



# Evaluation of the Patas Monkey (*Erythrocebus Patas*) Lifestyle and Habitat Management Strategies in Kainji Lake National Park, Nigeria, for the Development of Ecotourism

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## Abstract

The rising human activities around the protected areas have been a significant limitation to wildlife conservation, especially in Nigeria. This study evaluated habitat management for the patas monkey (*Erythrocebus patas*) in Kainji Lake National Park. A field survey through the administration of a structured interview guide was used to extract information on the effective management of the habitat from the park staff. Site assessment was also carried out. Five transects of 1km length were laid at 500m intervals. Four plots of 50m × 50m were alternately laid at 200m intervals in each transect. Enumeration of trees ≥ 10 cm diameter at breast height (DBH) was carried out while the patas monkey activities were monitored. Data collected were analyzed using descriptive statistics. Thirty-five (35) tree species were identified and classified based on their IUCN status, with 62.86 % as least concern (L.C.), 22.86 % not evaluated (N.E.), and 5.71 % vulnerable (V.U.), 2.86 % endangered (EN). In contrast, 5.71 % do not have an IUCN status code (N.C.). Activities of patas monkey show that those sighted in plots 1, 14, 18, and 20 were running, while those sighted in plots 7 and 10 were feeding on fruits, seeds, leaves, and flowers. It was also observed that the animal moves in groups. The respondents opined that hunting and capturing are the primary threat to the animal. Registration of visitors, control burning, and regular patrol were the major habitat management strategies at the park. It is recommended that more water holes be provided to limit the animal's movement to less guided areas. The government should procure more patrol vehicles to improve the regular anti-poaching patrol.

**Keywords:** Patas Monkey; Habitat Management; Kainji Lake; National Park; Nigeria

## Introduction

A habitat is the type of natural environment in which a particular species of organism lives. A species' habitat is where a specific animal species can find food, shelter, protection, and mates for reproduction [1]. Wildlife habitats

are areas distributed horizontally and vertically across the landscape that fulfill the needs of a specific wildlife species for the basic requirements of food, water, reproduction (nesting), and protection (cover) against predators and competitors. Habitat provides the space requirements that allow wildlife to occupy, move around, and generally survive

and cope with climatic extremes [2]. The concept of wildlife habitat varies according to the needs of each animal species. For land managers, the concept may be simplified to include a description of those areas that are best suited for a species to nest, roost, forage, and reproduce successfully.

Management can be described as the wise application of resources to achieve a goal. Wildlife management necessitates habitat change in order to suit the animals' basic needs. This is changing the types, amount, or arrangement of food, water, and cover in a habitat in order to make it more suited for a particular species. Proper knowledge about wildlife and its environment is required for wildlife management and conservation projects [3]. Wildlife management entails the management of an entire ecosystem, not only the preservation of specific plant and animal species. When ecosystems are threatened, so are the animals that dwell there; wildlife is protected when habitats are protected.

Forest lands have been designated for biodiversity conservation by many nations of the world; these are otherwise referred to as forest reserves/protected areas. A protected area/forest reserve is a clearly defined geographical space, recognized, dedicated and managed through legal or other effective means, to achieve the long-time conservation of nature with associated ecosystem services and cultural values [4]. In national parks, forest reserves and other protected areas, unique natural resources (flora and fauna), sceneries and landscapes areas are protected, managed and regulated for human benefit from one generation to another. Protection helps maintain ecological processes that cannot survive in most intensely managed landscapes and seascapes [4].

The belief of most people that live around protected areas is that wildlife is a gift from nature and is owned by everybody hence there is no need restricting its use. Most people inherit only hunting equipment and skill from their parents; as a result, poaching is not viewed by such people as a crime against wild animals and breach of law of the land on protected areas [5]. Destruction of the animals' habitat and indiscriminate killing of young and pregnant animals leads to the disappearance of valuable wild animal species. Other factors that influence biodiversity or species loss are poaching, over-exploitation of forest, urbanization and other competing land-use activities [6].

African savannas support a uniquely diverse fauna whose conservation, unfortunately, is marred by increased habitat encroachment and illegal hunting [7]. Patas monkey (*Erythrocebus patas*) also known as wadi monkey or hussar monkey is a ground-dwelling monkey belonging to family Cercopithecidae of the grand order primates. Although, patas monkey is still widespread and numerous, yet vulnerable to

poaching and habitat loss because it is occasionally hunted for food, and is also persecuted as a crop pest in several range countries. It is threatened by habitat loss due to increasing desertification as a result of land-use practices (overgrazing by cattle, clearance of savanna for crops) [4].

Kainji Lake National Park (KLNP) management set aside some areas for the management of the patas monkey, however, the conservation of this animal is threatened because the inhabitant of the communities around the park are unemployed as most of their soil is unsuitable for agriculture leaving nothing other than hunting and harvesting of natural resources from forests around them. The specie could easily become more threatened due to increasing deforestation as a result of land-use practices which has caused severe population declines [4]. It is suspected that the situation will be worse now that a lot of advancements in hunting techniques and poaching strategy are unfolding daily. There is therefore, a need to put in place strategies and conservation measures to maintain the status of the habitat for the effective protection of these species.

## Materials and Methods

### The Study Area

Kainji Lake National Park was established in 1978 and it is managed by the National Parks Service and owned by Federal Government. Kainji Lake is Nigeria's first experiment at establishing and managing a national park. The park has a total area of 5340.82sq/km and it is separated into two distinct sectors namely: Borgu sector with an area of 3970.02 sq/km, and Zeugma sector with an area of 1370.80 sq. /km respectively [8]. This study was conducted in the Borgu sector of Kainji Lake National Park Figure 1. Which is situated in Borgu, Kalama Local Government Areas of Niger State [8]? Borgu lies between latitudes 9°45'N - 10°25'N, and longitudes 3°40'E - 4°30'E.

The park enjoys savanna climate with distinct wet and dry seasons. The mean temperature during the wet season is about 30°C and drops to about 28°C during the dry season as a result of the north east harmattan winds. The mean annual rainfall is about 1,100 mm, with the wet season lasting from May to November and the dry season from December to April [9]. The Borgu sector of the park is well drained by River Oli and Eri. River Oli, the main river takes its source from outside Nigeria and drains the western two-third of the park. While River Eri drains the remaining northern one-third of the sector. The topography consists of hills, extensive plains and river valleys. On the whole, the entire area is gently undulating with quartzite ridge in few places. Elevation in most parts of the park ranges between 250 m and 300 m above sea level. The highest point in the park is at the north-western corner

with an elevation of 350 m, while the lowest elevation is along the River Niger where the maximum water mark is about 140 m above sea level [9]. The Borgu sector is mostly savanna woodland dominated by *Burkea Africana*, *Terminalia avicennioides* *Terminalia macroptera*, *Isoblerlinia tomentosa*, *Isoblerlinia doka* and *Deuterium microcarpum*.

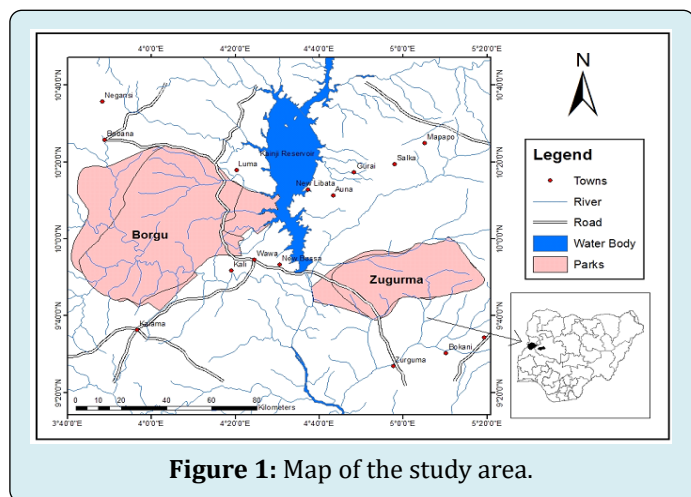


Figure 1: Map of the study area.

### Sampling Procedure, Data Collection and Analysis

Survey and field experiment were used for the study. Structured questionnaire was administered to the park staff at the Kainji Lake National Park to extract information on area designated for the management of patas monkey, and measures put in place towards effective management of the areas among other things. Visitation to the field for on-site assessment of the patas monkey habitats in the company of experienced rangers of the park and identification of the location of habitats for the patas monkey were carried out by traversing through the areas. A systematic line transect method was adopted for sampling the plot location. Five transects of 1km long were laid at 500m interval. Four plots of 50m 50m were alternately laid at 200m intervals on each transect. Identification of trees  $\geq 10$  cm diameter at breast height (DBH) were carried out with the help of an experienced taxonomist. Other animals utilizing the habitat were also identified. Activities of patas monkey sighted during the study were also observed. Data collected was analyzed using descriptive statistics and presented in tables.

## Results

### Demographic Information of the Respondents

Results on sex, age, education and rank of the respondents were presented under this section. Table 1 show that 70 % and 30 % of the respondents are male and female respectively. Age distribution revealed that 42.5 %

of the respondents are between 31-40 years. Respondents between 41-50 years and above 50 years accounted for 25 % and 15 % respectively. While 17.5 % of the respondents are 20-30 years. The result also shows that 92.5 % of the respondents are graduates of higher institution, while 7.5 % have secondary education. Staff officers by rank shows that 32.5 % are park warden, 22.5 % are range officers, 30 % are park inspectors, 7.5 % are senior park inspectors, while 5 % and 2.5 % are deputy park inspectors and assistant chief park inspector respectively.

Variables	Frequency	Percentage (%)
<b>Gender</b>		
Male	28	70
Female	12	30
<b>Age</b>		
20-30	7	17.5
31-40	17	42.5
41-50	10	25
Above 50	6	15
<b>Level of Education</b>		
Primary	0	0
Secondary	3	7.5
Tertiary	37	92.5
<b>Staff Rank</b>		
Assistant Chief Park Inspector	1	2.5
Deputy Park Inspector	2	5
Senior Park Inspector	3	7.5
Park Inspector	12	30
Park Warden	13	32.5
Range Officer	9	22.5
<b>Total</b>	<b>40</b>	<b>100</b>

Table 1: Demographic information of the respondents.

### Tree Species Composition and Distribution in the Study Area

Table 2 shows that 35 tree species, belonging to 19 families were identified in the study area with *Combretum nigericans*, *Terminalia glaucescens*, *Detarium microcarpum* and *viteliaria paradoxa* been the most frequent species having occurred in all the sampled plot. The least-occurring species were *Daniella oliveri*, *Diospyros mespiliformis*, *Adansonia digitata*, *Sterculias etigera*, *Tamarindus indica* and

*Ficus circumorus* each occurring in only one plot.

Table 3 shows that 22 species were of least concern (L.C.) based on IUCN status, representing 62.86 % of the total

tree species while 8 species (22.86 %) were not evaluated (N.E.). Two species (5.71 %) were vulnerable (V.U.), 1 specie (2.86 %) is endangered (EN) while 2 species (5.71 %) do not have an IUCN status code (N.C.).

S/N	Species name	Plot 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	<i>Acacia khayensis</i>	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Acacia gourmaesis</i>	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Gardenia aqualla</i>	+	-	-	-	+	-	+	+	-	-	+	-	+	+	+	-	+	-	-	+
	<i>Piliostigma thonningii</i>	-	+	-	-	-	+	-	+	-	-	+	+	+	+	+	+	+	-	-	-
	<i>Daniella oliveri</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Burkea Africana</i>	-	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+
	<i>Combretum nigericans</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Combretum mole</i>	-	+	-	+	-	-	-	-	+	-	+	-	+	+	+	-	-	-	-	-
	<i>Grewia mollis</i>	+	+	-	+	-	+	+	-	-	-	-	+	+	+	+	+	-	+	+	-
	<i>Terminalia glaucescens</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Pterocarpus erinaceous</i>	-	-	+	-	+	+	-	-	-	-	-	+	-	-	-	-	-	+	-	-
	<i>Azelia Africana</i>	+	+	-	+	-	-	+	-	-	-	-	-	+	-	-	+	+	+	+	+
	<i>Detarium microcarpum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Crossopteryx febrifuga</i>	+	-	+	+	+	+	-	+	+	+	+	-	-	+	+	+	-	+	+	-
	<i>Maytenus senegalensis</i>	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	-
	<i>Entanda Africana</i>	-	-	-	-	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Buttrespamus cuntianus</i>	+	-	+	+	+	+	+	+	-	-	-	+	-	+	+	-	+	-	+	-
	<i>Vitellaria paradoxa</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Anona senegalensis</i>	+	+	+	-	+	+	+	+	-	-	+	-	+	-	+	-	+	+	-	-
	<i>Strychnos spinose</i>	-	-	+	+	-	+	+	+	-	+	-	+	+	+	+	+	-	-	+	+
	<i>Lannea acida</i>	-	-	+	-	-	-	-	-	-	+	+	-	+	+	+	-	-	-	-	-
	<i>Bradelia ferrugena</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-
	<i>Anogeissus leiocarpus</i>	-	-	-	-	+	+	-	-	-	-	-	-	-	+	-	-	+	+	-	-
	<i>Hymenocardia acida</i>	-	-	-	-	+	-	+	-	+	-	-	-	-	-	+	+	-	-	-	-

<i>Aqualla spp</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Diospyros mespiliformis</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-	-	-
<i>Adansonia digitate</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
<i>Sterculia setigera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
<i>Tamarindus indica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
<i>Ficus circumorus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Securidaca longipedunculata</i>	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-	-	-	-	-
<i>Nauclea latifolia</i>	-	-	-	-	-	-	-	+	-	+	+	+	-	-	-	-	-	-	-	-	-
<i>Vitex doniana</i>	-	-	-	-	-	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-
<i>Bombax cons Tatum,</i>	-	-	-	-	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
<i>Prosopis Africana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-	-

KEY: + Present, - absent.

Table 2: Plant species distribution within the plots.

Species	Family	IUCN Status				
		NE	LC	EN	VU	NC
<i>Acacia khayensis</i>	Fabaceae	+				
<i>Acacia gourmaensis</i>	Fabaceae		+			
<i>Gardenia aqualla</i>	Rubiaceae	+				
<i>Piliostigma thonningii</i>	Fabaceae	+				
<i>Daniella oliveri</i>	Fabaceae		+			
<i>Burkea Africana</i>	Fabaceae		+			
<i>Combretum Nigerians</i>	Combretaceae		+			
<i>Combretum mole</i>	Combretaceae		+			
<i>Grewia mollis</i>	Malvaceae		+			
<i>Terminalia glaucescens</i>	Combretaceae		+			
<i>Pterocarpus erinaceous</i>	Fabaceae			+		
<i>Afzelia Africana</i>	Fabaceae				+	
<i>Detarium microcarpum</i>	Fabaceae		+			
<i>Crossopteryx febrifuga</i>	Rubiaceae		+			
<i>Maytenus senegalensis</i>	Celastraceae	+				
<i>Entada Africana</i>	Fabaceae		+			
<i>Buttrespamus cuntianus</i>	Fabaceae					+
<i>Vitellaria paradoxa</i>	Sapotaceae				+	
<i>Annona senegalensis</i>	Annonaceae		+			
<i>Strychnos spinose</i>	Loganiaceous	+				
<i>Lannea acida</i>	Anarcadiaceae		+			

<i>Bridelia ferruginous</i>	Phyllanthaceae		+			
<i>Anogeissus leiocarpus</i>	Combretaceae		+			
<i>Hymenocardia acida</i>	Phyllanthaceae		+			
<i>Diospyros mespiliformis</i>	Ebenaceae	+				
<i>Adansonia digitate</i>	Malvaceae		+			
<i>Sterculia setigera</i>	Sterculiaceae		+			
<i>Tamarindus indica</i>	Fabaceae		+			
<i>Ficus sycomorus</i>	Moraceae		+			
<i>Vitex doniana</i>	Verbenaceae	+				
<i>Bombax costatum</i>	Malvaceae		+			
<i>Securidaca longipendiculata</i>	Polygalaceae					+
<i>Nauclea latifolia</i>	Rubiaceae	+				
<i>Prosopis Africana</i>	Fabaceae		+			
<i>Lannea schimperi</i>	Anacardiaceae	+				
Total = 35	19	8 (22.9%)	22 (62.9%)	1 (2.8%)	2 (5.7%)	2 (5.7%)

**Note:** LC = Least Concern, NE = Not Evaluated, VU = Vulnerable, EN = Endangered, NC = No Code. **Table 3:** Tree species composition and IUCN status in KLNP.

### Activities of Patas monkey and other animals in the study area

Result in Table 4 shows that patas monkey sighted in plots 1, 14, 18 and 20 were running while those sighted in plot 7 and 10 were feeding. Table 5 shows other animals utilizing the habitat with patas monkey. These animals include: Baboon, Kobs, Duiker, Bushbuck, and Warthog, and Squirrels, Roan antelope, Hippopotamus, Green monkey and reptiles.

Track	Plot	Activities observed
Bukar Shuaib	1	Running
Bukar Shuaib	3	Scavenging
Bukar Shuaib	7	Feeding
Bukar Shuaib	10	Feeding
Bukar Shuaib	14	Running
Bukar Shuaib	18	Running
Bukar Shuaib	20	Running

**Table 4:** Activities of patas monkey sighted in each plot.

Common name	Scientific name	Family
Baboon	<i>Papio Anubis</i>	Cercopithecidae
Kobs	<i>Kobus kob</i>	Bovidae
Duiker	<i>Sylvicapra grimmia</i>	Bovidae
Bushbuck	<i>Tragelaphus sylvaticus</i>	Bovidae
Warthog	<i>Phacochoerus africanus</i>	Suidae
Squirrels	<i>Sciurus carolinensis</i>	Sciuridae
Roan antelope	<i>Hippo tragus equinus</i>	Bovidae
Hippopotamus	<i>Hippopotamus amphibious</i>	Hippopotamidae
Green monkey	<i>Chlorocebus sabaes</i>	Cercopithecidae
Reptiles		

**Table 5:** Other animals utilizing the habitat.

### Tree species preferred and the part utilized

Table 6 shows the preferred tree species and plant parts utilized by Patas monkey. The result shows that Patas monkey mostly feed on fruits, seeds, leaves and succulent plant parts. They also feed on flowers, gums and latex and insect.

Tree species	Parts utilized
<i>Acacia spp</i>	Fruit, seed, leaf, gum, latex, flower
<i>Gardenia aqualla</i>	Fruit, seed, leaf, flower
<i>Piliostigma thonningii</i>	Fruit, seed
<i>Detarium macro carpum</i>	Fruit, seed, succulent plant
<i>Entanda Africana</i>	Fruit, leaf
<i>Lanea acida</i>	Fruit, seed, succulent plant
<i>Vitellaria paradoxa</i>	Seed, fruit
<i>Tamarindus indica</i>	Fruit
<i>Diasporus spp</i>	Fruit
Wild mango	Fruit, flower
Kola	Fruit
<i>Terminalia macroptera</i>	Seed
<i>Parkia biglobosa</i>	Fruit flower
<i>Stacnose spp</i>	Succulent plant, fruit

**Table 6:** Tree species preferred and parts utilized.

### Patas Monkey Lifestyle and Habitat Management Strategies

Table 7 present the lifestyle of the patas monkey based on observation and information from the staff of the park. The result shows that the animal move in groups, during the day. Mating is secret; reproduce once a year with average lifespan of Male (19-24 years) and Female (15-20 years). The result shows that the animal is susceptibility to disease all year round with gestation period of 23.8 weeks or 5 months. The biggest threat to the animal is hunting and capture by wild animals and human. Result on feeding habit shows that Patas monkey is omnivorous. Respondents management strategies Table 8 shows that registration of visitors, regular patrol by range officers and arrest of poachers were the major management strategies for the protection of the park with 16.53 % each. Other measures are control burning, prohibition of logging, farming and grazing with 14.88 %, 14.46 %, 11.57 % and 9.50 % respectively.

Activities	Lifestyle
Movement	Gregarious/group
Feeding habit	Omnivorous
Active time	Diurnal
Mating	Secret
Reproduction	Once in a year
Average Lifespan	Male = 19-24 years, Female= 15-20 years
Lifespan	24 years in managed care, 17 years in the wild
Inter-birth interval	12-14 months
Susceptibility to disease	All year round
Gestation	23.8 weeks or 5 months
Peculiarity	-Fastest species of primate in the world. -Red back and white moustache and beard
Population status	Decreasing
Habitat	Savanna and open woodland
Biggest threat	Hunting & capture
Predators	Wild animals, human

**Table 7:** Other activities and lifestyle of the patas monkey.

Management strategies	Frequency	Percentage (%)
Registration of visitor	40	16.53
Prohibition of logging	36	14.88
Control Burning	40	16.53
Regular patrol	40	16.53
Arrest of poachers	35	14.46
Prohibition of farming	28	11.57
Prohibition of Grazing	23	9.50
Total	242*	100

**Table 8:** Respondents management strategies in the study area.

\*Multiple responses

## Discussion

The study revealed that large area of land was designated for the effective management of the patas monkey in the study area. All the plots assessed were on the Bukar Shuaib track Table 10 in the Borgu sector of the park. This track occupies a wide range of habitats from riverine and montane forests to savannas, open woodland and forest edges as well as mangrove swamps. This is an indication that patas monkey is hardy and can survive under different vegetation and weather condition. Similar observations were reported by Zinner D, et al. [10]; Getachew, et al. [11] on grivet monkey in eastern and central Eritrea and Zegie Peninsula, Ethiopia respectively where wide range of habitat are been utilize by the species. Feeding on wide range of plants and omnivorous nature of patas monkey (i.e. having both plants and animal diet) could be a factor that favours the adaptability of the animal to different types of habitat. The fact that patas monkey sighted in the park runs on sensing human presence is an indication that the animal did not like disturbance and probably not friendly and playful like some other species of monkey. This observation further confirms the report of Morjan MD, et al. [12] that patas move away from human disturbances.

The high number (35) of tree species belonging to 19 families obtained in this study indicates that the park site has a great potential for flora and wildlife conservation, since one of the criteria for considering an ecosystem as a good game reserve and ecotourism destination is its biodiversity richness in term of plant and animal both in diversity and population. The floristic diversity obtained in this study is similar to results obtained in other protected forests as reported by Oladoye AO, et al. [13]; Olujobi OJ, et al. [14] who in separate studies recorded 57 tree species from 28 families in International Institute of Tropical Agriculture Forest Reserve and 66 tree species from 20 families in Arinta Waterfall Watersheds respectively.

The observed high level of protection for the animals within the park could be attributed to regular patrol by park wardens and rangers. This singular measure help prevents illegal human activities such as logging, farming and grazing at the park which usually results into habitat fragmentation. This assertion corroborates the submission of Goodall J, et al. [15] who report that increased in human and cattle population in most game reserve continuously putting more pressure on forest resources and has ultimately caused fragmentation and degradation of wildlife habitats More so, arrest of illegal hunters also prevents poachers from coming into the park thereby guarantee the protection of the animals in the park. This submission is in agreement with Fa JE, et al. [16]; Kümpel N, et al. [17] who both posited that hunting is a greater threat to wildlife than habitat loss particularly

for large mammals, including primates. The location of the designated area (i.e patas habitat) along the route normally traversed during anti-poaching patrol by the park rangers and its closeness to the Roan gate base camp of the park is an added advantage by providing additional protection for the patas monkey.

## Conclusion

This study evaluates habitat management strategies for patas monkey in kaninji lake national park. The study revealed that the animal inhabits large area of land with different vegetation structure ranging from montane forests, savannas, open woodland, forest edges and mangrove swamps in the borgu sector of the park. The study also revealed that the park is rich in biodiversity with 35 different plant species of which 2 species vulnerable and 1 endangered. The major management strategies put in place are control burning, regular patrol of the park and registration of visitors to regulate influx of criminals into the park. For effective management the habitat and consequent increase in the animal population, government should employ more personnel and procure more patrol vehicles to improve the regular anti-poaching patrol.

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