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BABOON (*PAPIO ANUBIS*) AS AGENT OF HABITAT REGENERATION WITHIN THE MARGUBA RANGE OF OLD OYO NATIONAL PARK, NIGERIA

Oyeniya, Oreoluwa John

Department of Forestry and Wildlife Management
Federal University of Agriculture, Abeokuta, Nigeria

Jayeola Omotola Abiola

Department of Forestry and Wildlife Management
Federal University of Agriculture, Abeokuta, Nigeria

Yisau Muideen Alade

Department of Forestry and Wildlife Management
Federal University of Agriculture, Abeokuta, Nigeria

Ogunjinmi Anthony Adekunle

Department of Ecotourism and Wildlife Management
Federal University of Technology, Akure, Nigeria

Abstract-- Tropical forests and the animals they support are being threatened by rapid rates of forest conversion and degradation. The impact of *Papio anubis* on habitat regeneration within the marguba range of Old Oyo National Park was assessed, in-order to determine their role in seed dispersal. Five existing transects within the Marguba range of the Park were identified and marked at every 1 km for data collection. Population structure of Baboon troops sighted along the transects were recorded, fecal droppings and soil samples were collected along the transects. Vegetation assessment were carried out at 15 m radius around each fecal sample. Each fecal sample collected was examined for visible presence of seeds, and number of each seed extracted was recorded and sowed into its corresponding extraction site soil for germination trial. Replica of each seed extracted was procured from Forestry Research Institute of Nigeria and treated appropriately before sowing, as control. A total of twenty *Papio anubis* from four troops were sighted, in four of the five transects. A total of eight seed species; *Blighia sapida* (8), *Vitex donianan* (5), *Vitellaria paradoxa* (13), *Citrus pomelo* (10), *Piliostigma thonningii* (16), *Parkia biglobosa* (10), *Sarcocephalus latifolius* (14) and *Detarium macrocarpum* (4) were found in the 18 fecal samples collected. *Piliostigma thonningii* and *Vitellaria paradoxa* trees were found to have the

highest abundance, while *Sterospermum kunthianum*, *Ficus thonningii*, *Pterocarpus erinacus*, *Securidaca longipedunculata* and *Grewia mollis* were the least abundant during the vegetation assessment around fecal sites in the park. Seeds extracted from all the fecal samples showed reduction in weight compared to the control seeds. *Blighia sapida*, *Vitex donianan*, *Citrus pomelo*, *Piliostigma thonningii*, *Sarcocephalus latifolius*, *Parkia biglobosa* and *Detarium macrocarpum* were found to have a percentage germination rates of 39, 50, 50, 44, 36, 50 and 50 respectively, while *Vitellaria paradoxa* did not germinate. Days before emergence was shorter in seeds of *Vitex doniana* (14-19 days) and *Detarium macrocarpum* (7-8 days) compared to their control seed (25-26 days and 9 days respectively), while days before emergence in seeds of *Piliostigma thonningii* (14-20 days), *Parkia biglobosa* (14-18 days), *Sarcocephalus latifolius* (21-24 days) and *Citrus pomelo* (8-14 days) were longer compared to their control seed (10-11, 8-10, 14 and 7 days respectively). The days before emergence for *Blighia sapida* was the same with that of its control (16 days). This study concluded that *P. anubis* were agent of seed dispersal. Also, seeds that moved through the gut of Baboons has shown to remain viable, but its movement along the gut does not appear to effectively affect its dormancy.



Keywords-- Ecosystem, Seed dispersal, Deforestation, Habitat loss, Fragmentation, Frugivores

I. INTRODUCTION

The natural home of a plant, animal or other organism is understood as its habitat and maintaining this space is crucial to the survival of both individuals and species (World Wide Fund for nature, (WWF, 2017). But unfortunately, the habitats of large numbers of the Earth's plant and animal species are under threat due to the impact of man (WWF, 2017). Natural habitat for animal and plant species is being destroyed at an alarming rate. Nigeria is a home to an upscale diversity of forest and wildlife, including a minimum of 899 species of birds, 274 mammals, 154 reptiles, 53 amphibians, and 4,715 species of higher plants (Connell, 1978). Nevertheless, Nigeria's forest is one of the most threatened on the planet due to high population growth rates, conversion for subsistence and industrial agricultural, and logging (Butler, 2014). The country's rainforest is fast declining, according to the United Nations (2012), Nigeria lost nearly 80 percent of its old-growth forests between 1990 and 2005, giving the dubious distinction of having the highest deforestation rate of natural forest on the earth during that period. Also, according to FAO (2005), Nigeria had the highest of deforestation in the world as of 2005. Between 2000 and 2005, the country lost 55.7% of its primary forest. Between 1990 and 2000 Nigeria lost a mean of 409,700 hectares of forest per annum which equals to a mean annual deforestation rate of 2.38%. Between 1990 and 2005, in total, Nigeria lost 35.7% of its forest cover, or around 6,145,000 hectares. Therefore, there is need to search for sustainable solutions to these high rates and look extensively into a way of habitat regeneration, and a way to keep the forest resources alive with human's poor conservation practice. Hence, other means of dispersing seeds in natural habitat and forests, through wild animals like primates, which could be omnivorous (having the tendency to protect themselves and serve in habitat regeneration i.e. dispersing of seeds) in diet.

Baille *et al.*, (2004) emphasizes that habitat loss and fragmentation are major threats to terrestrial biodiversity. The planet's human population has

doubled in the past 50 years and the pressure to house and feed more than eight billion people has increased dramatically, thereby causing an incursion into previously pristine natural habitats. Animals left residing in degraded forests or forest fragments may face reduced food resources and loss of cover or hiding places, and in some cases pressure from invasive species. Populations may also be more vulnerable in the event of natural disasters such as hurricanes, and changes in habitat brought about by global climate change, such as seasonal droughts (Malhi *et al.*, 2008). Deforestation, which is the main reason for habitat degradation, is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing or urban development (van Kooten and Bulte, 2000). Deforestation is primarily an issue for the developing countries of the tropics (Myers, 1994) because it is shrinking areas of the tropical forests (Barraclough and Ghimire, 2000) causing loss of biodiversity and enhancing the atmospheric phenomenon (Angelsen *et al.*, 1999). One method used to counteract the loss of forest is land restoration and subsequent habitat regeneration. Protection of the remaining intact patches would be insufficient to save the ecosystem; therefore, knowledge of natural succession in tropical forest is crucial to reclaim disturbed land (Sabogal, 1992). Seed dispersal is important for the long-term survival of forests (Nuñez-Iturri *et al.*, 2008), and as such need's consideration and incorporation into conservation plans. Vertebrate frugivores, in particular primates, play an important role in the regeneration of tropical forest habitats through their roles as seed dispersers (Oliveira and Ferrari 2000) and understanding this role in conservation and restoration projects is highly valuable. Moreover, maximizing natural seed dispersal services has the potential to be a cost-effective approach to conservation efforts (Wunderle, 1997; Duncan and Chapman, 1999). Kunz and Linsenmair (2008), suggested that the role of baboons as seed dispersers may increase as populations of elephants and hornbills decline in the savanna-forest mosaic of West Africa. **Objective:** To determine the role of baboon in habitat regeneration within the Marguba range of Old Oyo National Park, Nigeria and also compare the regeneration capacity of seeds extracted from baboon faeces and seed from seed store.

II. METHODS

Study Area

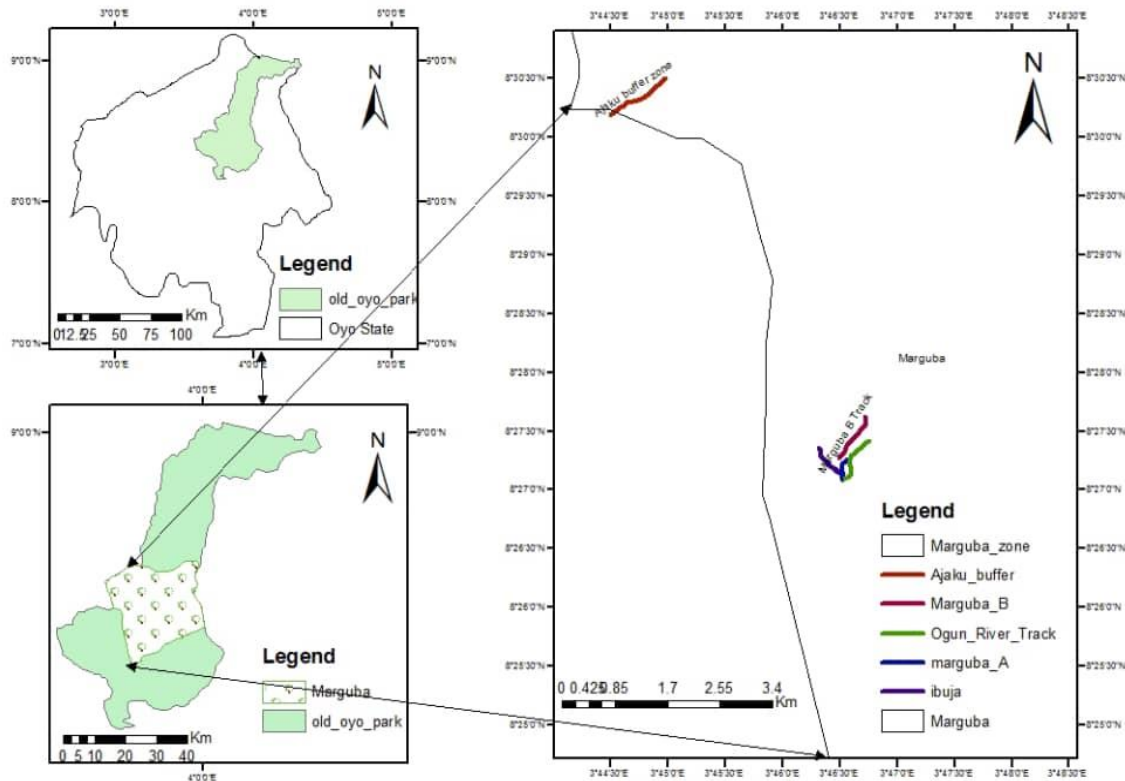


Figure 1: Map showing the Location of Transect used within the park for Data Collection

The study was conducted in the Marguba range of Old Oyo National Park, Oyo State, Nigeria. The range was purposively selected because it was reported that the range has the highest abundance of Baboon in the park (Adetoro *et al.*, 2011). This range is also described as heartbeat of the park. The park has a saxophone-like shape. It is bordered in the North by Kwara State, in the South by Ikoyi while in the western part it is bordered by towns such as Igbope and Sepeteri. The Old Oyo National Park lies between latitudes 8° 15' and 9° 05' N and longitudes 3° 35' and 4° 20' E. The location has inevitably placed the park at a vantage position of abundance acreage also as diverse wildlife and cultural/historical settings. The park covers a land area of approximately 251,200ha making it the fourth largest park in Nigeria after Gashaka Gumti National Park (673,100ha), Kainji National Park (538,000ha), Cross River National Park (400,000ha). The park is made up of five ranges namely: Marguba range in Sepeteri, Oyo Ile range in Igbeti, Yemoso range in Ikoyi-Ile, Tede Park in Tede, Sepeteri range in Igboho. It provides a thriving habitat for a range of wild fauna

among which are primates that inhabit the guinea savannah.

The park covers 2,512 km², mostly of lowland plains at a height of 330 m and 508 m above sea level. The southern part is drained by the Owu, Owe and Ogun Rivers, while the northern sector is drained by the Tessi River. Outcrops of granite are typical of the north eastern zone of the park, including at Oyo-Ile, with caves and rock shelters within the extreme north. The central axis of the park has scattered hills, ridges and rock outcrops that are suitable for mountaineering. The Ikere Gorge Dam on the Ogun river provides water recreation facilities for tourists (Nigeria National Park Service, (NNPS, 2014). The purpose was mainly for conservation, preservation and protection of our natural resources. The Park is rich in Fauna resources with significant species of which are the Buffon's kob (*Kobus kob*), Roan Antelope (*Hippotragus equines*), Western hartebeest (*Alcelaphus buselaphus*), Bush buck (*Tragelaphus scriptus*), Baboon (*Papio anubis*), Patas monkey (*Erythrocebus patas*), Grimm's duiker (*Slyvicappa*



grimmia), Lion (*Pantera leo*), War thog (*Phacochoerus aethiopicus*), Water buck (*Kobus defasa*), Red flanked Duiker (*Cephalophus rufilatus*), Black and White Colobus monkey (*Colobus vellerous*), Green monkey (*Cercopithecus athieops*) and many more, with variety of birds (Nigeria Galleria, 2017). Vegetation of the Old Oyo National Park has been classified as Southern Guinea Savanna (Keay, 1959). However more intense studies classify the Southern portion of the vegetation as Forest savanna Mosaic with wooded savanna containing relic of Moist Semi deciduous forest, grading northwards into drier Mixed Leguminous Wooded Savanna with a continuous lower stratum of perennial grasses (Charter, 1970).

Sample Collection

From July 2018 to August 2018, we surveyed Five existing track (either Jeep or foot) within the Marguba range of the Old Oyo National Park. The five tracks were traversed daily from 7.00 am to 12.00 pm and from 4.00 pm to 7.00 pm (local time) with an average walking speed of 1.0 km/hr covering an estimated 1km distance per track. Periods of walking were interspersed with periods of ‘silent’, ‘watch’ and ‘wait’ in order to increase the possibility of detecting animals that might hide or flee upon the approach or movement of observers. The coordinates of the tracks were taken using a Global Positioning System (GPS) at the beginning and end of the track. The individual animals directly encountered were counted. A Binocular (10x42mm) was used to observe and detect the presence of animals. Animals sighted were identified as outlined and described by Jean and Pierre (1990). Information was collected on groups of animals sighted which included species, sex, sighting distance (m) and population structure such as, number of adult males, females, sub-adult males, sub-adult females, and juveniles. Five basic assumptions were made as recommended by Burnham (1980), Seber (1982) and Dunn (1993). Each Baboon troop encountered were observed and stalked for thirty minutes; before another one present can be stalked. The aim was to enhance chances of collecting fresh fecal samples from different troop members. Each time the focal animal defecated, the fecal clumps were collected. The dung dropped by Baboon detected along the track was also collected and added-on to the fecal samples collected during observations. Each independent fecal sample was put in a separate plastic bag, differently labelled and kept in an ice pack to prevent the fecal clump from disintegration before seed extraction. A 15 meters’ radius circular plot assessment was carried out on every site of fecal collection with the aim of identifying the Plant species

in the habitat. Moderately deep (50 centimeter) soil sample was collected from each sampled site and latter sterilized in an oven at 100°C for 24hours to kill the seed within the bank, and transferred into separate polythene nursery bag (20cm deep), and allowed to rest for 7 days. At the end of each sampling day, every fecal samples collected were searched for visible seed constituents, seeds present in each collected sample were washed, and weighed using a weighing balance. The density of Baboon scats was determined by measuring the total weight of the fecal sample to the weight of the seeds extracted from each, the number of seeds in each Baboon scat was counted and identified to species level. Extracted seeds were visually examined for damage and coded as either whole (undamaged to the human eye or had shallow scratches) or destroyed (occur in species identifiable pieces). The seeds were then dried under room temperature, and stored for germination trials. Each extracted seed was sown into its respective sampled site soil sterilized and kept moderately moist by watering twice a day. It was tagged First group.

Replicate of each identified seed species extracted from Baboons dung was obtained at the Forest Research Institute of Nigeria (FRIN) seed store. River side sand was also obtained and sterilized in an oven at 100°C for 24 hours, and also transferred into different polythene nursery bag (20cm deep). Each seed specie obtained from FRIN was treated (to enhance optimum regeneration as a unit for measurement) and then broadcasted in separate sterilized River side soil in the polythene nursery bag. This serves as the control experiment and was tagged Second group.

The first and second group were checked twice a day (morning and evening) to record any seed that germinated. The growth rate (height) of successful seedling was recorded at intervals in each of the nursery bag and groups. The total number of successful seedlings in all the nursery bags were determined after 2 months. The approximated percentage of germinated seeds in relation to the number of extracted seeds was determined. The percentage Germination of seeds was calculated thus:

% Germination of Seeds =

$$\frac{\text{Total Number of Germinated Seeds}}{\text{Total Number of Extracted Seeds}} \times 100\%$$

Seed species collected from the Federal Research Institute of Nigeria (FRIN), passed through different treatment based on research studies before planting, as shown in table 1.



Table 1: Treatment Administered to Replicate Seed Species Collected from Forest Research Institute of Nigeria (FRIN), Before Sowing

Seed	Treatment	
	No Treatment	Scarification
<i>Blighia sapida</i>	+ (Koenig, 2012)	
<i>Vitex donianan</i>		+ (Fern, 2014)
<i>Vitellaria paradoxa</i>	+ (Nikiema and Umali, 2007)	
<i>Citrus pomelo</i>	+ (Herzog <i>et al.</i> , 1994)	
<i>Piliostigma thonningii</i>		+ (Amonum <i>et al.</i> , 2016)
<i>Parkia biglobosa</i>		+ (Burkill, 1997)
<i>Sarcocephalus latifolius</i>	+ (Kouyate and Van Damme, 2006)	
<i>Detarium macrocarpum</i>		+ (Lamessa, 2010)

Statistical Analysis

Duncan Multiple Range Test was used to determine the difference in mean of weights obtained from measurement of seeds from Forest Research Institute of Nigeria (FRIN).

III. RESULT

Population Structure of Baboon

Four baboon troops were sighted, the First, Second, Third and Fourth troop composed of Five, Three, Seven and Five members respectively (Table 2).

Habitat Utilization of Baboon based on Faecal point Extraction

A total of Eighteen (18) faecal samples were collected at different locations within the Five tracks used (Table 3). The samples were labelled (F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18) based on their sequence in collection (that is, the first faecal sample collected was labelled F1 and subsequent collection following the same trend in labelling respectively).

Vegetation Assessment around Faecal Collection Sites

Faecal extract F1 composed of 5 different species of trees of 5 different families within a 15-metre radius around the defecated site. F2 was found to have 5 Species with two of the species sharing the same member thereby making 4 families (Table 4). Appendix 1 shows the specie names vegetation assessed within each plot of faecal extract and their family names are shown in Appendix 2.

Composition of Seeds voided by Baboon

A total of eight (8) species were identified in all the faecal sample collected (Table 5), with a total seed count of 86 seeds. Seven of the eight tree species has presence within the park (Table 13). However, *Citrus pomelo* whose seed was also identified from faecal samples (Table 5) was not encountered during the vegetation assessment within the habitat used for feeding by Baboons within the park (Table 13).



Table 2: Population Structure of Baboon troops within the Park

Track	No of Adults	No of Juvenile	Total	% Abundance	Sex		Activity	Dropping collected from troop	Location From Track (Metres)
					Male	Female			
Ibuya- Ipade Aya Track	3	2	5	25%	Un	Un	Running	None	420m from base
Track Along River Ogun	2	1	3	15%	2	1	Playing	F11	Track Starting point
Marguba B Track	0	0	0	0	-	-	-	-	-
Marguba A Track	4	3	7	35%	Un	Un	Running	None	300m from Starting point
Ajaku Buffer Zone	3	2	5	25%	2	3	Playing	F6, F7	Track Starting point
Total	12	8	20						

*Un – Unidentified, F – Faecal sample



Table 3: Feecal Extract Per Transect

<i>TRANSECT</i>	<i>FEACAL SAMPLES</i>
<i>Ibuya – Ipade Aya Transect</i>	<i>F3, F4, F9, F10.</i>
<i>Transect Along River Ogun</i>	<i>F11, F14, F17.</i>
<i>Marguba B Track</i>	<i>F5, F15, F18.</i>
<i>Marguba A Track</i>	<i>F1, F2, F13, F16.</i>
<i>Ajaku Buffer Zone</i>	<i>F6, F7, F8, F12.</i>

Table 4: Vegetation Assessment of Habitat used for feeding by Baboon around point of feecal collection

<i>Sample</i>	<i>Tree</i>	<i>Numbers of Family</i>
<i>Plot</i>	<i>Species</i>	<i>Composition</i>
<i>F1</i>	<i>5</i>	<i>5</i>
<i>F2</i>	<i>5</i>	<i>4</i>
<i>F3</i>	<i>5</i>	<i>5</i>
<i>F4</i>	<i>6</i>	<i>5</i>
<i>F5</i>	<i>6</i>	<i>4</i>
<i>F6</i>	<i>5</i>	<i>3</i>
<i>F7</i>	<i>6</i>	<i>5</i>
<i>F8</i>	<i>6</i>	<i>5</i>
<i>F9</i>	<i>5</i>	<i>5</i>
<i>F10</i>	<i>4</i>	<i>4</i>
<i>F11</i>	<i>5</i>	<i>2</i>
<i>F12</i>	<i>6</i>	<i>4</i>
<i>F13</i>	<i>5</i>	<i>4</i>
<i>F14</i>	<i>5</i>	<i>2</i>
<i>F15</i>	<i>5</i>	<i>3</i>
<i>F16</i>	<i>5</i>	<i>4</i>
<i>F17</i>	<i>5</i>	<i>2</i>
<i>F18</i>	<i>6</i>	<i>3</i>



Table 5: Seed species composition voided by Baboon

Tree specie	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	Total
<i>Blighia sapida</i>		2	2	2						2	2			2			1		13
<i>Vitex doniana</i>		2					2	2											6
<i>Vitellaria paradoxa</i>		1	2			2				4	2		2						13
<i>Citrus pomelo</i>									4			6							10
<i>Piliostigma thonningii</i>	3		3						2					2	3		3		16
<i>Parkia biglobosa</i>	2				2		2	2								2			10
<i>Sarcocephalus latifolius</i>						4				1			3			4		2	14
<i>Daterium macrocarpum</i>				1		1	1	1											4
Total	5	5	7	3	2	7	5	5	6	7	4	6	5	4	3	6	4	2	86

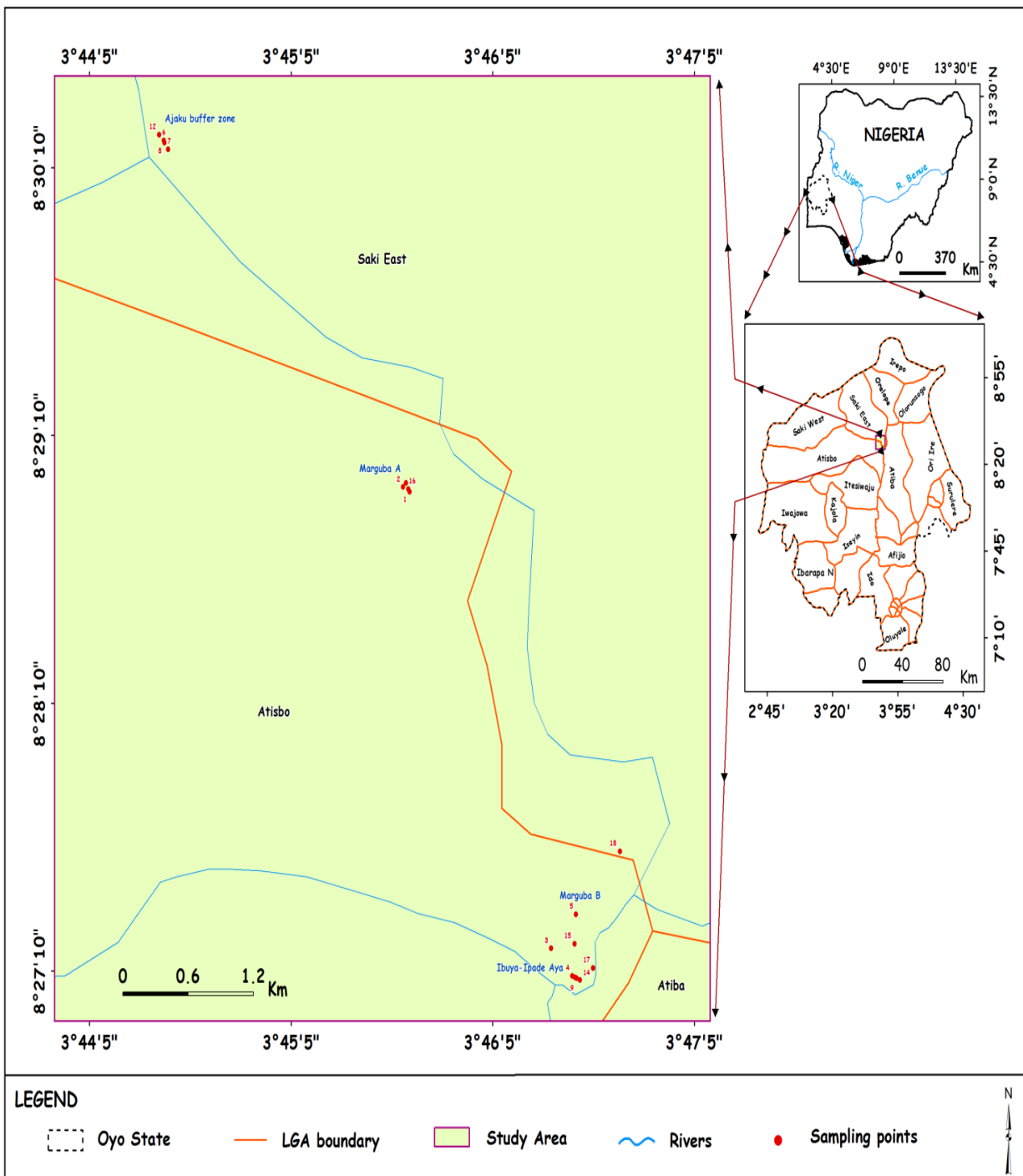


Figure 2: Map showing the point of fecal extraction (habitat utilization) in the park.



Weight of Baboon Feecal Seeds and Seed from Forest Research Institute of Nigeria (FRIN)

Weight of Baboon Feaces and Seed Constituent

Appendix 3 shows the individual weight of each seed specie extracted from the various fecal sample collected. Due to the tiny nature of *Sarcocephalus latifolius* seed, its seeds were not measured individually but the total seed extracted in each fecal dropping collected was measured together and has a range of 0.02g – 0.03g which shows to have the lowest weight. Other seeds were measured individually (Table 6).

Weight of Sample Seeds Collected from Forest Research Institute of Nigeria (FRIN)

Shown in Table 7 is the weight (g) of seed species collected from the Forest Research Institute of Nigeria (FRIN) as a unit of control to check for variation and for similarities with Baboon fecal seed extract. The weight of seeds extracted from the fecal sample of all species shows a reduction compared the fresh seeds obtained from FRIN *Parkia biglobosa* has the highest seed weight, while *Sacrocephalus latifolius* has the lowest weight (Table 7).

Regeneration Capacity of Baboon fecal seeds

Table 8 shows the number of seeds that had visible sign of growth within the two months of planting in relation to the number of seed species extracted in each fecal sample collected. It also shows the approximated percentage of germinated seeds in relation to the number of extracted seeds.

Faecal sample (F1) had the highest percentage of seed germination (80%), while F18 showed to have 0% viability (i.e. no visible growth). All fecal samples extracted within the Marguba B (F5, F15, F18) track, also had 0% seed germination (i.e. No visible growth from all seeds extracted). Likewise, *Vitellaria paradoxa* showed no visible sign of growth in all the seeds extracted.

Table 6: Weight of Baboon Feaces and Seeds

Sample	Feecal Weight Before Seed Extraction	Total Weight of Seeds
F1	256.9	6.9
F2	206	5.4
F3	226.2	5.8
F4	226	5.3
F5	175	4.8
F6	235.43	4.63
F7	208.6	8.1
F8	196.7	7.8
F9	207.4	2.6
F10	283.3	12.5
F11	177.7	8.5
F12	180.3	2.6
F13	265.23	4.73
F14	240.1	4.8
F15	201.2	1.4
F16	252.73	5.13
F17	166.3	3.5
F18	160.42	0.02

Table 7: Weight (g) of Seed Collected from Forest Research Institute of Nigeria (FRIN), Before Planting

Seed Species	Weight of seed species
<i>Blighia sapida</i>	2.490 ± 0.014 ^f
<i>Vitex doniana</i>	0.980 ± 0.028 ^d
<i>Vitellaria paradoxa</i>	2.985 ± 0.021 ^h
<i>Citrus pomelo</i>	0.615 ± 0.021 ^b
<i>Piliostigma thonningii</i>	0.810 ± 0.014 ^c
<i>Parkia biglobosa</i>	2.815 ± 0.021 ^g
<i>Sarcocephalus latifolius</i>	0.015 ± 0.007 ^a
<i>Detarium macrocarpum</i>	1.685 ± 0.021 ^e

The mean value in the same column with different superscripts are significant different (p<0.05)



Table 8: Seed Germination and Percentage Germination

<i>S</i>	<i>B s</i>		<i>V d</i>		<i>V p</i>		<i>C p</i>		<i>P t</i>		<i>P b</i>		<i>S l</i>		<i>D m</i>		<i>Total</i>		<i>% Germination</i>
	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	<i>E</i>	<i>G</i>	
<i>F1</i>									3	2	2	2					5	4	80%
<i>F2</i>	2	1	2	1	1	0											5	2	40%
<i>F3</i>	2	1			2	0			3	2							7	3	43%
<i>F4</i>	2	1												1	1		3	2	67%
<i>F5</i>											2	0					2	0	0%
<i>F6</i>					2	0							4	2	1	1	7	3	43%
<i>F7</i>			2	1							2	1			1	0	5	2	40%
<i>F8</i>			2	1							2	1			1	0	5	2	40%
<i>F9</i>							4	2	2	1							6	3	50%



<i>F10</i>	2	0		4	0				1	0				7	0	0%			
<i>F11</i>	2	1		2	0									4	1	25%			
<i>F12</i>						6	3							6	3	50%			
<i>F13</i>				2	0				3	1				5	1	20%			
<i>F14</i>	2	0						2	1					4	1	25%			
<i>F15</i>								3	0					3	0	0%			
<i>F16</i>									2	1	4	2		6	3	50%			
<i>F17</i>	1	1						3	1					4	2	50%			
<i>F18</i>										2	0			2	0	0%			
<i>Total</i>	13	5	6	3	13	0	10	5	16	7	10	5	14	5	4	2	86	33	38%
<i>% Germination</i>		39%		50%		0%		50%		44%		50%		36%		50%		38%	

*S- Feecal sample, B s- *Blighia sapida*, V d- *Vitex doniana*, V p- *Vitellaria paradoxa*, C p- *Citrus pomelo*, P t- *Piliostigma thonningii*, S l- *Sarcocephalus latifolius*, P b- *Parkia biglobosa*, D m- *Detarium macrocarpum*, E- Number of extracted seeds, G- Number of Germinated seeds



Days Before Emergence of Planted Seeds from Fecal Sample in Relation to Seeds from Forest Research Institute of Nigeria (FRIN), Within Two Months

Table 9 shows the days before visible sign of growth was observed in germinated seeds after sowing within Two months. Fecal sample having more than a seed of the same species that germinated, were both recorded in the same box. Fecal collection whose species of seed shows no sign of growth in any of its seed planted was recorded as “No Visible growth”. Table 10 shows the days before emergence of the seed species collected from FRIN after appropriate treatment and sown for a period of Two (2) months.

Height of Plants Grown from Fecal Sample Seeds in Relation to Heights from Seed Collected from Forest Research Institute of Nigeria (FRIN), After Two Months of Planting.

Table 9: Days of Seedling Emergence of Seeds Collected from Baboon Feaces

Fecal sample	Seeds	Days of Emergence
F1	<i>Piliostigma thonningii</i>	14 and 16
	<i>Parkia biglobosa</i>	15 and 16
F2	<i>Blighia sapida</i>	15
	<i>Vitex doniana</i>	14
	<i>Vitellaria paradoxa</i>	No Visible growth
F3	<i>Blighia sapida</i>	16
	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Piliostigma thonningii</i>	16 and 20
F4	<i>Blighia sapida</i>	16
	<i>Detarium macrocarpum</i>	8
F5	<i>Parkia biglobosa</i>	No Visible growth
F6	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Sarcocephalus latifolius</i>	21 and 24

The growth rate of the all the viable seeds that emerged after nurturing for a period of two months was observed and recorded. *Detarium macrocarpum* showed to exhibit the highest height of 17cm which was present in seed extracted from fecal sample F4, while *Parkia biglobosa*, showed to have the lowest height of all emerged seedlings of tree, with a height range of 5.6cm – 8cm (Table 11). Table 12 shows the growth rate/ Plant height of seedling from FRIN after Two (2) months of sowing.

Species Composition of Plant Resources around Defecated Site

Twenty-eight (28) species of trees were identified in total, around the eighteen (18) fecal samples collected. *Vitellaria paradoxa* and *Piliostigma thonningii* was *Vitellaria paradoxa* and *Piliostigma thonningii* was the most abundant tree species, found to have habitat presence within nine (9) out of the eighteen (18) fecal extract site (Table 13).

	<i>Detarium macrocarpum</i>	7
F7	<i>Vitex doniana</i>	14
	<i>Parkia biglobosa</i>	18
	<i>Detarium macrocarpum</i>	No Visible growth
F8	<i>Vitex doniana</i>	19
	<i>Parkia biglobosa</i>	15
	<i>Detarium macrocarpum</i>	No Visible growth
F9	<i>Citrus pomelo</i>	8 and 10
	<i>Piliostigma thonningii</i>	15
F10	<i>Blighia sapida</i>	No Visible growth
	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Sarcocephalus latifolius</i>	No Visible growth
F11	<i>Blighia sapida</i>	16
	<i>Vitellaria paradoxa</i>	No Visible growth
F12	<i>Citrus pomelo</i>	9; 12 and 14
F13	<i>Vitellaria paradoxa</i>	No Visible growth



	<i>Sarcocephalus latifolius</i>	24
F14	<i>Blighia sapida</i>	No Visible growth
	<i>Piliostigma thonningii</i>	14
F15	<i>Piliostigma thonningii</i>	No Visible growth
F16	<i>Parkia biglobosa</i>	14

	<i>Sarcocephalus latifolius</i>	21 and 23
F17	<i>Blighia sapida</i>	15
	<i>Piliostigma thonningii</i>	18
F18	<i>Sarcocephalus latifolius</i>	No Visible growth

Table 10: Days Before Seedling Emergence of Seeds Collected from Forest Research Institute of Nigeria (FRIN).

<i>Blighia sapida</i>	<i>Vitex doniana</i>	<i>Vitellaria paradoxa</i>	<i>Citrus pomelo</i>	<i>Piliostigma thonningii</i>	<i>Parkia biglobosa</i>	<i>Sarcocephalus latifolius</i>	<i>Detarium macrocarpum</i>
16 days	25-26 days	No Visible Growth	7 days	10-11 days	8-10 days	14 days	9 days

Table 11: Fecal Seeds Plant Height After Two (2) Months of Planting

Fecal sample	Seeds	Plant Height (CM)
F1	<i>Piliostigma thonningii</i>	9.3 and 8.5
	<i>Parkia biglobosa</i>	6 and 5.6
F2	<i>Blighia sapida</i>	14.3
	<i>Vitex doniana</i>	10.8
	<i>Vitellaria paradoxa</i>	No Visible growth
F3	<i>Blighia sapida</i>	14
	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Piliostigma thonningii</i>	9 and 8.6
F4	<i>Blighia sapida</i>	13.8
	<i>Detarium macrocarpum</i>	17
F5	<i>Parkia biglobosa</i>	No Visible growth
F6	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Sarcocephalus latifolius</i>	12 and 10
	<i>Detarium macrocarpum</i>	16. 4
F7	<i>Vitex doniana</i>	11
	<i>Parkia biglobosa</i>	6
	<i>Detarium macrocarpum</i>	No Visible growth
F8	<i>Vitex doniana</i>	10.9
	<i>Parkia biglobosa</i>	6.5

	<i>Detarium macrocarpum</i>	No Visible growth
F9	<i>Citrus pomelo</i>	8; 6
	<i>Piliostigma thonningii</i>	9
F10	<i>Blighia sapida</i>	No Visible growth
	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Sarcocephalus latifolius</i>	No Visible growth
F11	<i>Blighia sapida</i>	13
	<i>Vitellaria paradoxa</i>	No Visible growth
F12	<i>Citrus pomelo</i>	7.2; 7 and 6.2
F13	<i>Vitellaria paradoxa</i>	No Visible growth
	<i>Sarcocephalus latifolius</i>	12
F14	<i>Blighia sapida</i>	No Visible growth
	<i>Piliostigma thonningii</i>	9.1
F15	<i>Piliostigma thonningii</i>	No Visible growth
F16	<i>Parkia biglobosa</i>	7
	<i>Sarcocephalus latifolius</i>	13 and 10
F17	<i>Blighia sapida</i>	14
	<i>Piliostigma thonningii</i>	8
F18	<i>Sarcocephalus latifolius</i>	No Visible growth



Table 12: Plant Height of Seed Collected from Forest Research Institute of Nigeria (FRIN), After Two Months of Sowing

<i>Blighia sapida</i>	<i>Vitex doniana</i>	<i>Vitellaria paradoxa</i>	<i>Citrus pomelo</i>	<i>Piliostigma thonningii</i>	<i>Parkia biglobosa</i>	<i>Sarcocephalus latifolius</i>	<i>Detarium macrocarpum</i>
<i>14cm</i>	<i>4-4.1cm</i>	<i>No Visible Growth</i>	<i>10cm</i>	<i>10.8-11cm</i>	<i>9.5-10cm</i>	<i>16cm</i>	<i>15cm</i>



Table 13: Tree species abundance around sampled site

S/N	Tree specie	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	Ab	R/Ab
1	<i>Adansonia digitate</i>					1										1			2	4	0.024
2	<i>Albizia lebbek</i>														2			2		4	0.024
3	<i>Annona senegalensis</i>												1							1	0.006
4	<i>Blighia sapida</i>			3	3					2	3				2			2		15	0.089
5	<i>Bombax costatum</i>							2	1											3	0.018
6	<i>Burkea African</i>						2					2			2			3		9	0.053
7	<i>Ceiba pentandra</i>					1										2			1	4	0.024
8	<i>Crossopteryx febrifuga</i>		1									2								3	0.018
9	<i>Cussonia battersii</i>			1	2					2										5	0.03
10	<i>Daniellia oliveri</i>					1							3			1			1	6	0.036
11	<i>Deterium macrocarpum</i>				2		1	2	1					1						7	0.041
12	<i>Ficus thonningii</i>	2																		2	0.012
13	<i>Grewia mollis</i>																		2	2	0.012
14	<i>Hymnocardia acida</i>						1	2	2				1							6	0.036
15	<i>Isobertinia doka</i>									1	2									3	0.018
16	<i>Lannea schimperi</i>	1									3									4	0.024
17	<i>Parinari polyandra</i>									1										1	0.006
18	<i>Parkia biglobosa</i>					1						2		4	1	1	2	2	1	14	0.083



19	<i>Piliostigma thonningii</i>	3	2	2	1					2			1	2		2	1	16	0.095		
20	<i>Pterocarpus erinaceus</i>									2								2	0.012		
21	<i>Sarcocephalus latifolius</i>	2	4					1	2				2			2		13	0.077		
22	<i>Securidaca longipedunculata</i>														2			2	0.012		
23	<i>Sido cidrellia</i>					2	1	2			1							6	0.036		
24	<i>Sterospermum kunthianum</i>				1												1	2	0.012		
25	<i>Strychnos spinosa</i>												2			2		4	0.024		
26	<i>Terminalia glycoscen</i>			2	2													4	0.024		
27	<i>Vitellaria paradoxa</i>	2	1	2	1	2			3	2			1			2		16	0.095		
28	<i>Vitex doniana</i>		2			3	2	2				2						11	0.065		
	Total	10	10	10	11	7	9	10	10	9	10	10	9	10	9	7	10	10	8	169	1

*Ab- Abundance, R/Ab- Relative Abundance.

IV. DISCUSSION

There was a low rate of baboon sighted within the park, which was suggested to be caused by the raining season in which this research was carried out, which allows for abundant food material and water in their hideout, which was supported by Byrne (1981), that Baboon population increases in wet season, when visibility is reduced, and food are more abundant within their hideout. The findings from the study revealed that Baboon's presence was mostly felt around the buffer zone, denoting its range of habitat which could be due to the nearness of the buffer zone to farms where food crops and fruits could be found and also the diverse and dense population of tree species in this zone which serve as a source of nutrition for this primate. This agrees with the assertion that wild animals are more distributed



in areas with abundant food, water space and mates, and also agrees to the view of Newton (1998) and Benton *et al.*, (2003) that food abundance influences the distribution and size of wildlife populations. Furthermore, this manifested in the number of fecal sample extracted around the buffer zone, with transects around the buffer zone (Marguba A, Ajaku Buffer Zone and Ibuya-Ipade Aya Track) having the highest number of fecal extract, which is due to the baboons flair for nearby farm for obtaining food substances and fruits, which corroborate the findings of Adetoro *et al.*, (2011) who stated that that villagers reported 90% of maize destruction and locust bean destruction in their farms to be from Baboon.

Faecal extract within the same transect was found to exhibit similar surrounding vegetation within its 15 meters' radius. *Citrus pomelo* was not encountered during the course of this study in the park and in its surrounding, suggesting that baboon species obtain this fruit from surrounding farms. This would help greatly in introduction of new tree species or exotic species into the park region, thereby increasing the population of tree species and subsequently regeneration of the park.

It would be observed that seeds extracted from all the faecal samples show reduction in weight compared to the control seed (seeds collected from FRIN), which could be evidence of heat action and digestive enzymes on the seed supporting Kleyheeg, (2015) that the diversity of digestive processes and variable intensity of digestive forces between and within individuals are likely to greatly affect seed gut passage weight and survival, but very little is known about their interactions with seed traits, which could also support the exception seen in seeds of pomelo which shows to have some of its seeds not changing in weight with the control seed.

The growth emergence rate of *Vitex doniana* which presents a combination of physical and physiological dormancy, based on classification by Baskin and Baskin (2004) was increased compared to the control. There was early growth of 14-19 days compared to the control which took 25-26 days before visible sign of seedling growth was noticed This shows that the passage of seed through the gut of baboon serves to affect the dormancy of *Vitex doniana*. The growth emergence rate of *Citrus pomelo* was reduced having a range of 8-14 days, compared to the 7 days found in the control. The emergence rate of *Piliostigma thonningii* was also slowed down, having an emergence day range of 14- 20 days compared to the 10-11 days observed in the control. This was also seen in *Parkia biglobosa* having an emergence date of 15-

18 days compared to 8-10 days of the control, which was also concurrent in *Sacrocephalus latifolius*, while *Daterium macrocarpum* whose seed also has hard coating, which prevents the seeds from easy germination when the condition for germination is available, showed a faster rate of emergence (7 - 8 days) as compared to 9 days of the control. This shows that movement of the seed through the gut of baboon is an effective method of softening hard coated seed of *Daterium macrocarpum*, thereby affecting its dormancy. The growth emergence rate of *Blighia sapida* was found almost constant with that of the control, which suggest that movement of the fruit in the gut of Baboon has little or no effect on the seed.

The growth rate of *Blighia sapida* extracted from the fecal sample and that obtained from FRIN (the control), shows a high rate of correlation, therefore suggesting that the movement of this fruit through the gut of Baboon has little or no effect on the seed.

V. CONCLUSION

The impact of baboon on habitat regeneration within the marguba range of old Oyo national park have been studied. The range of habitat composed of high occurrence of baboon has been identified; with the high ratio of baboon's fecal sample extracted in and within the buffer zone and also the high ratio of visual encounter of baboon within this zone, suggests for the invasion of this non-human primate into neighboring habitat and vegetation's. The most preferred fruits within the park was also observed through the amount of seed of the species obtained, as seeds of *Blighia sapida*, *Piliostigma thonningii* and *Vitellaria paradoxa* was found to have the highest seed count which shows the high intake of this fruits and consequently its preference, leading to the high rate of dispersal of these seeds, which suggests for the dominant nature of this tree species within the study area and park, which could therefore be said that baboons have a positive effect in the dispersal of seed species and regeneration of trees within the park.

The passage of fruits through the digestive system of baboon has shown a reduction in the size of the seed, though this reduction in size varies and has an effect in the germination success or viability rate of the seed, as seeds with lowest weight range in a specie enumeration shows no significant growth, thereby reducing the regenerating ability of seeds dispersed. Passage of hard coated seed through the gut of baboon has shown to slightly improve its germination but has not shown to be an effective method in breaking seed dormancy. It could also be concluded that Baboons mostly get their food resources within the park, with



Seven of the Eight species (87.5%) fecal seeds extracted having tree species presence within the park after conducting habitat assessment around each fecal defecation site.

VI. ACKNOWLEDGEMENT

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APPENDIX

Appendix 1: Vegetation Assessment of Habitat used for feeding by Baboons

SAMPLES	SURROUNDING VEGETATIONS
F1	<i>Sarcocephalus latifolius, Ficus thonningii, Piliostigma thonningii, Lannea schimperi, Vitellaria paradoxa.</i>
F2	<i>Sarcocephalus latifolius, Crossopteryx febrifuga, Vitex doniana, Piliostigma thonningii, Vitellaria paradoxa.</i>
F3	<i>Blighia sapida, Piliostigma thonningii, Vitellaria paradoxa, Terminalia glycoscen, Cussonia baterii.</i>
F4	<i>Blighia sapida, Daterium macrocarpum, Vitellaria paradoxa, Cussonia baterii, Terminalia glycoscen, Piliostigma thonningii.</i>
F5	<i>Parkia biglobosa, Ceiba pentandra, Vitellaria paradoxa, Sterospermum kunthianum, Adansonia digitata, Daniellia oliveri.</i>
F6	<i>Vitex doniana, Sido cidrellia, Burkea africana, Hymnocardia acida, Daterium macrocarpum.</i>

F7	<i>Bombax costatum, Vitex doniana, Daterium macrocarpum, Sido cidrellia, Sacrocephalus latifolius, Hymnocardia acida.</i>
F8	<i>Bombax costatum, Vitex doniana, Detarium macrocarpum, Sido cidrellia, Sacrocephalus latifolius, Hymnocardia acida.</i>
F9	<i>Blighia sapida, Vitellaria paradoxa, Cussonia baterii, Isoberlinia doka, Parinari polyandra.</i>
F10	<i>Blighia sapida, Vitellaria paradoxa, Lannea schimperi, Isoberlinia doka.</i>
F11	<i>Crossopteryx febrifuga Burkea africana, Parkia biglobosa, Pterocarpus erinaceus, Piliostigma thonningii.</i>
F12	<i>Vitex doniana, Sido cidrellia, Daniellia oliveri, Annona senegalensis, Daterium macrocarpum, Hymenocardia acida.</i>
F13	<i>Sarcocephalus latifolius, Vitellaria paradoxa, Parkia biglobosa, Piliostigma thonningii, Strychnos spinosa.</i>



F14 *Blighia sapida, Burkea africana, Piliostigma thonningii, Albizia lebbeck, Parkia biglobosa.*

F15 *Parkia biglobosa, Ceiba pentandra, Adansonia digitanta, Securidaca longipedunculata, Daniellia oliveri.*

F16 *Strychnos spinosa, Parkia biglobosa, Sarcocephalus latifolius, Piliostigma thonningii, Vitellaria paradoxa.*

F17 *Blighia sapida, Piliostigma thonningii, Burkea africana, Albizia lebbeck, Parkia biglobosa.*

F18 *Parkia biglobosa, Ceiba pentandra, Sterospermum kunthianum, Grewia mollis, Daniella oliveri, Adansonia digitata.*

Appendix 2: Family Name of Tree species composition around sampled site

Tree specie	Family Name
<i>Sarcocephalus latifolius</i>	Rubiaceae
<i>Ficus thonningii</i>	Moraceae
<i>Piliostigma thonningii</i>	Fabaceae
<i>Lannea schimperi</i>	Anacardiaceae
<i>Vitellaria paradoxa</i>	Sapotaceae
<i>Crossopteryx febrifuga</i>	Rubiaceae
<i>Vitex doniana</i>	Lamiaceae
<i>Blighia sapida</i>	Sapindaceae
<i>Terminalia glycoscen</i>	Combretaceae
<i>Cussonia battersii</i>	Araliaceae
<i>Dateryum macrocarpum</i>	Fabaceae
<i>Parkia biglobosa</i>	Fabaceae
<i>Ceiba pentandra</i>	Malvaceae
<i>Sterospermum kunthianum</i>	Bignoniaceae
<i>Adansonia digitanta</i>	Malvaceae
<i>Daniellia oliveri</i>	Fabaceae
<i>Sido cidrellia</i>	Fabaceae
<i>Burkea African</i>	Fabaceae



<i>Hymnocardia acida</i>	Phyllanthaceae
<i>Bombax costatum</i>	Malvaceae
<i>Isobertinia doka</i>	Fabaceae
<i>Iperenia polyandra</i>	Chrysobalanaceae
<i>Pterocarpus erinaceus</i>	Fabaceae
<i>Annona senegalensis</i>	Annonaceae
<i>Strychnos spinose</i>	Loganiaceae
<i>Albizia lebbek</i>	Fabaceae
<i>Securidaca longipedunculata</i>	Polygalaceae
<i>Grewia mollis</i>	Malvaceae



Appendix 3: Weight (g) of Seeds Extracted from Baboon Fecal Dropping, Before Planting

SAMPLES	<i>Blighia sapida</i>	<i>Vitex donianan</i>	<i>Vitellaria paradoxa</i>	<i>Citrus pomelo</i>	<i>Piliostigma thonningii</i>	<i>Parkia biglobosa</i>	<i>Sarcocep halus latifolius</i>	<i>Daterium macrocarpum</i>
F1					0.6, 0.5, 0.6	2.6, 2.6		
F2	2.2, 1.9	0.7, 0.6	2.6					
F3	2.2, 2.0				0.4, 0.6, 0.6			
F4	2.0, 1.8							1.5
F5						2.4, 2.4		
F6			2.4, 2.2				0.03	1.5
F7		0.8, 0.7				2.6, 2.5		1.5
F8		0.8, 0.6				2.4, 2.5		1.5
F9				0.6, 0.4, 0.2, 0.5	0.4, 0.5			
F10	1.9, 2.0		2.4, 2.0, 2.0, 2.2					
F11	2.1, 2.0		2.0, 2.4					
F12				0.5, 0.5, 0.6, 0.2, 0.4, 0.4				
F13			2.5, 2.2				0.03	
F14	1.8, 1.9				0.4, 0.7			
F15					0.4, 0.5, 0.5			
F16						2.6, 2.5	0.03	
F17	2.2				0.3, 0.6, 0.4			
F18							0.02	

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