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Occurrence and habitat preference of wildanimals in T. A. Afolayan wildlife park, Nigeria

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ABSTRACT: Adequate knowledge of wild fauna occurrence and habitat preference is essential for inventory and effective ecosystem management. This study at T.A. Afolayan Wildlife Park, Federal University of Technology Akure, Nigeria, assessed the occurrence, distribution, and habitat preference of wild animals. Data on animal population and habitat were collected using camera traps, direct and indirect methods along park transects. Vegetation data were obtained from four 20m x 20m plots laid alternately at 40m intervals along transects. Descriptive statistics and Shannon-Wiener Diversity Index (H) were used for analysis. Six wild animal species were observed: tree squirrel (*Paraxerus cepapi*), maxwell duiker (*Philantomba maxwellii*), bushbuck (*Tragelaphus scriptus*), black cobra (*Naja nigricollis*), flat-headed cusimanse (*Crossarchus platycephalus*), and freshwater turtle (*Pelusios* spp.). Tree squirrel had the highest naïve occupancy (NO=1.00), while freshwater turtle had the lowest (NO=0.14). Thirty-six tree species from 16 families were identified, with a diversity index (H1) of 2.68. Diversity indices for open secondary forest and rock outcrop vegetation were 2.56 and 2.00, respectively. Maxwell duiker and bushbuck were found in open secondary forest and degraded vegetation, tree squirrels in open secondary forest, and freshwater turtles in rock outcrop. This study highlights wild animal distribution in the park and recommends proactive wildlife resource management by the University administration.

Ocorrência e preferência de habitat de animais selvagens no parque de vida selvagem T. A. Afolayan, Nigéria

RESUMO: O conhecimento adequado sobre a ocorrência e a preferência de habitat da fauna selvagem é essencial para o inventário e a gestão eficaz de ecossistemas. Este estudo, realizado no Parque de Vida Selvagem T.A. Afolayan, na Universidade Federal de Tecnologia Akure, Nigéria, avaliou a ocorrência, distribuição e preferência de habitat dos animais selvagens. Os dados sobre a população animal e os habitats foram coletados usando armadilhas fotográficas, métodos diretos e indiretos ao longo dos transectos do parque. Os dados de vegetação foram obtidos em quatro parcelas de 20m x 20m dispostas alternadamente a intervalos de 40m ao longo dos transectos. Estatísticas descritivas e o Índice de Diversidade de Shannon-Wiener (H) foram usados para análise. Seis espécies de animais selvagens foram observadas: esquilo arborícola (*Paraxerus cepapi*), antílope maxwell (*Philantomba maxwellii*), imbabala (*Tragelaphus scriptus*), cobra preta (*Naja nigricollis*), cusimanse-de-cabeça-chata (*Crossarchus platycephalus*) e tartaruga de água doce (*Pelusios* spp.). O esquilo arborícola apresentou a maior ocupação ingênua (NO=1,00), enquanto a tartaruga de água doce teve a menor (NO=0,14). Foram identificadas 36 espécies de árvores pertencentes a 16 famílias, com um índice de diversidade (H1) de 2,68. Os índices de diversidade para floresta secundária aberta e vegetação de afloramento rochoso foram 2,56 e 2,00, respectivamente. O antílope maxwell e a imbabala foram encontrados em floresta secundária aberta e vegetação degradada, esquilos arborícolas na floresta secundária aberta e tartarugas de água doce em afloramentos rochosos. Este estudo destaca a distribuição de animais selvagens no parque e recomenda ações proativas para a gestão dos recursos de vida selvagem pela administração da universidade.

Introduction

Wildlife habitats are areas of land that provide resources such as food, cover, water, environmental conditions in the form of precipitation, soil types that affect occupancy of individuals or populations of species, allowing those species to survive and reproduce (Morrison et al. 2006). About 22% of 5,488 mammal species around the world are globally threatened or extinct in the wild due to habitat loss, utilization and invasive species, and about 15% of species have insufficient data to assess their conservation status (Vié, Hilton-Taylor and Stuart, 2009). However, due to the expansion of human settlement and agriculture that lead to habitat destruction, the natural habitats range of many wildlife species have increasingly become smaller. The wildlife populations are however forced to occupy isolated habitat areas majorly found in protected areas (Girma et al. 2012).

Therefore, it is of topmost importance to understand how habitat changes affect the distribution and abundance of wildlife for biodiversity conservation and sustainable resource use planning. Information on habitat uses and selection patterns is crucial for understanding the biological requirements of animals and the strategies they use to fulfil their needs (Manly et al. 2002). This is also essential for conservation and management purposes (Guisan and Thuiller 2005).

Rates of biodiversity loss are usually associated with a reduction in the extent of original habitat (Tews et al. 2004; Sinclair and Byrom, 2006, Pardini *et al.* 2017) One important step in planning and promoting sustainable land management strategies is the identification of key habitat types for wildlife (Garshelis, 2000; Morrison, 2002; Vavra, 2005; Carter et al. 2006). Management alternatives can then be planned and adapted to safeguard these important habitats.

Understanding the habitat use and spatial distribution of wildlife is important for conservation and management (Morris, 2003; Tews et al. 2004; Klar *et al.* 2008;). By defining the relative frequency of occurrence of animals (utilization distribution), ecologists and conservationists can obtain a global representation of spatial use (Benhamou and Riotte-Lambert, 2012). Utilization distribution can help determine protection areas of high priority and highlight essential habitat management (Cañadas et al. 2005). Monitoring the home ranges of various species and their potential changes, induced by natural population, environmental factors, or by man, is one of the essential conditions for understanding their ecology, habitat requirements, or the threats to their survival.

This study seeks to determine the occurrence, distribution and habitat preference of wild animals in T.A Afolayan Wildlife Park, at the Federal University of Technology, Akure (FUTA), Ondo State Nigeria. Despite being gazette as a conservation area for research, training, recreation and conservation purposes, the occurrence of human activities such as farming had resulted into its habitat destruction (Olaniyi et al. 2016). These activities were observed very close to the park boundaries, especially in the southern (farming), western (farming and roads) and eastern (urbanization) leading to habitat fragmentation around the park boundary due to loss of habitats (Olaniyi et al. 2016). This study is very important because it provides clear insights on the animal species and a predictive basis for game viewing planning to boost ecotourism activities, contribute to improved management of wildlife habitats, and provide adequate measures to conserve the animals.

Materials and Methods

The location for the study is T.A. Afolayan Wildlife Park, a conservation area within the Federal University of Technology Akure (FUTA). The study area is located in Akure, the state capital of Ondo State, Nigeria. The state lies between latitudes 50^0 45' and 70^0 52'N and longitudes 40^0 20' and 60^0 05'E, with a land cover area of about 15,500 km^2 (UNAAB-IFSERAR, 2010).

The wildlife Park lies between latitudes 7.2935^0N and 7.2963^0N and longitudes 5.1425^0E and 5.1445^0E Figure 1 (Olaniyi et al. 2016). Its land area is about $94.18m^2$ (9.418 hectares) and it is located on elevation 369m – 383m above sea level. The study area is underlaid with crystalline basement rock which imposes a partially rugged topographic relief on the area.. The terrain of T.A. Afolayan Wildlife park can be described as undulating with small outcrop scattered about. The study area enjoys favorable rainfall with an average rainfall of 1650mm to 1700mm annually (Oguntuase and Agbelusi, 2013).

The vegetation is typical of secondary forest with herbaceous undergrowth, a combination of tropical trees, shrubs and herbaceous plants in great diversity such as: *Tetrapleura tetraptera, Trichilia emetic, Newbouldia leavis, Jatropha gossypifolia, Aframomum melegueta, Elaeis guineensis, Diospyros spp, Khaya ivorensis, Milicia excelsia, Aspilia africana* (Abu, 2010). The vegetation classification according to Olaniyi *et. al.* (2017) are non-forested vegetation, forested vegetation (dense,degraded and sparse) and bare surfaces (lands without shrubs and barren rocky areas). The park is dominated with a large diversity of rodents; though other families of animal do exist. The fauna resources in general include: Bush Buck (*Tragelaphus scriptus*), Duiker (*Philantomba maxwellii)*, Grasscutter (*Thryonomys swinderianus*),

Giant Rat (*Cricetomys gambianus)*, Squirrel (*Paraxerus cepapi*) and Rock Python (*Python sabae*) (Idowu, 2010). The Park is embedded with facilities for biological studies and at the same time used for recreation while a small number of mammals and birds' species are kept in small enclosure in situations as similar to their natural habitat in the ex-situ section of the park.

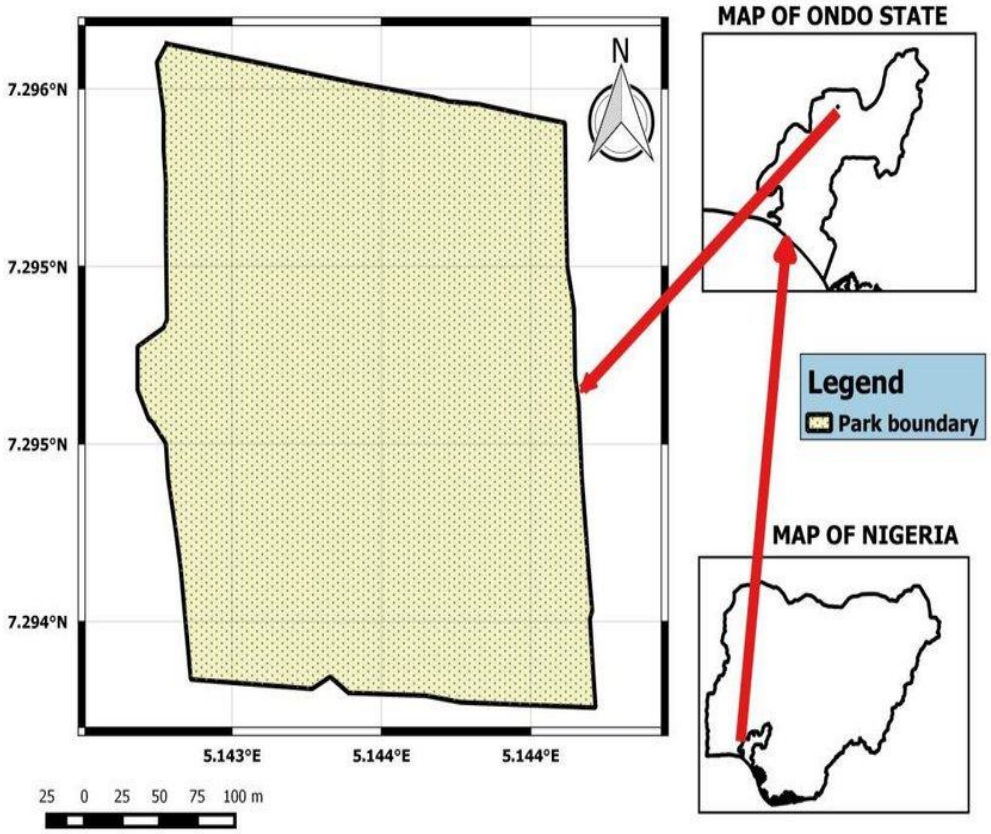

Figure 1: T.A.Afolayan Wildlife Park in Ondo State, Nigeria Source: Olaniyi *et al.* (2016).

Line transect method was used to enumerate the population of animals within the study area. Field survey was conducted to assess and estimate the status of various species of wild fauna and flora resources in the wildlife park. The Survey was carried out by direct observation using binoculars on foot during the study period. The observation was done early in the morning and late in the evening for good visibility (morning 06:00am – 10:00am and evening 04:00pm – 06:00pm) three consecutive days every week for three (3) months on seven transects. Observation of animals on each transect was conducted by walking quietly along the transect with total length of 270m each. These transects are laid at 50 meters apart from the park boundary, evenly transverse the perimeter of the park. Data were recorded using standardized data sheet which contain information on species of animal, numbers of individual, habitat types, location, time of sighting, sighting distance, date, season, records of numbers of individuals, group, species, activities when sighted and food fed upon. At the sights of any animal or group of animals, a standard time of five to ten minutes was spend observing and taking records of their activities. The GPS coordinate of the sighting point was taken using the Garmin GPSmap 62s and weather was also noted.

Motion sensor Bushnell camera were mounted in a vantage position as described by (Andrew, Todd, & Laurie, 2008) to capture wild animals in the early morning (01:00-06:00 hours), afternoon (11:00-15:00 hours) and late evening (18:00-24:00 hours). Bushnell cameras were mounted on trees with clear visualization to avoid poor image quality from sun rays. The cameras were set on different transect and were retrieved every 5days for data download and battery replacement. Data recorded was analyzed, habitat of animals captured by the cameras was assessed to determine the habitat preference of the animal.

Vegetation assessment of each location that is the open secondary forest, rock outcrop vegetation, and the degraded portion of the park was done by laying out of four plots of 20m by 20m alternatively on each of the existing transect at 40m interval where animals were found. Identification of woody trees, shrubs and herbaceous plants in each plots were assessed and analyzed for their diversity indices.

Tree species were identified with the aid of taxonomist and folia samples of those that could not be identified on the field were collected for further identification in the University herbarium, species were classified into family and their botanical names were recorded using Keay (1989) as guide.

Data Analysis

The data obtained were analyzed using descriptive statistics and presented in the form of tables.

$$\text{No of Young} = \frac{\text{Average Total Number of Young}}{\text{Total Number of Occurrence}}$$

$$\text{No of Adult} = \frac{\text{Average Total Number of Adult}}{\text{Total Number of Occurrence}}$$

$$\text{ERS} = \frac{\text{Total Number of Animal}}{\text{Total Length of Transect}}$$

ERS = Encounter Rate Sighted

Total Length of Each Transect = 270m

The phyto-sociological parameters of the woody species in the study area were computed using the folmular

H	Shannon's diversity index
S	total number of species in the community (richness)
p_i	proportion of *S* made up of the *i*th species
E_H	equitability (evenness)

Dominance = 1-Simpson index. Ranges from 0 (all taxa are equally present) to 1 (one taxon dominates the community completely).

Simpson index = 1-dominance. Measures 'evenness' of the community from 0 to 1.

The Shannon diversity index (*H*) as described by Jannat *et al.* (2019) is another index that is commonly used to characterize species diversity in a community. Like Simpson's index, Shannon's index accounts for both abundance and evenness of the species present. The proportion of species *i* relative to the total number of species (p_i) is calculated, and then multiplied by the natural logarithm of this proportion ($\ln p_i$). The resulting product is summed across species, and multiplied by -1:

$$H = \sum_{i=1}^{S} P_i \ln P_i \quad (1)$$

Shannon's equitability (E_H) can be calculated by dividing *H* by H_{max} (here $H_{max} = \ln S$). Equitability assumes a value between 0 and 1 with 1 being complete evenness.

$$E_H = \frac{H}{H_{max}} = \frac{H}{lnS} \quad (2)$$

Shannon Werner diversity index (entropy), H: A diversity index, taking into account the number of individuals as well as number of taxa. Varies from 0 for communities with only a single taxon to high values for communities with many taxa, each with few individuals.

PRESENCE program was used to estimates the site occupancy and detection probability for wild animals sighted in TA Afolayan wildlife park.

Results

Table 1 presents the fauna species found during the survey at the T.A. Afolayan Wildlife Park, FUTA. Fauna species encountered include Maxwell Duiker (*Philantomba maxwellii*), Bushbuck (*Tragelaphus scriptus*), Tree Squirrel (*Paraxerus cepapi*), Black Cobra (*Naja nigricollis*), Flat-Headed Cusimanse (*Crossarchus platycephalus*) and Fresh Water Turtle (*Pelusios species)*. Table 2 presents the details of the presence (checked), absence (unchecked), total count (footprint and droppings), and motion sensor records for species of wild fauna in the study area (Figures 1-7). The table presents the transect (TRST) where each species was found and six species of wild animals were recorded. PC detected 175 individuals and Motion-Sensor Camera (MSC) detected 11 individuals during 42 days. Both methods detected 2(33.33%) species in common and 4 (66.67%) species exclusively.

Table 1: Occurrence of wild fauna species in T. A. Afolayan Wildlife Park, FUTA.

Common Name	Scientific Name	No of Young Sighted	No of Adult Sighted	Total No Sighted	Activities During Sighting	Encounter Rate
			Direct sighting			
Tree Squirrel	*Paraxerus cepapi* A Smith	1.5±0.1	1.4±0.2	1.5±0.1	Climbing	0.1±0.02
Maxwell Duicker	*Philantomba maxwellii* C.H.Smith,	1.2±0.1	1.1±0.1	1.2±0.1	Running and grazing	0.04±0.02
Bush Buck	*Tragelaphus scriptus* P S Pallas	1±0	1±0	1±0	Running and grazing	0.003±0.003
Black Cobra	*Naja nigricollis* Reinhardt	1±0	1±0	1±0	Crawling	0.01±0.003
Fresh Water Turtle	*Pelusios species* Duméril and Bibron	3±0	3±0	3±0	Swimming	0.003±0.003
Flat Headed Cusimanse	*Crossarchus platycephalus* Goldman	1.5±0.5	1±0	1.3±0.3	Climbing	0.002±0.001

Table 2**:** Presence (checked√), absence (unchecked -) across the Transect (TRST) and total count for Point Count (PC) and Motion-Sensor Camera (MSC) records for species of wild Fauna Species in T. A. Afolayan Wildlife Park, FUTA, Akure.

S/N	Common name	Scientific name	Trst 1	Trst 2	Trst 3	Trst 4	Trst 5	Trst 6	Trst 7	MS C	P C	Occurrence (%)
1	Maxwell duiker	*Philantomba maxwellii*	√	√	-	√	√	√	-	6	158	88.17
2	Tree squirrel	*Paraxerus cepapi*	√	√	√	-	√	√	√	1	-	0.54
3	Bushbuck	*Tragelaphus scriptus*	-	√	-	-	√	√	-	3	17	10.75
4	Fresh water Turtle	*Pelusios species*	-	-	-	√	-	-	-	-	-	-
5	Flat headed cusimanse	*Crossarchus platycephalus*	-	-	-	√	-	-	√	1	-	0.54
6	Black cobra	*Naja nigricollis*	-	√	√	√	-	√	-	-	-	-

Figure 2: Maxwell duiker (*Philantomba maxwellii*) captured by the Camera Trap in Transect 2

Figure 3: Bushbuck (*Tragelaphus scriptus*) captured by the Camera Trap in Transect 2

Figure 4: Flat-Headed Cusimanse (*Crossarchus platycephalus*) captured by the Camera Trap in Transect 4

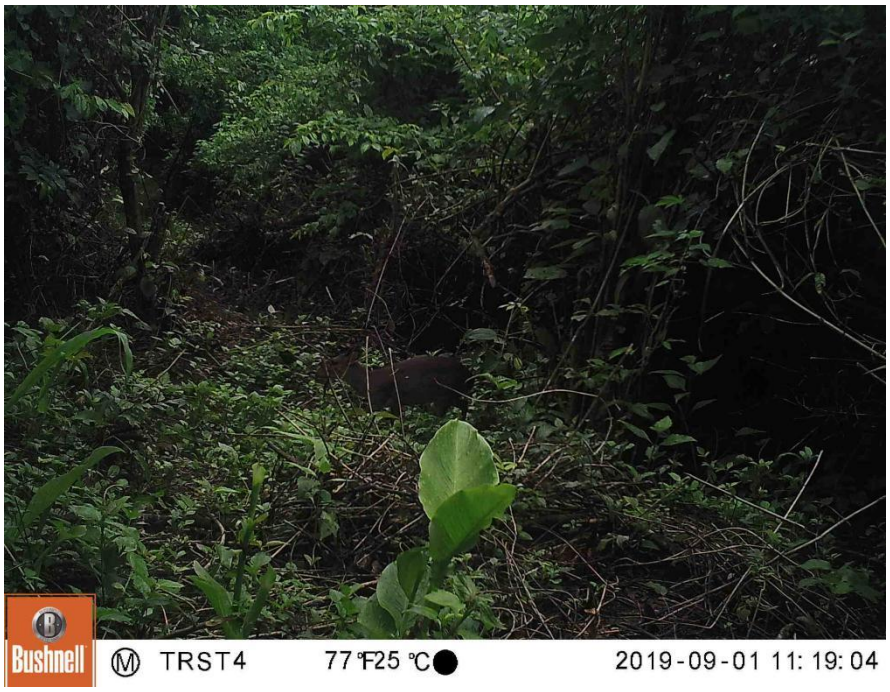

Figure 5: Maxwell Duiker (*Philantomba maxwellii*) captured by the Camera Trap in Transect 4

Figure 6: Bushbuck (*Tragelaphus scriptus*) captured by the Camera Trap in Transect 2

Figure 7: Tree Squirrel (*Paraxerus cepapi*) captured by the Camera Trap in Transect 5

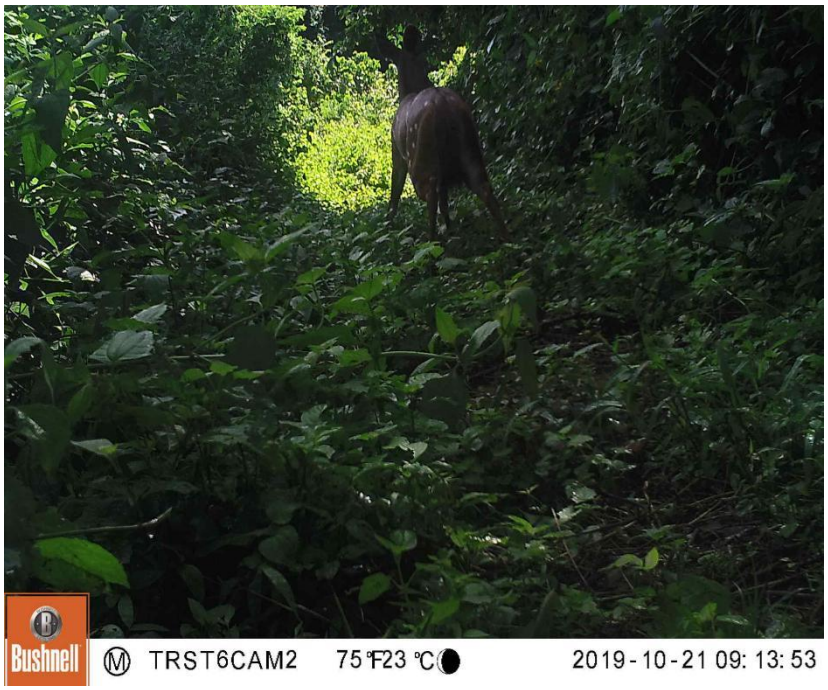

Figure 8: Bushbuck (*Tragelaphus scriptus*) captured by the Camera Trap in Transect 6

Site occupancy estimate of wild animals in T. A. Afolayan wildlife park

Table 3 present the site occupancy estimates of wild animals sighted in T.A. Afolayan Wildlife Park, FUTA is presented in table 3. The park recorded the same naïve occupancy by Maxwell Duiker and Black Cobra (NO=0.71), the same naïve occupancy by Bushbuck and Fresh water Turtle (NO=0.14), Flat-Headed Cusimanse had (N=0.43) and Tree Squirrel (NO=1.00). The park had higher occupancy estimate by Tree Squirrel (Ψ=1.00 ± 0.00)with CI (0.00 – 1.00) followed by Flat-Headed Cusimanse (Ψ=0.93±0.76) with CI (0.00 – 1.00), followed by Black Cobra (Ψ=0.74 ± 0.18) with CI (0.32 – 0.94), followed by Maxwell Duiker (Ψ=0.71 ± 0.17) with CI (0.33 – 0.93), the park had the same occupancy estimate by Bushbuck and Fresh Water Turtle (Ψ=0.14 ± 0.13) with CI (0.02 – 0.58). Higher detection probability for Water Turtle (P=0.38 ± 0.07) with CI (0.25 – 0.53), followed by detection probability of Tree Squirrel (P=0.30 ± 0.03) with CI (0.25 – 0.36), followed by detection probability of Maxwell Duiker (P=0.29 ± 0.03) with CI (0.23 – 0.36), followed by detection probability of Bushbuck (0.17 ± 0.06) with CI (0.08 – 0.31), followed by detection probability of Black Cobra (p=0.08 ± 0.02) with CI (0.05 – 0.13), the park had the least detection probability of Flat Headed Cusimanse (p=0.02 ± 0.01) with CI (0.00 – 0.09).

Table 2

Table 3: Estimates of site occupancy and detection probability for wildanimals sighted in TA Afolayan wildlife park

Estimate/ Species	Maxwell Duiker	Tree Squirrel	Bushbuck	Flat headed Cusimanse	Black Cobra	Fresh Water turtle
NO	0.71	1.00	0.14	0.43	0.71	0.14
Ψ ± SE	0.71 ± 0.17	1.00 ± 0.00	0.14 ± 0.13	0.93 ± 0.76	0.74 ± 0.18	0.14 ± 0.13
CI	0.33 – 0.93	0.00 – 1.00	0.02 – 0.58	0.00 – 1.00	0.32 – 0.94	0.02 – 0.58
P ± SE	0.29 ± 0.03	0.30 ± 0.03	0.17 ± 0.06	0.02 ± 0.01	0.08 ± 0.02	0.38 ± 0.07
CI	0.23 – 0.36	0.25 – 0.36	0.08 – 0.31	0.00 – 0.09	0.05 – 0.13	0.25 – 0.53

NO = naïve occupancy; Ψ = occupancy estimate; SE = standard error; CI = 95% confidence interval (specified by Program PRESENCE output) and P = detection probability

Table 4 describes the phyto–sociological characteristics of the study area which recorded 36 species of trees belonging to 16 families, among the families.Ulmaceae (3 species), Bignolaceae (1 specie), Sapotaceae (2 species), Anacardiaceae (2 species), terculiaceae (7 species), Sapindaceae (2 species), Euphobiaceae (3 species), Rubiaceae (1 specie), Bombacaceae (1 specie), Cannabaceae (1

species), Apocynaceae (4 species), Moraceae (1 specie), Rutaceae (1 specie), Papiloinodaceae (1 specie), Meliaceae (1 specie), Loganaceae (1) with Shannon Weiner Diversity Index) =2.67955, Simpson Dominance = 0.133479, Species evenness = 0.198135 and Margalef richness = 7.201924

Table 5 recorded open secondary forest species in the park having 26 species of trees belonging to 14 families Cannabaceae (1 specie), Euphorbiaceae (2 species), Loganaceae (1 specie), Fabaceae (5 specie), Sapindaceae (2 species), Bombacaceae (1 specie), Ulmaceae (3 species), Sapotaceae (2 species), Sterculiaceae (5 species), Moraceae (1 specie), Apocyneceae (3 species), Rubiaceae (1 specie), Anacardiaceae (2 species), Bignolaceae (1 specie) with Shannon Weiner Diversity Index) =2.563039183, Simpson Dominance = 0.129131653, Species evenness = 0.275952945 and Margalef richness =5.62727

Table 6 recorded rock outcrop vegetation in the park having 14 species of trees belonging to 9 families Caescyoinoideae (1 specie), Sapindaceae (1 specie), Euphorbiaceae (1 specie), Ulmaceae (1 specie), Rutaceae (1 specie), Apocynaceae (2 species), Sterculaecea (3 species), Meliaceae (1 species) Bignonaceae (1) with Shannon Weiner Diversity Index = 2.00003, Simpson Dominance = 0.22698413, Species evenness = 0.287489, Margalef Richness = 3.627719

Table 7 shows the species of herbaceous and shrubby components which dominate the degraded area in the park

Table 4: Phyto-sociological characteristics of wild animal habitat in T. A. Afolayan Wildlife Park

S/N	Name of Trees	Family	Frequency of Occurrence	Number of Species per family
1	*Celtis zenkeri* A. Engl.	Ulmaceae	43	3
2	*Newbouldia laevis* (P. Beauv.)	Bignolaceae	1	1
3	*Chrysophyllum albidum* G. Don	Sapotaceae	1	2
4	*Mangifera indica* C. Linnaeus	Anacardiaceae	1	2
5	*Spondias mombin* C. Linnaeus	Anacardiaceae	1	
6	*Hildergadia barteri* (Mast.) Kosterm.	Malvaceae	10	
7	*Lecaniodiscus cupanoides* Planch. ex Benth.	Sapindaceae	1	2
8	*Sterculia tragacantha* Lindl.	Sterculiaceae	7	7
9	*Manihot glaziovii* (Muell. Arg.)	Euphobiaceae	4	3
10	*Alchornea cordifolia* (Schumach. &Thonn. Mull. Arg.	Euphobiaceae	3	
11	*Kydia calycina* W. Roxburgh	Rubiaceae	1	1
12	*Ceiba pentadra* (L.) Gaertn.	Bombacaceae	1	1
13	*Albizia zygia* (D. C.) Macbr.	Fabaceae	8	
14	*Funtumia elastica* (Preuss) Stpaf	Apocyneceae	4	
15	*Cola gigantea* A. Chev.	Sterculiaceae	11	
16	*Celtis philippensis* Blanco	Cannabaceae	1	1
17	*Blighia sapida* K.D. Koenig	Sapindaceae	3	
18	*Sterculia rhinopetala* (K. Schum.)	Sterculiaceae	1	
20	*Holarrhena floribunda* G. Don	Apocynaceae	2	4

Table 4: Phyto-sociological characteristics of wild animal habitat in T. A. Afolayan Wildlife Park. *Continuation…*

21	*Ficus exasperata* M. Vahl.	Moraceae	8	1
22	*Bridelia micrantha* C. F. Hochstetter	Euphorbiaceae	1	
23	*Albizia adianthifolia* H.C. Schumacher	Fabaceae	1	
24	*Mansonia altissima* A. Chev.	Sterculiaceae	2	
25	*Fagara leucomeris* A. Richard	Rutaceae	1	1
26	*Pterocarpus osun* P.Beauv	Papilionideae	1	1
27	*Pterygata macrocarpa* H.C. Schumacher	Sterculiaceae	1	
28	*Trichilia heudelotii* H.E. Baillon	Meliaceae	1	1
30	*Rauvolfia vomitoria* W. Afzel	Apocynaecae	2	
31	*Anthocleista vogellii* C.F. Hochstetter	Loganaceae	2	1
32	*Balphia nitida* P.Beauv	Fabaceae	1	
33	*Malancantha alnifolia* (Baker.) Pierre	Sapotaceae	1	
34	*Nesogodonia papaferifera* A. Chevalier	Sterculiaceae	1	
35	*Rauvolfia Africana* P.Beauv	Apocynaceae	1	
36	*Celtis zygia* C. Linnaeus	Ulmaceae	1	
No of species	36			
No of families	16			
Shannon Werner diversity Index	2.67955			
Simpson evenness index	0.198135			
Simpson Dominance	0.133479			
Margalef Richness	7.201924			

Table 5: Open secondary forest vegetation of T. A. Afolayan wildlife park

S/N	Species	Family	Frequency of occurrence	Number of Species per family
1	*Albizia zygia* (DC.) Macbr.	Fabaceae	4	5
2	*Alchornea cordifolia* (Schumach. &Thonn. Mull. Arg.	Euphorbiaceae	2	2
3	*Anthocleista vogellii*	Loganaceae	2	1
4	*Baphia nitida* Lodd.	Fabaceae	1	
5	*Blighia sapida* Koenig.	Sapindaceae	1	2
6	*Ceiba pentadra* (L.) Gaertn.	Bombacaceae	2	1
7	*Celtis philippensis* Blanco	Cannabaceae	1	1
8	*Celtis zenkeri* Engl.	Ulmaceae	27	3

Table 5: Open secondary forest vegetation of T. A. Afolayan wildlife park. ***Continuation…***

9	*Celtis sinensis* Pers.	Cannabaceae	1	
10	*Chrysophyllum albidium* G. Don.	Sapotaceae	1	2
11	*Cola gigantea* A. Chev.	Sterculiaceae	9	5
12	*Ficus exasperate* Vahl.	Moraceae	3	1
13	*Funtumia elastica* (Preuss) Stpaf	Apocyneceae	2	3
14	*Hildegardia barteri* (Mast.) Kosterm.	Malvaceae	10	
15	*Keetia vulgarize* (Oliv.) Bridson	Rubiaceae	1	1
16	*Lecaniodiscus cupanioides* Planch. ex Benth.	Sapindaceae	1	
17	*Mangifera indica* L.	Anacardiaceae	1	2
18	*Malacantha alnifolia* (Baker.) Pierre	Sapotaceae	1	
19	*Manihot glaziovii* (Muell. Arg.)	Euphobiaceae	4	
20	*Nesogordonia papaverifera* A. Chev. Capuron	Sterculeaceae	1	
21	*Newbouldia laevis* P.Beauv.	Bignolaceae	1	1
22	*Rauvolfia vomitoria* Afzel.	Apocynaceae	1	
23	*Rawvolfia africana* Afzel.	Apocynaceae	1	
24	*Spondia mombin* L.	Anacardiaceae	1	
25	*Sterculia rhinopetala* K. Schum.	Sterculiaceae	1	
26	*Sterculia tragacantha* Lindl.	Sterculiaceae	5	
No of species	26			
No of families	14			
Shannon Werner diversity index	2.563039183			
Simpson evenness index	0.275952945			
Simpson evenness index	0.129131653			
Simpson Dominance Margalef Richness	5.62727			

Table 6: Rock outcrop vegetation of T. A. Afolayan wildlife park

S/N	Species	Family	Frequency of occurrence	Number of Species per family
1	*Albizia adianthifoli* W. Wight	Caescyoinoideae	1	1
2	*Blighia sapida* K.D Koenig	Sapindaceae	2	1
3	*Bridelia micrantha* (Hochst) Baill.	Euphorbiaceae	1	1
4	*Celtis zenkeri* Engl.	Ulmaceae	17	1
5	*Cola gigantea* A. Chev.	Sterculaecea	1	3
6	*Fagara leprieurii* (Guill. & Perr.) Engl.	Rutaceae	1	1
7	*Funtumia elastica* (Preuss) Stapf	Apocynaceae	2	2
8	*Mansonia altissima* A. Chev.	Sterculaecea	2	3
9	*Newbouldia laevis* Seem. Ex Bureau	Bignonaceae	2	1
10	*Pterygota macrocarpa* K. Schum.	Sterculaecea	1	
11	*Rauvolfia vomitoria* Afzel.	Apocynaecae	1	
12	*Sterculia rhinopetota* K Schum.	Sterculiaceae	1	
13	*Sterculia tragacantha* Lindl.	Sterculiaceae	3	
14	*Trichilia heudelotii* Planch. Ex Oliv.	Meliaceae	1	
No of Families	9			
Shannon Werner diversity index	2.00003			
Simpson evenness index	0.287489			
Simpson Dominance	0.22698413			
Dominance Margalef Richness	3.627719			

Table 7: Degraded vegetation of T. A. Afolayan wildlife park

S/N	Species	Family	Vegetation
1	*Alchornea cordifolia* Mull.Arg.	Euphorbiaceae	Sapling
2	*Acalypha indica* L.	Euphorbiaceae	Herb
3	*Adenia lobata* (Jacq.) Engl.	Passifloraceae	Climber
4	*Albizia zygia* J. F. Macbr.	Leguminosae	Sapling
5	*Alchornea discolor* Poepp L. C.	Euphorbiaceae	Herb
6	*Alchornea laxiflora* (Benth) Pax.&K. Hoffm.	Euphorbiaceae	Sapling
7	*Aspilia Africana* (Pers.) C. D. Adams.	Asteraceae	Herb
8	*Asystasia gigantea* (L) T. Anderson	Acanthaceae	Herb
9	*Canna indica* L.	Cannaceae	Herb

Table 7: Degraded vegetation of T. A. Afolayan wildlife park. ***Continuation…***

10	*Cardiospermum halicacabum* L.	Sapindaceae	Climber
11	*Celtis philippensis* Blanco	Cannabaceae	Sapling
12	*Centrosema pubescens* Benth.	Fabaceae	Herb
13	*Chromolaena odorata* R.M King & H Rob	Asteraceae	Herb
14	*Cissus aralioides* (Welw. ex Baker)	Vitaceae	Climber
15	*Cnestis ferrugenea* Vahl ex DC.	Connaracaeae	Sapling
16	*Combretum racemosum* P. Beauv.	Combretaceae	Sapling
17	*Cyathula prostrata* (L. Blume)	Euphorbiaceae	Herb
18	*Diospyros monbutensis* A. Chev. ex Lecomte	Ebenaceae	Shrub
19	*Hoslundia opposita* (Vahl)	Lamriaceae	Herb
20	*Jateorhiza macrantha* (Hook. f.) Exell & Mendonça	Menispermaceae	Climber
21	*Melanthera scandens* (Schum. & Thonn.)	Asteraceae	Herb
22	*Momordica charantia* (L.)	Cucurbitaceae	Climber
23	*Momordica foetida* (Schumach)	Cucurbitaceae	Climber
24	*Mondia whitei* (Hook. F.)	Apocynaceae	Climber
25	*Mucuna pruriens* (L. DC.)	Fabaceae	Climber
26	*Panicum maximum* (Jacq.)	Poaceae	Grass
27	*Parguetia nigrescens* (Afzel.) Bullock.	Apocynaceae	Climber
28	*Pergularia daemia* (Forssk.) Chiov.	Asclepiadaceae	Climber
29	*Pouzolzia guineensis* (Benth)	Urticaceae	Herb
30	*Setaria barbata* (Lam.) Kunth	Poaceae	Grass
31	*Spondias mombin* L.	Anacardiaceae	Sapling
32	*Tetracera sarmentosa* L. (Vahl)	Dilleniaceae	Climber

Discussion

Assessment of diversity and distribution of ecosystem provide information on the resources that is contained in an ecosystem, resource relationships and the environmental factors that influence their distribution and diversity (Oliveira *et al.*, 2016). The findings of this research show that six wild animal species were identified during the field survey which relates to the distribution of wild fauna species in the study area. Animals that were encounter includes Maxwell Duiker (*Philantomba maxwellii*), Bushbuck (*Tragelaphus scriptus*), Tree Squirrel (*Paraxerus cepapi*), Black Cobra (*Naja nigricollis*), Flat-Headed Cusimanse (*Crossarchus platycephalus*) and Fresh Water Turtle. This corroborate Abu (2010) who reported that the fauna resources in T. A. Afolayan Wildlife Park generally include Bushbuck, Duiker, Squirrel, Grasscutter, Giant Rat and Rock Phyton. These animals inhabit different habitat based on the requirements available (food, security etc) in each location as suggested by Calenge et al. (2005), Lele and Keim (2006), Johnson and Seip, (2008) that habitat characteristics describes the distribution and abundance of animals.

It was recorded that Maxwell Duiker (*Philantomba maxwellii*) are mainly found in transect one, two, three, four, five and six, these areas are secondary forest and consist of thickets which support the assertion of Wilson (2001) attributes that Maxwell Duiker prefer habitat variety of food plants and denser cover growing under a felled or partial canopy. The species was captured six (6) times along the five transects with their point count of 158 (footprints and droppings). Tree squirrel were found in transects one, two, three, five six and seven of the park, vegetation of which consists of climbers and thicket. The species have a single capture across the 6 transects. Bushbuck are found in transect two, five and six, they are water loving animals and because of that, they normally wander around transect two where there is a stream of water. This is in corroborates Mungai, (2022) which stated that tree squirrel's habitat consists of thicket or closed vegetation canopy and riverine bush and forest. These transects provides abundant

shade, cover for refuge and nutritious browse fodder. The species was captured three times across the three transects with point counts of 17 (footprints and droppings).

Flat-headed Cusimanse were found on transect four and seven, these area consists of thickets and shrubs which agrees with assertion made by Oguntuase and Agbelusi, (2013) that the species of the flat-headed Cusimanse are adapted to fairly dense vegetation and preferred to utilize fallen logs, thicket of bush, environments with considerable wetness with pond or stream and crevices formed by fallen logs and rock outcrops as habitats. The species was captured with the motion-sensor camera once on transect four. Fresh Water Turtle was found only on transect four of the park because of the presence of suspended lake found there. Black Cobra were found in transect three which is characterized by lowland forest and moist savanna where it favours coastal thickets.

Furthermore, the number of woody species and families reported in the study include 16 families of 36 woody tree species which is similar to what was reported by Adekola (2013) on Ecotourism Resources Mapping of T. A. Afolayan Wildlife Park which reported 24 families of 39 different woody tree species. The study by Agbelade and Akindele (2013) had the woody species and families compositions of 21 families belonging to 42 species in the Federal University of Technology, Akure where the wildlife park is located. The open secondary forest of the park is mostly inhabited by majority of the fauna species because of shade and security it provides. Maxwell Duiker, Bushbuck and Snake were observed to occupied transect 3, 4, 5 and 6 of the park because of the vegetation structure. The area provides an adequate requirement needed for those animals to survive. Bushbuck are found in transect 2 due to the presence of water pool, while Black Cobra were found in degraded forest.

The Shannon Weiner Diversity Index of the whole area is recorded as (2.67955) with Simpson Dominance (0.133479), Species evenness (0.198135) and Margalef richness (7.201924) which implies that the study area has higher diversity of tree species but has low level of dominance. The open secondary forest and the rock outrock vegetation has Shannon Weiner Diversity Index of (2.563039183) and (2.00003) respectively with Simpson dominance of (0.129131653) and (0.22698413). The implication of this is that open secondary forest of the park has higher species diversity of trees than the rock outcrop vegetation of the park.

Conclusions

The study has identified flora and fauna compositions in Prof. T. A. Afolayan Wildlife Park, FUTA. Thirty-six (36) species belonging to sixteen (16) families of woody component were identified, thirty two (32) species belonging to twenty three (23) familes of herbaceous and shrubby components were assessed. Six (6) species of fauna resources were discovered during the study which include Maxwell Duiker (*Philantomba maxwellii*), Bushbuck (*Tragelaphus scriptus*), Tree Squirrel (*Paraxerus cepapi*), Black Cobra (*Naja nigricollis*), Flat-Headed Cusimanse (*Crossarchus platycephalus*) and Fresh Water Turtle. Tree squirrel was noticed to be abundant, maxwell duiker and bushbuck are still occurring in some area of the park but their population is decreasing as a result farming and poaching activities that were observed in the park.

For effective conservation, management measures in the park must be designed and targeted to conserve these wild species and their associated habitats. Efforts should be intensified by the management to reduce human disturbances to the integrity of the wildlife park.

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