seasons, a six-month rainy season from late April to mid-October and a dry season from November to April during the period which no rain is observed (Michael, 2009). The region receives between 1000 and 1,250 mm of precipitation per year and the rainiest months are August and September while the annual average temperature is $28^0$C. The region has a dense hydrographic network, unlike other rivers that are seasonal in this part of the country (Stuart et al., 1990). Water is abundant throughout the national park and even during the dry season, thus ensuring the development of ecological interaction processes between wildlife species and habitat characteristics in the environment. The

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national park is also a home to 24 species of large and medium mammals such as African elephant, Lions, Giraffes, Leopards, Hyenas, Bush pig, Warthogs, Hippos, Buffaloes, Hartebeest antelopes, Eland antelopes, Kob antelopes, Reedbuck antelopes, etc. Additionally, the national park homes about 250 bird species. Considering the ornithological richness of the national park, it has been declared and area of importance for the conservation of birds (Stuart et al., 1990).

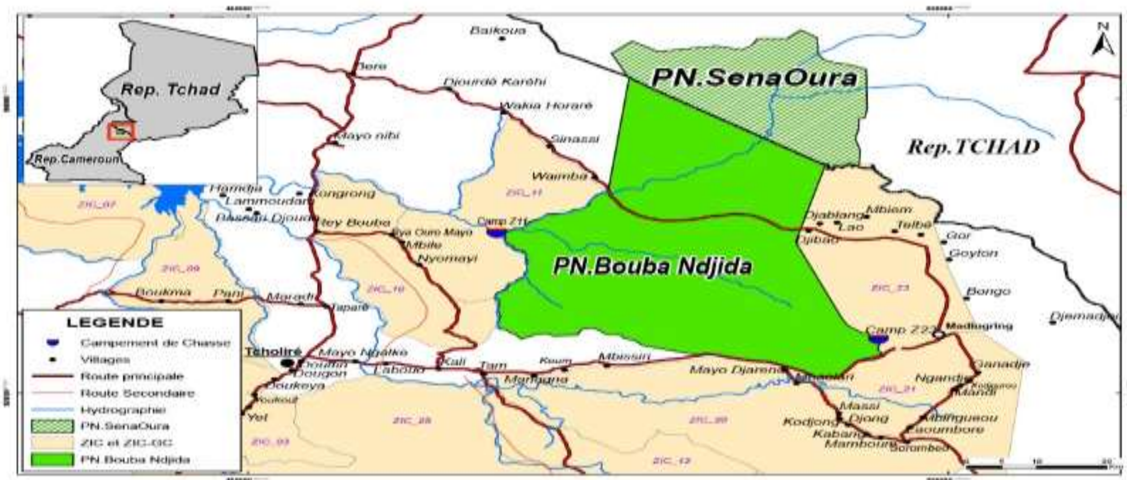


*Figure 1: map of Bouba ndjidda National Park (Michael, 2009)*

**Data Collection**

Data collection on antelopes' activity in the preferred habits were done by direct observation (focal sampling method) from appropriate visible points. This included watching an individual or group of antelopes for 10 minutes within an interval of 5 minutes (Sutherland et al., 2005). Antelopes were observed in the early morning (06:30 to 10:30) and in the late afternoon (14:00 to 18:00) when they were active (Tahani and Ibrahim, 2014; Wubie and Mesele, 2018). Recordings were ceased whenever the animals moved out of sight. Data were collected more than ten times per month on antelopes' habitat activity. More so, observations were recorded when the antelopes were foraging (grazing/browsing/chewing/biting) on plants (tree/shrub/herb/grass) or consumed plants parts (leaf/shoot/stem/fruit) (Wubie and Mesele, 2018).

**Data Analysis**

Before conducting the actual data analysis, data were checked for some errors (e.g. recording and consistencies). Data were analyzed using statistical package for social science (SPSS) version 20 software ($\alpha = 95\%$ level of significance, $p < 0.05$), descriptive statistics and Excel spreadsheet. The variables were cross-tabulated to understand their degree of association.

## RESULTS

The survey showed a significance between the antelope-group size and behavior $X^2 = 5.441$ df=3, $P<0.05$ (fig.2). The population of hartebeest in Bouba ndjidda national park is seemingly high compared to other antelope species. Some of the reasons, however, may be some ecological system rich in woody grassland vegetation suitable for the feeding of these antelopes. Hartebeest is one of the largest antelope species in sub Saharan Africa that form herds of 30 to 300 animals in food-rich ecosystems. Nonetheless, the survey witnessed animal-group sizes ranging from 1-5 (22%) and 6-10 (78%) respectively (fig.3). The low group formation strength in the national park might be due to the dry season food scarcity witnessed by this study, carried out in the dry season. More so, antelopes' movement witnessed a significant activity 70% compared to feeding 20%, rest 7% and drinking 4% respectively (fig.4). The food scarcity caused by the hot dry season might be one of the reasons the movement of the antelope recorded the highest behavioral activity observation. During the dry season of the year, the woodland savanna ecosystem of northern Cameroon experiences vegetation dryness due to low humidity and soil moisture content caused by the hot weather condition. This condition causes feeding problems to herbivorous antelopes such as the hartebeest antelopes that predominantly depend much on grass nutrient.

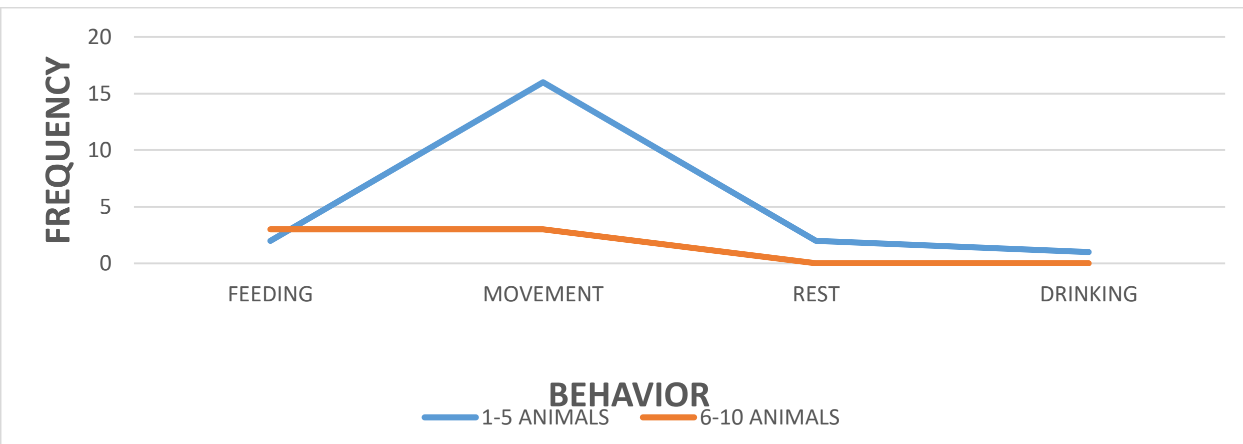


***Fig. 2: Antelope-group sizes and behavior***

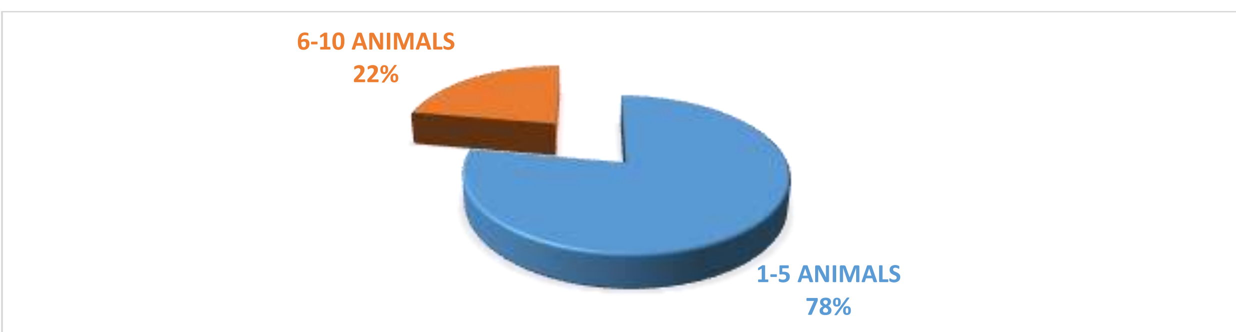


***Fig.3: Antelope-group sizes***

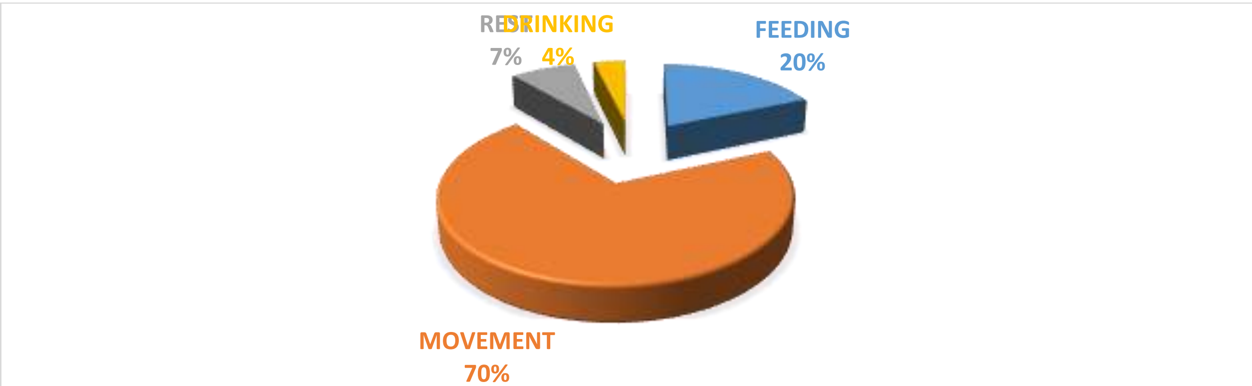


*Fig.4: Antelope behavior*

There was a significance between antelope-group behavior and vegetation $X^2 = 9.723$ df=6, P<0.05 (fig.5). Vegetation availability has been a determinant factor to the wildlife population availability in protected area management. The role played by vegetation in the management of wildlife population are enormous. One of the most important role is the provision of habitat for wildlife shelter, secondly, it's a food resource to herbivorous wildlife species such as hartebeest antelopes. Though, Bouba ndjidda national park is a woodland savanna ecosystem, it has a rich vegetation during the raining season than the dry season. Both seasonal changes affect animal population increase, however, the wet season experiences higher increase than the dry season. The rain gives rise to healthy vegetation growth needed to feed herbivorous antelopes and other wildlife species, creating a fertile reproduction environment. Three vegetation types were considered during this study, grassland 48%, shrub-land 45%, and forest patches 7% respectively (fig.6).This study observed the hartebeest antelopes feeding on grass vegetation 93% and lower branches of shrubs 7% due to their large body sizes (fig.7).

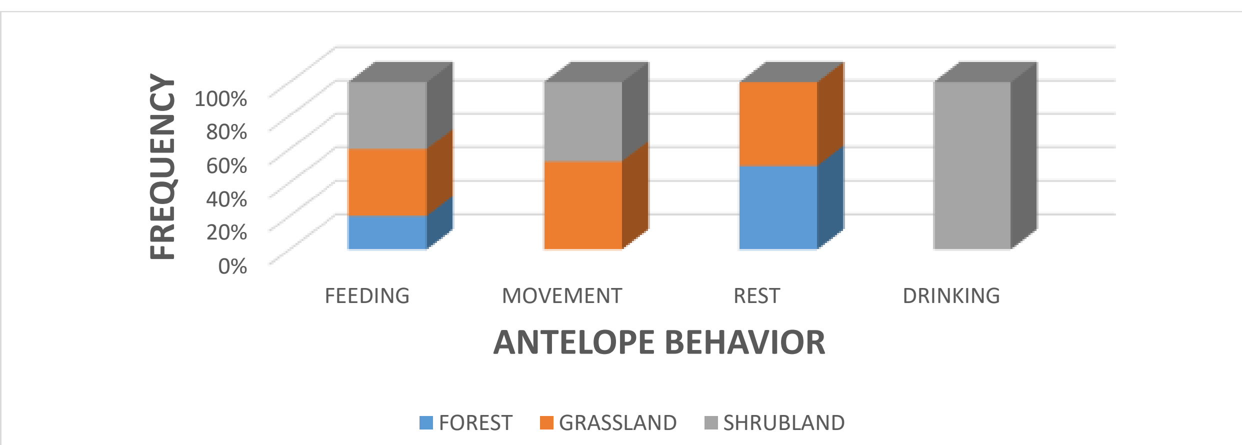


*Fig. 5: Antelope behavior and vegetation*

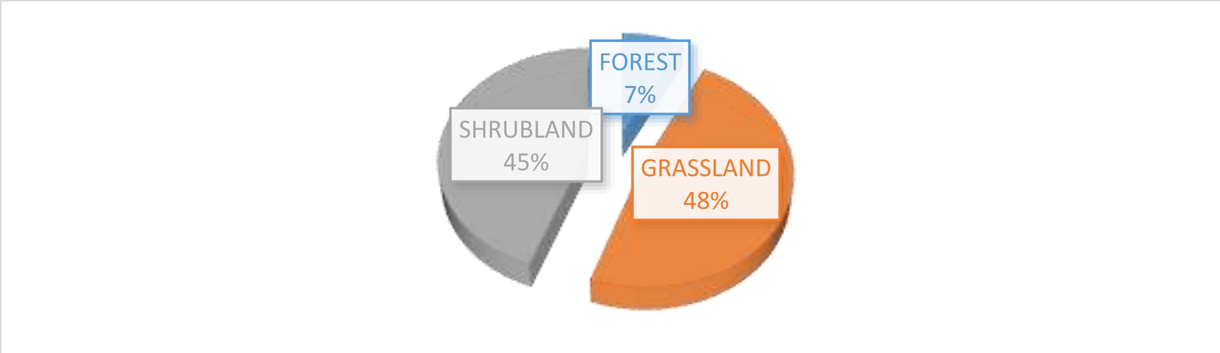


***Fig. 6: Vegetation cover***

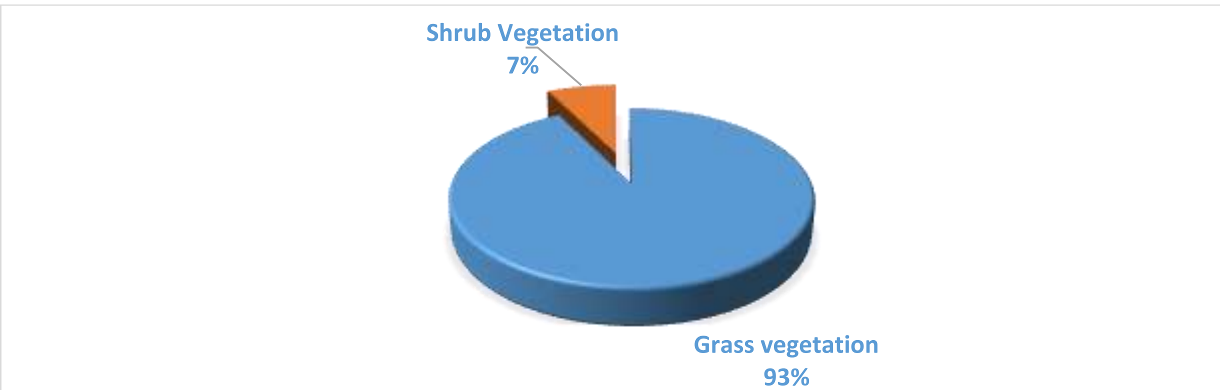


***Fig.7: Food resources***

Also, there was a significance between landscape and hartebeest-group behavior $X^2 = 34.371$ df=9, $P<0.05$ (fig. 8). Antelope-group behavior was predominantly recorded in flat landscape areas 55% than slope 30%, hill 11%, and flood plains 4% respectively (fig. 9). Flat landscapes were richer in grass vegetation than other areas in the national park. The high behavioral activity recorded on the flat landscape was on animal movement in search of food. Though, open flat landscapes might expose hartebeests to predatory big cats such as lions and leopards to be sighted easily, the animal herd was always vigilant to their presence and would often trigger running whenever these cats were sighted in their territory.

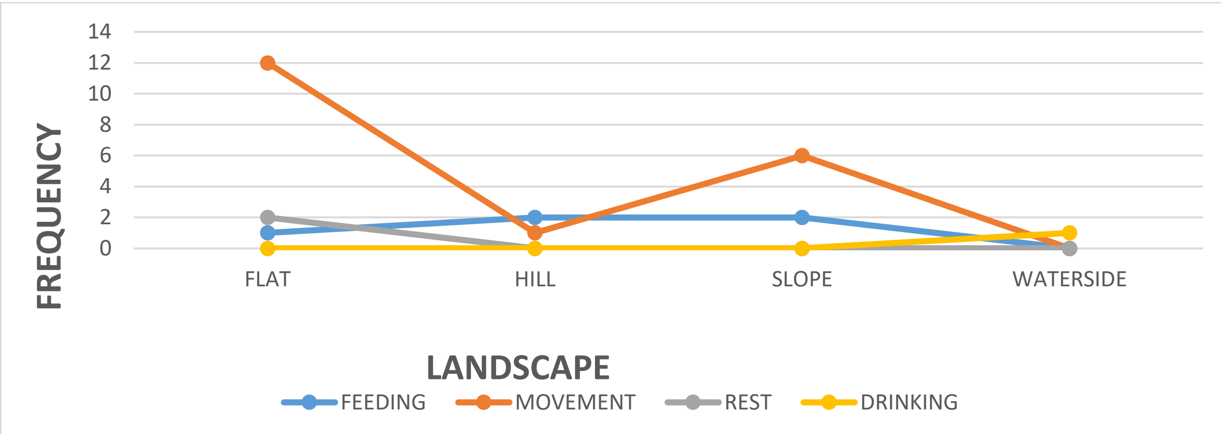


***Fig.8: landscape and hartebeest behavior***

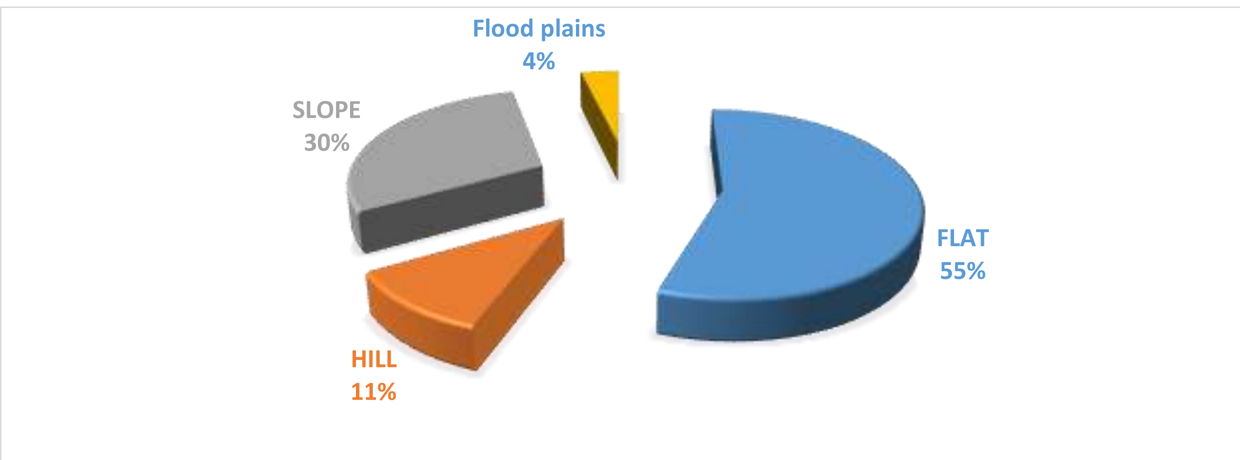


***Fig. 9: Landscape***

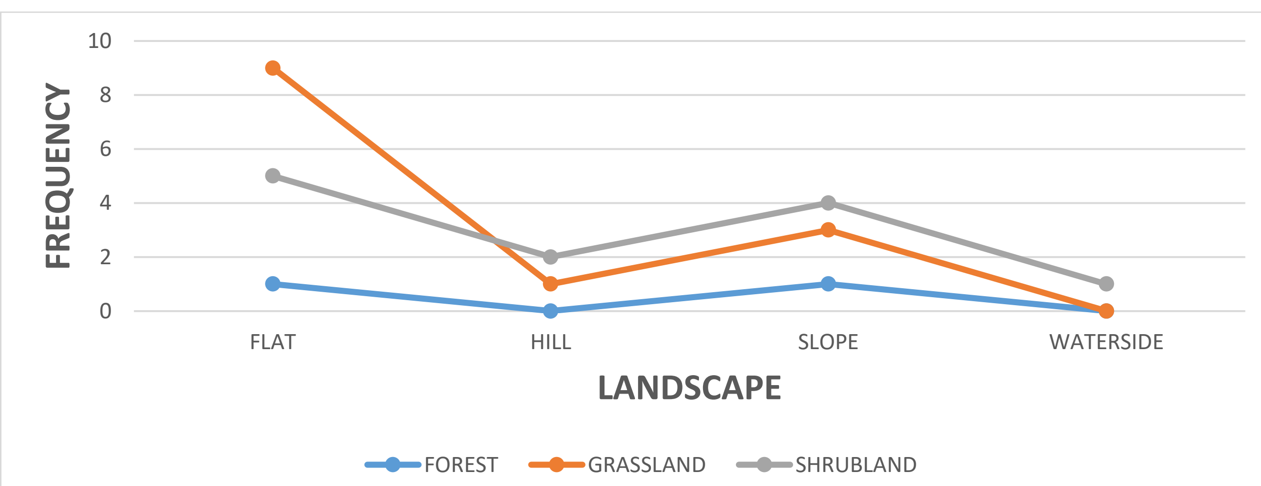


***Fig.10: landscape and vegetation***

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Landscape recorded a significance on vegetation $X^2 = 3.332$ df=6, P<0.05 (fig. 10). The national park is not rich in forest vegetation, but the presence of few forest patches helps to shade wildlife from the hot sun during the dry season, especially during the mid-day and afternoon periods when the sun is extremely hot. The grassland and shrub-land were major contributors in feeding these herbivorous antelopes.

## DISCUSSION

The availability of preferred habitats determines the spatial and temporal distribution of herbivores in savanna ecosystems. Understanding habitat preference of a targeted wildlife species is crucial for developing effective conservation strategies (Misganaw et al. 2020). Habitat preference of large grazers in connection to grass height and post-fire effect has been debated for the last century. The effects of season, grass height and burning on the habitat preference on Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) in Maze National Park (Misganaw et al. 2020) was examined. Data for seasonal habitat selection were collected using both direct observation along established transect lines and pellet counting using permanently established plots. Every month, we measured grass height commonly preferred by Swayne's hartebeest in grassland habitat (Misganaw et al. 2020).

The grass height has been demonstrated to exert a major influence on bite size that in turn impacts on food intake rate achieved by grazing herbivores (Drescher et, al. (2006). Larger body sized herbivores (> 100 kg body weight) (Arsenault &Owen-Smith, 2008) are expected to graze taller grasses to meet their quantitative food requirements (Bjørneraas et, al. 2012), while smaller body-sized herbivores can achieve an adequate amount of food intake from short grass swards (Demment & Van Soest, 1985). In theory, shorter grasses are generally leafy with higher proportion of nutrients and preferred by many small body-sized herbivores (Arsenault &Owen-Smith, 2008), while larger body-sized herbivores can tolerate poorer quality food provided by the taller grasses (Bhola et, al. 2012). When grass grows and matures, its nutritional quality decreases (Thompson et, al. 2003). This can be demonstrated by the decrease proportion of leaves and the nitrogen content (both indicating high grass quality) in the grass with increasing grass mass in savanna ecosystem (Van Langevelde et, al. 2008).

Our study showed that Swayne's hartebeests preferred open grassland habitat in Maze National Park throughout the year as observed with other wild herbivores, such as Coke's hartebeest (*Alcelaphus buselaphus cokii*) in Athi-Kapiti Plains, Kenya (Casebeer & Koss 1970); hartebeests (*Alcelaphus buselaphus*) in southern border of Burkina Faso (Schuette et, al. 1998) and wildebeest (*Connochaetes taurinus*) in Serengeti National Park, Tanzania (Bell, 1971). Although the Park has a wider coverage of other habitat types, such as bush-land habitats and riverine forest, the Swayne's hartebeest rarely used them. This reflects on the fact that Swayne's hartebeest conservation is largely based on the management of the grassland habitat in Maze National Park. Our surveys detected few Swayne's hartebeest pellets in bush-land habitats and riverine forests during the dry season, which likely occurred when they were walking to a water source.

Swayne's hartebeests were not encountered in agricultural lands and rugged habitats except in a rare occurrence, which might have been a response to predators in the area. In the grassland habitat, the grass grows fast and reaches above one meter within a month after the wet season begins and becomes taller in the early-dry season, but decreases in height in the first few months of dry season. However, Swayne's hartebeests almost abandoned the taller grass height, and consistently preferred the shorter (below 30 cm) available grass height areas in the Park. Our findings are thus in support of the previous studies in other areas, for instance, hartebeests and roan antelope (*Hippotragus equinus*) in Nazinga Game Ranch, Burkina Faso (Schuette et, al. 1998), and wildebeest in Serengeti Park, Tanzania preferred short grass height (Eby et, al. 2014). There are two speculations about short grass preferences of herbivores: (1) due to the higher nutritional quality of short grasses and (2) to avoid predation risk.

Even though the fear of predation may influence short grass habitat selection in some cases, in this study the predation risk is rather less due to low density of predators (mainly lions) in the Park, suggesting that the Swayne's hartebeest preference of short grass habitats is more likely the result from nutritional gain. Shorter grasses have less lignin with lower carbon to nitrogen ratios which are more palatable and digestible for grazers (Van Langevelde et, al. 2008). Shorter grasses also have higher nutritional quality (Treydte et, al. 2013) and percentage of green leaves that allow higher bite rates for herbivores foraging (Drescher et, al. 2006). Grass height preferences of Swayne's hartebeest influence their distribution in Maze National Park in different seasons. Previous studies (Soder et, al. 2009) also revealed that forage influences the distribution of herbivores.

## CONCLUSION

The benefits of group-living in wildlife are enormous, survival of sub-adults and juveniles, location and movement to new feeding sites, and mostly importantly defense against invasion. Bouba ndjidda national park is rich grass vegetation on flat landscape sustaining a hug population of many herbivorous wildlife species, especially antelope species like hartebeest. The huge antelope population in this areas has also been credited to the conservation authorities of the national park and the Ministry of Forestry and Wildlife. Poaching is believed to have been significantly reduced to the advantage of wildlife population increase. Secondly, the drainage system of this area is the best in the northern region of the country, an advantage to antelope-group feeding along the river banks during the dry season period of the year when rivers in other protected areas like Faro and Benue must have dried up by the hot weather condition.

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