

KUKULA Vol 4 No 4-6 (2019)

Diversity and Abundance of Bird Species in Akure Forest Reserve South Western Nigeria.

¹E.F. Okosodo, ²J.O. Orimaye, O.Ogunyemi, O.O. and O.O. Kolawole

¹Department of Leisure and Tourism,

Federal Polytechnic Ilaro, Ogun State

²Department of Forest Resources and Wildlife Management,

Ekiti State University Ado-Ekiti, Ekiti State

Abstract

The Abundance and Diversity of bird species was studied in Akure Forest Reserve, South Western Nigeria. The study area was divided into three compartments based on their different land use types. Line transects method was used to collect data on bird species diversity, and abundance in the study area. In all an of 60 transect lines were randomly placed measuring 1000 m each transect was divided into 200 m sections with each block having 20 transects randomly placed. The number of transect lines was determined by the site size. Data were collected for six months (Dry and Wet seasons) in 20018. Quadrant method was used to determine plant species composition. This method involves a total enumeration count (TEC) of all trees above 1m in height and Basal area of not less than 10cm from 25×25m² quadrant sample plot which was randomly selected through balloting form each sampling compartments. Thirty-five (31) bird species were recorded in the Farmland, Forty five (45) bird species in the Fallow Area and sixty seven (67) species encountered in the Undisturbed forest area. In all, a total of 143 bird species belonging to 43 families and 18 orders were recorded in the three study sites, The Order Passeriformes had the highest frequency (51 %) of the entire number of birds recorded, while the dominant families were Cuculidae and Pycnonotidae, comprising (7.4 %) of the total species One endangered bird species, African Grey Parrot and 13 species cuculidae were encountered in the study area. A total of 117 tree species were enumerated in the study area, Ficus exasperata had the highest DBH, while, Ceiba pentandra has the highest mean height. Alchornea oppositifolia has the highest frequency of occurrence in the study area.

Key Words: Home Range, Agricultural intensification, Avian Species and Habitat fragmentation.

INTRODUCTION

Nigeria is endowed with a variety of flora and fauna species, including charismatic mammals such as Cross River Gorilla (*Gorilla gorilla diehli*) (Oates et al. 2008b), the West African chimpanzee (*Pan troglodytes verus*) (Humble et al. 2008), the African bush elephant (*Loxodonta Africana*) (Blanc 2008), white-bellied pangolin (*Phataginus tricuspis*) (Waterman et al., 2014), and beautiful avian species such as crowned eagle (*Stephanoaetus coronatus*) (Bird Life International, 2012a) and Ibadan malimbe (*Malimbus ibadanensis*) (Bird Life International, 2012b). However, biodiversity research and conservation efforts made during the last fifty years or so have mostly focused on the fauna that in habait southeastern regions further east of Lagos, north, south, or in the Niger Delta, or near the Cameroon border (Luiselli et al., 2015). This is partly because human population densities are lower and forests are denser in these regions. For this reason, our knowledge of the fauna of southwestern Nigeria west of Lagos is deficient (Koyenikan, 2004).

Birds are among the best monitors of environmental changes and have been used to evaluate the environment throughout the history as „biomonitors“ and; the changes in their population, behavior patterns and reproductive ability have most often been used to examine the long term affects of habitat fragmentation. Hence they are the good indicators of ecological status of any given ecosystem (Oates, 2008a). Forests attract a large number of avifauna because of the habitat suitability for most of them. This especially includethe birds that are associated with the vegetation and for most, the existence of trees is vital to their life cycle. Birds show different levels of interest to various stands depending on the age of the stands.

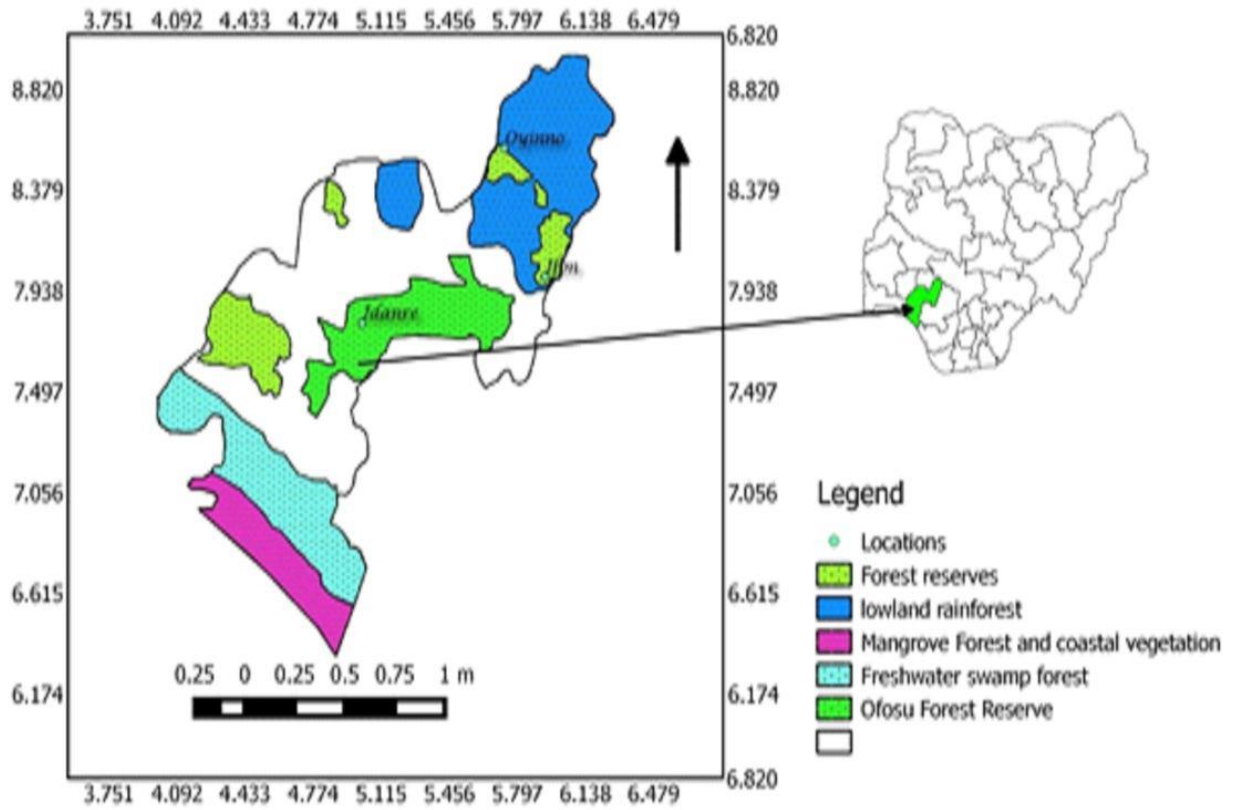
The bird species composition is highly related to the forest's vegetation structure. The diversity of birds, and in particular the native species, is positively correlated with increasing structural complexity of the vegetation. Also a seasonal change in species diversity of birds occurs in forests due to their foraging behaviour (Oates, 2008d). The present study was undertaken to assess the pattern of distribution and diversity of avifauna species abundance and diversity in Akure Forest reserve southwestern Nigeria. This limited studies in Nigeria confirm that much more research needs to be carried out on tropical farmland biodiversity and these has

great potential to contribute to maintaining the populations of common and rare bird species through the well-informed management of agricultural development in Nigeria. The study areas are hotspots for birds in Africa as recorded by International Birdlife Fact. Hence, this research work will provide baseline information that will be of immense important to other researchers in management of birds

MATERIALS AND METHODS

Study area

This study was carried out in Akure Forest Reserve, Ondo State, Nigeria. It covers an area of 69.93 km². The three land uses selected for the study were present within this reserve. Akure Forest Reserve is managed by the Department of Forestry, Ondo State, Nigeria. The study site is situated on latitude 7°18'N and longitude 5°02'E. The three land uses were adjacent to each other. The climate is humid tropical with seasonal variation. The mean annual rainfall is about 4000 mm with double maxima in the months of July and September and a short relatively dry period in August. December through to February constitutes the major dry season while January and February are the driest months with each having less than 30 mm rainfall (Ajiboye, 2012). . The relative humidity at 15 hours Greenwich Mean Time (GMT) is highest in the maxima months of July and September (81%) and lowest in February (44%). Temperature ranges from about 20.6 °C to 33.5 °C. The monthly mean temperature is about 27 °C, a condition that is conducive to the development of tropical rainforest (Ajiboye, 2012). Soils are predominantly ferruginous tropical, typical of the variety found in intensively weathered areas of basement complex formations in the rainforest zone of south-western Nigeria. The soils are well-drained, mature, red, stony and gravelly in upper parts of the sequence. The texture of topsoil in the reserves is mainly sandy loam (Oksanen, et al, 2013). The natural vegetation of the area is tropical rainforest characterized by emergent with International Journal of Development and Sustainability multiple canopies and lianas. Some of the most commonly found trees in the area include *Melicia excelsa*, *Azelia bipindensis*, *Antiaris africana*, *Brachystegia nigerica*, *Lophira alata*, *Lovoa trichilodes*, *Terminalia ivorensis*, *Terminalia superba*, and *Triplochiton scleroxylon*. However, the natural vegetation of the area except for the areas devoted to forest reserve has now been reduced to secondary regrowth forest thickets and fallow regrowth at varying stages of development or replaced by perennial and annual crops (Ogunsesan, et al, 2012).



Source; (Olajuyigbe and Adaja, 2014)

Data Collection

The study area was divided into three compartments which include the undisturbed forest area, farmland and Secondary forest for the purpose of this study. Line transects method according to (Sutherland, 2009) was used to collect data on bird species diversity, and abundance in the study area. In all an of 60 transect lines were randomly placed measuring 1000 m each transect was divided into 200 m sections with each block having 20 transects randomly placed. The programme GPS 2011 Utility (GPSU, 2012) was used to locate the starting and ending points of transects. Transect lines were walked three times a week for three months in both seasons (May, July and September for wet season and November, January, and March for dry season) of the year. Survey was conducted between 0.600hours and 10.00hours and 1600 hours to 1800 hours, the survey was not conducted beyond 10.00hours in the morning in other to reduce day light effect. Transects were walked at an average speed of one kilometre per hour, depending on the terrain and the number of bird species recorded. All birds viewed on the ground or in the vegetation, as well as birds that are flying ahead, were identified and the number in the group recorded. Birds of the same species within 10m of each other were counted in the same group. A pair of binoculars with a magnification 7x 50 was used in the identification of bird species. Distance estimates were obtained by using a digital range finder. The side of the transect that the bird was recorded was also noted in order to calculate the distance from the transect for groups made up separately recorded individuals which may have been on different sides of the transect. If birds were in a tight group or recordings were to be made, the distance to the centre of the group was taken. Physical features of birds sighted but could not be identified immediately were taken and field guide book of West African birds (Burrow and Demey, 2011) was used to identify the bird species and bird calls was used to confirmed the presence of nocturnal bird species within the study sites. Data was collected for six months three months in the dry season (November, February and March) and three months in the wet season (June, August, and September) in 2014

From the data collected, avian species diversity was calculated using Shannon diversity index, (Usher, 1991) which is given as:

$$H^i = - \sum P_i \ln P_i$$

Where: H^i = diversity index

P_i = is the proportion of the i th species in the sample

$\ln P_i$ = is the natural logarithm of the species proportion.

Species Relative Population Density

The relative population density of bird species at various sites and seasons were determined as outlined by Bibby *et al.*, (1992) as follows:

$$D = \frac{n_1 + n_2 \text{Log}_e \left[\frac{n_1 + n_2}{n_2} \right]}{\pi r^2 m}$$

where: D = density

r = radius of the first zone

n_1 = number of birds counted within zone

n_2 = number of birds counted beyond zone and m = number of replicate count in such area.

Habitat analysis

Quadrant method (Ogunjiemitie et al, 2005) was used to determine plant species composition. This method involves a total enumeration count (TEC) of all trees above 1m in height and Basal area of not less than 10cm from 25×25m² quadrant sample plot which was randomly selected through balloting form each sampling compartments. Three out of the 16 quadrants was randomly selected through balloting in each of the 5 sampling compartments giving 15 plots of a dimension of 25×25m². The following data was collected within each sampling quadrants. They include:, mean height of 22m and above was considered Tall Emergent Tree, 11m to 21m Middle layer and 1m to 10m Understorey. The classification of the tree species into different strata layers was carried using (Longman and Jennik 1987).

- i Total enumeration of all trees above 1m height and basal area ≥10cm.
- ii Total enumeration of all the trees species (s) and family which they belong.
- iii The diameter of all the plants above 1m in the height ≥10cm.

3.6 Statistical Analysis

Data obtained from the field survey were entered into excel (version 15) spread sheet prior to both descriptive (tables, frequency and percentage frequency, graph, pie and bar charts) and analytical statistics. Variables. Test of homogeneity for the effect of logging and farming on the bird diversity was carried out using PAST Model.

Results

From the result obtained from the research study it indicates that the study area support diversity and abundance of bird life. A total of 143 bird species belonging to 43 families and 18 orders were recorded in the study area. The Unlogged compartment has 47% of bird species which is the highest in the study area, Logged compartment has 31% and farmland has 22% bird species which is the lowest in the study area (Figure 2). A total of 1131 individual bird species were recorded in the study area, Farmland has the highest individual bird species (496) while, Unlogged compartment has the lowest 274 individual bird species in the study area (Figure 3). The result of the family composition indicates that cuculidae has the highest number of bird species, class cuckoo and Dusky Long-Tailed and Jacobin Cuckoo have highest frequency of occurrence during the period of study (Figure 4). The result of the diversity index indicates that it was higher in the unlogged compartment (4.406) than the rest other two compartment than the compartments Logged (3.341) and Farmland 2.962) Table 1. A total of 117 tree species were enumerated in the study area, Ficus exasperata had the highest DBH, while, Ceiba pentandra has the highest mean height. Alchornea oppositifolia has the highest frequency of occurrence in the study area (Table 2). The land use impact on the bird species in linear regression in shown in Figure 6. The result of the forest layers obtained shows that understory has the number of tree species (60), the middle layer 37 tree species and Tall emergent layer 11 Figure 7. The result of habitat specialization of bird species in the study area indicates that understory has 64 bird species, wetland 11, Grassland 14, Middle layer 37 and tall emergent 17 bird species Figure 8. Checklist of the bird species in the study area is shown in Table 3

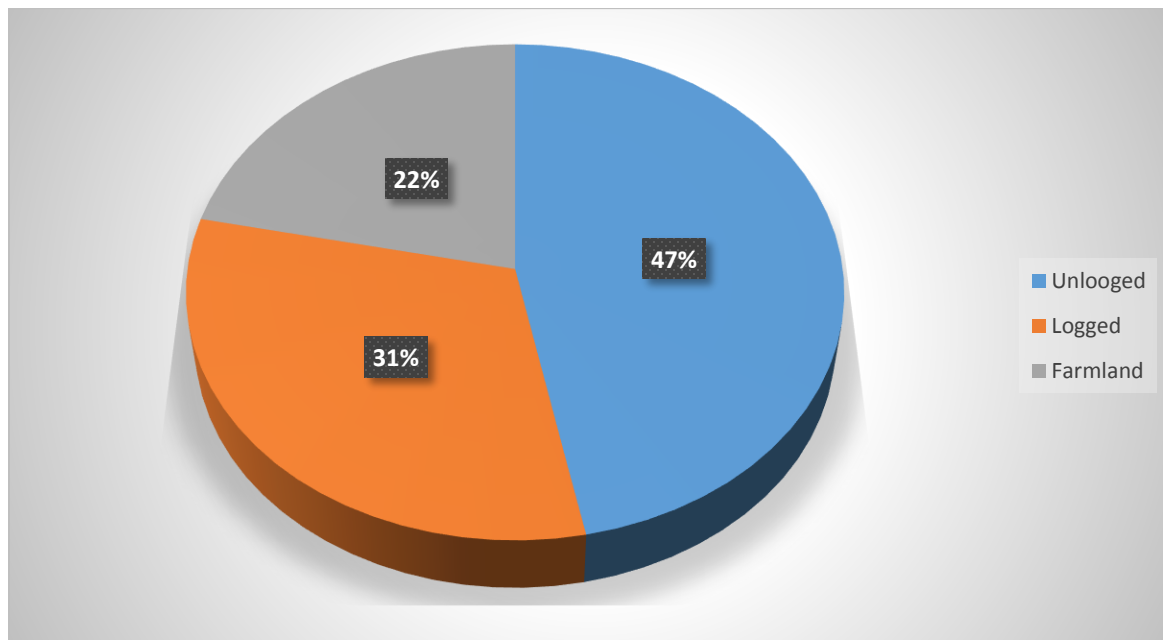


Figure 2 Percentage of bird Species in each Compartment

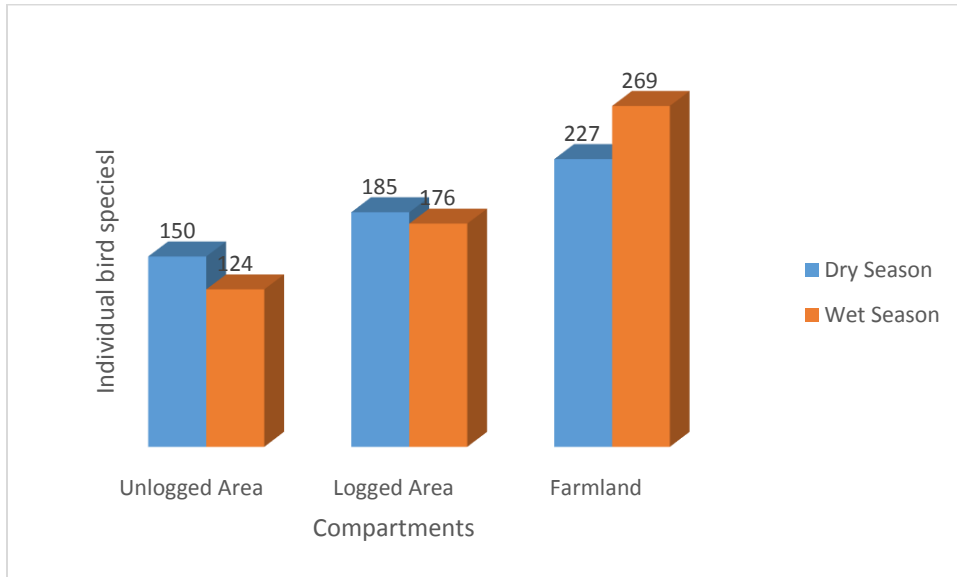


Figure 3 Individual Bird Species in Each Compartment

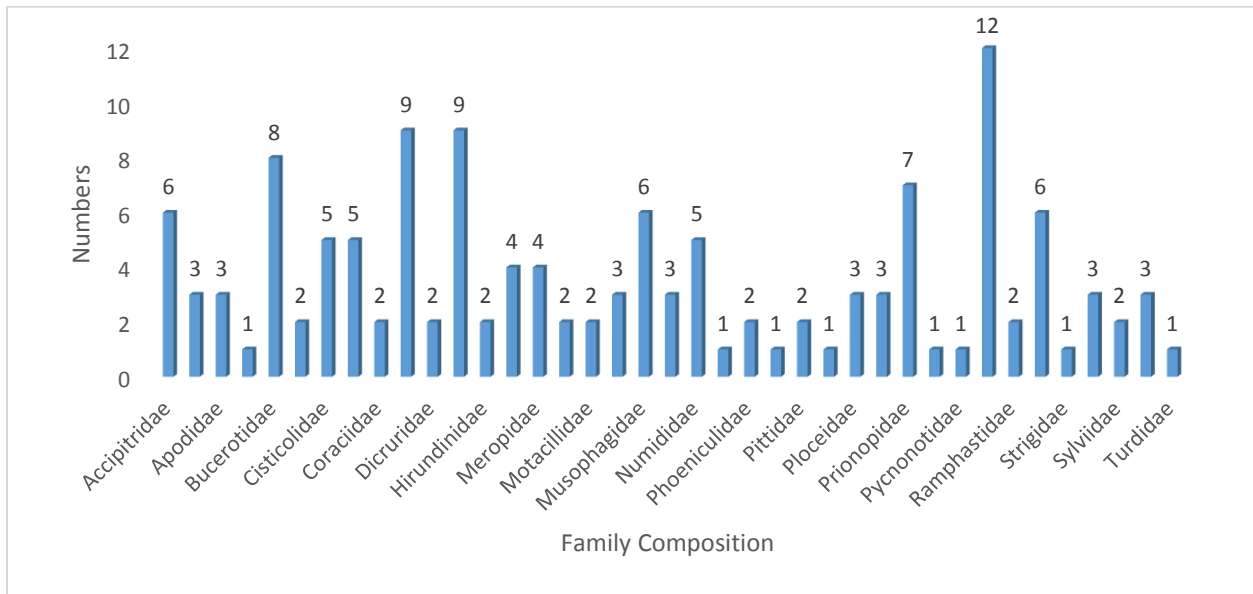


Figure 4 Family Composition in the Study Area

Table 1 Diversity index of Bird species in the Study area

Diversity Index	Unlogged	Lower	Upper	Logged	Lower	Upper	Farmlands	Lower	Upper
Taxa_S	92	90	92	46	44	46	22	21	22
Individuals	272	272	272	175	175	175	49	49	49
Dominance_D	0.01349	0.01422	0.01698	0.02609	0.02753	0.03491	0.05789	0.05539	0.08205
Shannon_H	4.406	4.278	4.371	3.732	3.558	3.694	2.962	2.775	2.985
Evenness_e^H/S	0.8905	0.7901	0.8634	0.9075	0.7753	0.8785	0.8787	0.7505	0.9008
Brillouin	3.934	3.826	3.906	3.341	3.192	3.309	2.436	2.286	2.455
Margalef	16.23	15.88	16.23	8.713	8.326	8.713	5.396	5.139	5.396
Equitability_J	0.9744	0.9478	0.9675	0.9747	0.9334	0.966	0.9582	0.9065	0.966
Fisher_alpha	48.9	46.99	48.9	20.33	18.9	20.33	15.35	13.92	15.35
Berger-Parker	0.02574	0.02574	0.04779	0.04571	0.04571	0.08571	0.102	0.08163	0.1837

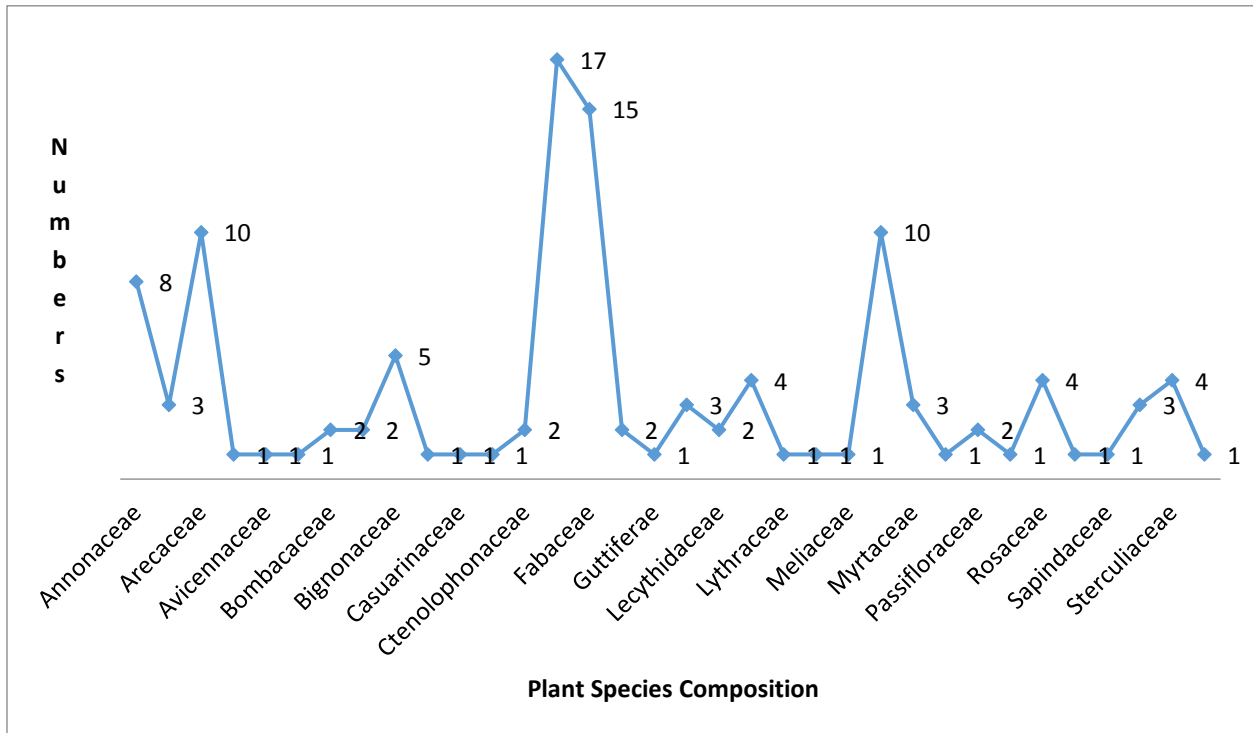


Figure 5 Plant species Composition in the study Area

Table 2 Checklist of Plant species in the Study Area

Name of Tree species	Family	DBH (cm)	Mean Height(m)	Frequency
Afrolicania elaeosperma	Rosaceae	21	12	1
Alchornea cordifolia	Euphorbiaceae	22	14	8
Alchornea oppositifolia	Euphorbiaceae	23	16	11
Alstonia congensis	Anacardiaceae	24	14	4
Anacardium occidentale	Annonaceae	12	21	2
Anonidium friesianum	Loganiaceae	13	21	3
Anthocleista congonesis	Loganiaceae	23	18	4
Anthocleista nobilis	Loganiaceae	34	19	3
Anthocleista vogelii	Loganiaceae	23	21	4
Anthothona macrophylla	Euphorbiaceae	45	22	5
Anthostema aubryanum	Moraceae	22	13	6
Artocarpus communis	Avicennaceae	32	17	7
Avicennia germinans	Meliaceae	21	15	5
Azadirachta indica	Balanitaceae	24	17	4
Balanites wilsoniana	Passifloraceae	23	15	7
Barteria nigritiana	Fabaceae	34	16	4
Bauhinia monandra	Fabaceae	30	23	3
Beilschmiedia mannii	Lauraceae	34	16	4
Beilschmiedia gaboonensis	Lauraceae	29	21	2
Beilschmiedia talbotiae	Sapindaceae	26	29	1
Blighia sapida	Bombacaceae	23	14	2
Bombax buonopozense	Euphorbiaceae	24	13	4
Bridelia micrantha	Calophyllaceae	23	12	2
Calophyllum inophyllum	Samydaceae	23	15	3
Casearia barberi	Casuarinaceae	23	29	2
Casuarina equisetifolia	Bombacaceae	34	14	2
Ceiba pentandra	Rutaceae	334	36	1
Chrysobalanus atacorensis	Rutaceae	22	12	2
Chrysobalanus ellipticus	Chrysophylloideae	34	11	3
Chrysophyllum albidum	Rutaceae	19	10	1
Citrus sinensis	Annonaceae	31	8	3
Cleistopholis patens	Arecaceae	13	9	2
Cocos nucifer	Sterculiaceae	14	8	1
Cola gigantea	Sterculiaceae	280	39	32
Cola nitida	Boraginaceae	17	8	3
Cordia abyssinica	Boraginaceae	12	9	2
Ctenolophon englerianus	Ctenolophonaceae	11	8	1
Ctenolophon englerianus	Ctenolophonaceae	14	10	2
Ctenolophon englerianus	Lecythidaceae	21	11	4
Crateranthus talbotii	Fabaceae	12	9	1

<i>Delonix regia</i>	Fabaceae	23	31	3
<i>Dialium guineensis</i>	Fabaceae	34	12	4
<i>Dissomeria crenata</i>	Euphorbiaceae	33	12	1
<i>Drypetes principum</i>	Arecaceae	32	33	2
<i>Elaeis guineensis</i>	Fabaceae	36	21	1
<i>Erythrina senegalensis</i>	Myrtaceae	39	31	2
<i>Eugenia malaccensis</i>	Moraceae	40	22	3
<i>Ficus congoensis</i>	Moraceae	34	11	3
<i>Ficus exasperata</i>	Moraceae	336	35	3
<i>Ficus sycomorus</i>	Moraceae	22	11	4
<i>Funtumia elastic</i>	Tiliaceae	34	17	3
<i>Grewia coriacea</i>	Malvaceae	29	35	2
<i>Holarrhena floribunda</i>	Euphorbiaceae	28	12	4
<i>Hura crepitans</i>	Rosaceae	18	11	2
<i>Hymenocardia heudelotii</i>	Samydaceae	17	13	1
<i>Homalium molle</i>	Samydaceae	21	14	1
<i>Homalium africanum</i>	Flacourtiaceae	21	11	1
<i>Icacina trichantha</i>	Bignoneae	21	12	2
<i>Jacaranda mimosifolia</i>	Bignoneae	21	12	2
<i>Keayodendron bridelioides</i>	Phyllanthaceae	37	21	2
<i>Lagerstroemia speciosa</i>	Lythraceae	28	11	3
<i>Laguncularia racemosa</i>	Flacourtiaceae	22	12	1
<i>Lindackeria dentata</i>	Euphorbiaceae	26	13	4
<i>Macaranga barteri</i>	Euphorbiaceae	29	14	2
<i>Macaranga heudelotii</i>	Euphorbiaceae	30	13	1
<i>Maesobotrya barteri</i>	Anacardiaceae	23	13	2
<i>Mangifera indica</i>	Moraceae	27	31	1
<i>Milicia excelsa</i>	Fabaceae	81	34	2
<i>Millettia thonningii</i>	Rubiaceae	33	27	3
<i>Morinda lucida</i>	Moraceae	35	16	1
<i>Musanga cecropioides</i>	Moraceae	37	33	2
<i>Myrianthus preussi</i>	Moraceae	38	35	1
<i>Myrianthus arboreus</i>	Lecythidaceae	31	13	2
<i>Napoleona vogelii</i>	Euphorbiaceae	34	12	1
<i>Neoboutonia velutina</i>	Annonaceae	30	23	3
<i>Neostenanthera myristicifolia</i>	Sterculiaceae	36	16	1
<i>Nesogordonia papaverifera</i>	Bignoneae	41	15	2
<i>Newbouldia laevis</i>	Bignoneae	44	27	2
<i>Ochna multiflora</i>	<u>Ochnaceae</u>	31	22	1
<i>Ouratea calantha</i>	Rosaceae	34	15	2
<i>Parinari congensis</i>	Rosaceae	31	17	1

<i>Parinari robusta</i>	Fabaceae	24	13	2
<i>Peltophorum pterocarpum</i>	Fabaceae	21	15	1
<i>Pentadesma butyracea</i>	Lauraceae	23	12	2
<i>Persea americana</i>	Arecaceae	22	11	1
<i>Phoenix reclinata</i>	Arecaceae	21	14	3
<i>Phyllanthus pbysoarpus</i>	Fabaceae	26	14	3
<i>Piptostigma pilosum Oliv</i>	Fabaceae	10	9	3
<i>Pithecelobium dulce</i>	Fabaceae	12	9	2
<i>Plagiostyles africana</i>	Myrtaceae	7	10	1
<i>Psidium guajava L</i>	Annonaceae	6	4	2
<i>Polyalthia oliveri</i>	Arecaceae	13	11	3
<i>Raphia hookeri</i>	Apocynaceae	11	9	3
<i>Rauvolfia vomitora</i>	Arecaceae	10	8	2
<i>Roystonea oleracea</i>	Arecaceae	21	9	1
<i>Sacoglottis gabonensis</i>	Flacourtiaceae	14	9	3
<i>Scottellia mimfiensis</i>	Fabaceae	16	8	2
<i>Senna alata</i>	Fabaceae	12	7	2
<i>Senna fistula</i>	Passifloraceae	25	11	3
<i>Smeathmannia pubescens</i>	Fabaceae	12	7	3
<i>Senna siamea</i>	Euphorbiaceae	16	9	1
<i>Spondianthus preussii</i>	Anacardiaceae	27	12	2
<i>Spondias mombin</i>	Sterculiaceae	29	11	2
<i>Sterculia tragacantha</i>	Guttiferae	23	12	3
<i>Symphonia globulifera</i>	Myrtaceae	24	10	2
<i>Syzygium rowlandii</i>	Bignonaceae	25	11	1
<i>Tabebuia rosea</i>	Moraceae	34	12	2
<i>Treculia africana</i>	Euphorbiaceae	27	11	1
<i>Triumfetta cordifolia</i>	Euphorbiaceae	23	10	2
<i>Uapaca esculenta</i>	Euphorbiaceae	29	12	7
<i>Uapaca heudelotii</i>	Euphorbiaceae	29	12	2
<i>Uapaca paludosa</i>	Euphorbiaceae	27	15	3
<i>Uapaca vanhouttei</i>	Euphorbiaceae	28	15	17
<i>Urena lobate</i>	Annonaceae	28	21	2
<i>Uvariastrum insculptum</i>	Annonaceae	27	16	1
<i>Xylopi rubescens</i>	Annonaceae	24	8	4
<i>Xylopi stauditii</i>	Annonaceae	29	11	2

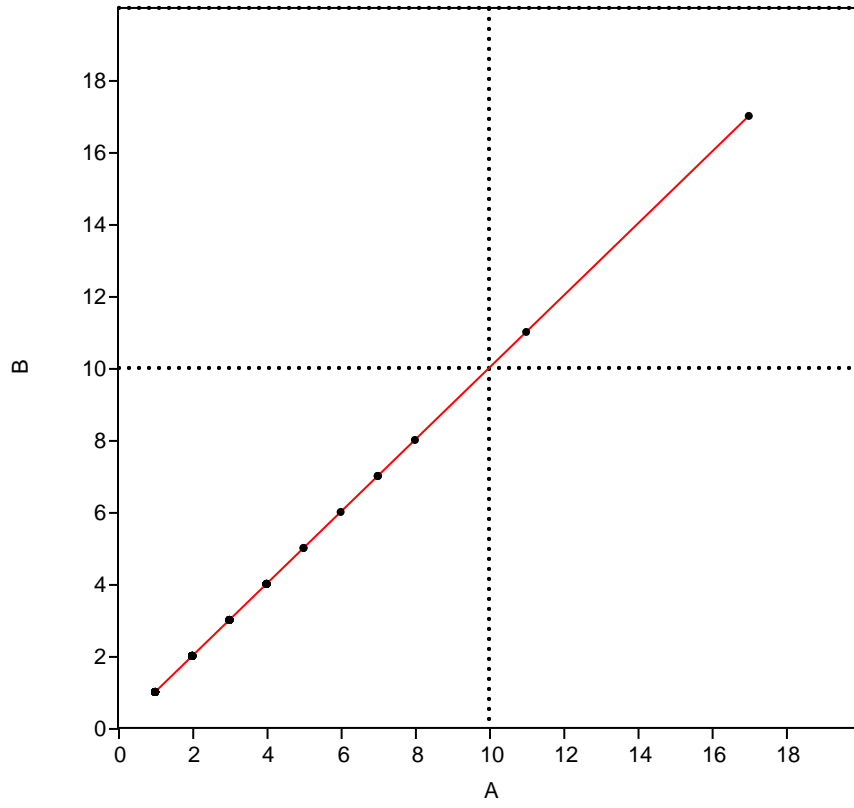


Figure 6: Bird species diversity in the study area (generalized linear model)

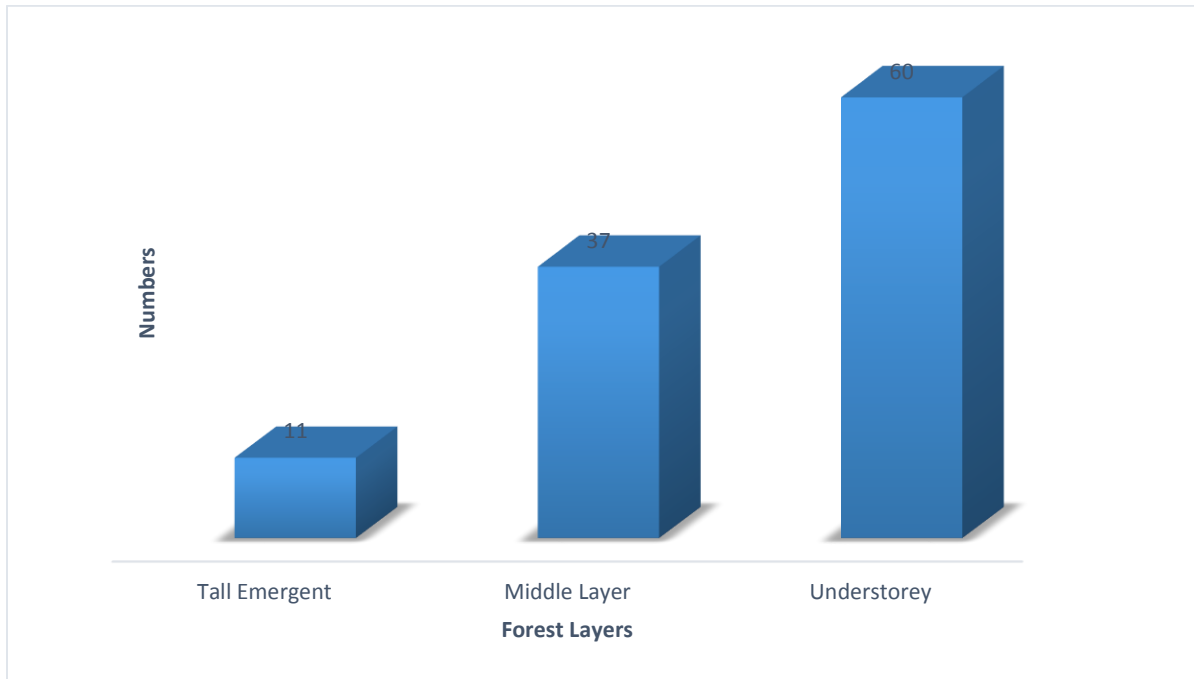


Figure 7 Forest layers in the Study Area

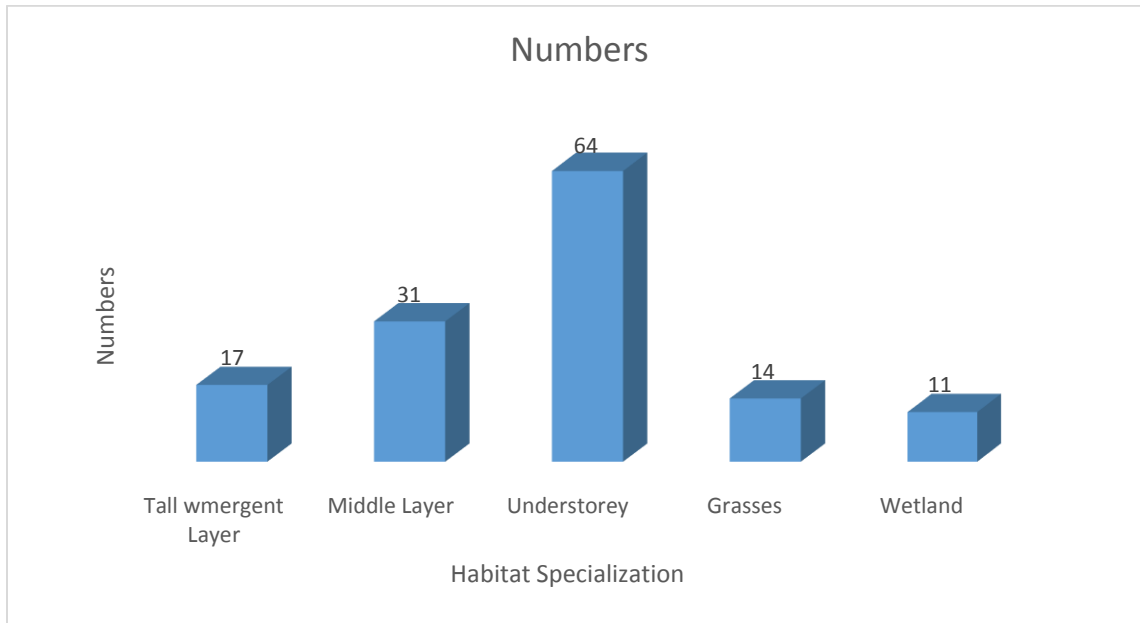


Figure 8 Habitat Specialization of Bird Species in the Study Area

Table 3 Checklist of Bird Species in the Study Area

Name of Bird Species	Scientific Name	Family	Order	Status
African Palm Swift	<i>Cypsiurus parvus</i>	Apodidae	Caprimulgiformes	R
Giant Kingfisher	<i>Megaceryle maxima</i>	Alcedinidae	Coraciiformes	R
African Emerald Cuckoo	<i>Chrysococcyx cupreus</i>	Cuculidae	Cuculiformes	R
African Fish Eagle	<i>Haliaeetus vocifer</i>	Accipitridae	Accipitriformes	R
African Forest Flycatcher	<i>Fraseria ocreata</i>	Muscicapidae	Passeriformes	R
African Green Pigeon	<i>Treron calva</i>	columbidae	Columbiformes	R
African Grey Parrot	<i>Psittacus erithacus</i>	Psittacidae	Psittaciformes	R
African Harrier Hawk	<i>Polyboroides typus</i>	Accipitridae	Accipitriformes	R
African Pied Hornbill	<i>Tockus fasciatus</i>	Bucerotidae	Bucerotiformes	R
African Pied Wagtail	<i>Motacilla aguimp</i>	Motacillidae	Passeriformes	R
African Pitta	<i>Pitta angolensis</i>	<u>Pittidae</u>	Passeriformes	R
African Shrike Flycatcher	<i>Megabyas flammulatus</i>	<u>Platysteiridae</u>	Passeriformes	R
African Wood Owl	<i>Strix woodfordii</i>	Strigidae	Strigiformes	R
Anssorges Greenbull	<i>Andropadus ansorgei</i>	Pycnonotidae	Passeriformes	R
Black And White Casqued Hornbill	<i>Ceratogymna subcylindricus</i>	Bucerotidae	Bucerotiformes	R
Black And White Mannikin	<i>Spermestes bicolor</i>	Estrildidae	Passeriformes	R
Black Coucal	<i>Centropus grillii</i>	Cuculidae	Cuculiformes	R
Black Neck Weaver	<i>Ploceus nigricollis</i>	Ploceidae	Passeriformes	R
Black Shouldered Puffback	<i>Dryoscopus senegalensis</i>	Malaconotidae	Passeriformes	R
Black Throated Apalis	<i>Apalis jacksoni</i>	Cisticolidae	Passeriformes	M
Black Winged Oriole	<i>Oriolus brachyrhynchus</i>	Oriolidae	Passeriformes	R
Black Winged Stilt	<i>Himantopus himantopus</i>	Recurvirostridae	Charadriiformes	R
Blck Dwarf Hornbill	<i>Tockus hartlaubi</i>	Bucerotidae	Coraciiformes	R
Blue Bellied Roller	<i>Coracias cyanogaster</i>	Coraciidae	Coraciiformes	P
Blue Billed Malimbe	<i>Malimbus nitens</i>	Ploceidae	Passeriformes	R
Blue Cuckoo Shrike	<i>Coracina azurea</i>	Campephagidae	Passeriformes	R
Blue Headed Crested Flycatcher	<i>Trochocercus nitens</i>	Muscicapidae	Passeriformes	R
Blue Headed Wood Dove	<i>Turtur brehmeri</i>	Columbidae	Columbiformes	R
Bristled Nosed Barbet	<i>Gymnobucco peli</i>	Ramphastidae	Piciformes	R
Broad Billed Roller	<i>Eurystomus glaucurus</i>	Coraciidae	Coraciiformes	M
Bronze Mannikin	<i>Spermestes cucullatus</i>	Estrildidae	Passeriformes	R
Buff Throated Sunbird	<i>Chalcomitra adelberti</i>	Nectariniidae	Passeriformes	R
Buff Throated Woodpecker	<i>Campethera nivosa</i>	Picidae	Piciformes	R
Cassin's Hawk Eagle	<i>Spizaetus africanus</i>	Accipitridae	Accipitriformes	R
Cassin's Spintail	<i>Neafrapus cassini</i>	Apodidae	Caprimulgiformes	R
Chestnut Breasted Negrofinchh	<i>Nigrita bicolor</i>	Estrildidae	Passeriformes	R

Chestnut -Capped Flycatcher	<i>Erythrocercus mccallii</i>	Monarchidae	Passeriformes	R
Chestnut Flanked Sparrowhawk	<i>Accipiter castanilius</i>	Accipitridae	Accipitriformes	R
Chestnut Wattle Eye	<i>Platysteira castanea</i>	Platysteiridae	Passeriformes	R
Chocolate Backed Kingfisher	<i>Halcyon badia</i>	Alcedinidae	Coraciiformes	R
Collard Sunbird	<i>Hedydipna collaris</i>	Nectariniidae	Passeriformes	R
Common Bulbul	<i>Pycnonotus barbatus</i>	Pycnonotidae	Passeriformes	R
Common Wattle Eye	<i>Platysteira cyanea</i>	Platysteiridae	Passeriformes	R
Crested Guinea Fowl	<i>Guttera pucherani</i>	Numididae	Galliformes	R
Crested Malimbe	<i>Malimbus malimbicus</i>	Ploceidae	Passeriformes	R
Dideric Cuckoo	<i>Chrysococcyx caprius</i>	Cuculidae	Cuculiformes	R
Dusky Blue Flycatcher	<i>Elminia nigromitrata</i>	<u>Monarchidae</u>	Passeriformes	R
Dusky Long Tailed Cuckoo	<i>Cercococcyx mechowi</i>	<u>Cuculidae</u>	Cuculiformes	R
Fanti Saw Wing	<i>Psalidoprocne obscura</i>	Hirundinidae	Passeriformes	R
Fire Tailed Alethe	<i>Alethe castanea</i>	Turdidae	Passeriformes	R
Forest Robin	<i>Stiphornis erythrothorax</i>	Muscicapidae	Passeriformes	R
Forest Scrub Robin	<i>Cercotrichas leucosticte</i>	Muscicapidae	Passeriformes	R
Forest Wood Hoopoe	<i>Phoeniculus castaneiceps</i>	Phoeniculidae	Bucerotiformes	R
Fork Tailed Drongo	<i>Dicurus adsimilis</i>	Dicuridae	Passeriformes	R
Frasser's Eagle Owl	<i>Bubo poensis</i>	Strigidae	Strigiformes	R
Gabon Woodpecker	<i>Dendropico gabonensis</i>	Picidae	Piciformes	R
Great Blue Turaco	<i>Corythaeola cristata</i>	Musophagidae	Musophagiformes	R
Great Egret	<i>Ardea alba</i>	Ardeidae	Pelecaniformes	R
Green Combec	<i>Sylvietta virens</i>	Sylviidae	Passeriformes	R
Green Hylia	<i>Hylia prasina</i>	Sylviidae	Passeriformes	R
Green Sunbird	<i>Anthreptes rectirostris</i>	Nectariniidae	Passeriformes	R
Green Tailed Bristlebill	<i>Bleda eximius</i>	Pycnonotidae	Passeriformes	R
Green Turaco	<i>Tauraco persa</i>	<u>Musophagidae</u>	Musophagiformes	R
Grey Ground Thrush	<i>Zoothera prince</i>	<u>Turdidae</u>	Passeriformes	R
Grey Backed Camaroptera	<i>Camaroptera brachyuran</i>	Cisticionidae	Passeriformes	R
Grey Headed Bristlebill	<i>Bleda canicapilla</i>	Pycnonotidae	Passeriformes	R
Grey Headed Bristlebill	<i>Bleda canicapilla</i>	Pycnonotidae	Passeriformes	R
Grey Headed Negrofinch	<i>Nigrita canicapilla</i>	Estrildidae	Passeriformes	R
Grey Headed Rail	<i>Canirallus oculus</i>	Rallidae	Gruiformes	R
Grey Longbill	<i>Macrosphenus concolor</i>	Pycnonotidae	Passeriformes	R
Hairy Barbet	<i>Tricholaema hirsute</i>	Ramphastidae	Piciformes	R
Icterine Greenbull	<i>Phyllastrephus icterinus</i>	Pycnonotidae	Passeriformes	R

Klaas Cuckoo	<i>Chrysococcyx klaas</i>	Cuculidae	Cuculiformes	R
Lagden's Bush Shrike	<i>Malaconotus legdeni</i>	Malaconotidae	Passeriformes	R
Large Billed Puffback	<i>Dryoscopus sabini</i>	Malaconotidae	Passeriformes	R
Lesser Striped Swallow	<i>Hirundo abyssinica</i>	Hirundinidae	Passeriformes	R
Little Swift	<i>Apus affnis</i>	Apodidae	Caprimulgiformes	R
Little Bee Eater	<i>Merops pusillus</i>	Meropidae	Coraciiformes	R
Lizard Burzard	<i>Kaupifalco monogrammicus</i>	Accipitridae	Accipitriformes	R
Long Tailed Hawk	<i>Urotriorchis macrourus</i>	Accipitridae	Falconiformes	R
Lowland Akalat	<i>Sheppardia cyornithopsis</i>	Muscicapidae	Passeriformes	R
Malachite Kingfisher	<i>Alcedo cristata</i>	Alcedinidae	Coraciiformes	R
Maxwell;S Weaver	<i>Ploceus albinucha</i>	Ploceidae	Passeriformes	R
Naked Faced Barbet	<i>Gymnobucco calvus</i>	Ramphastidae	Piciformes	R
Narina's Trogon	<i>Apaloderma narina</i>	Trogonidae	Trogoniformes	R
Narrow Tailed Starling	<i>Poeoptera lugubris</i>	Sturnidae	Passeriformes	R
Nkeulengu Rail	<i>Sarothrura pulchra</i>	Rallidae	Gruiformes	R
Olive- Green Camaroptera	<i>Camaroptera chloronota</i>	Cisticolidae	Passeriformes	R
Olive- Long Tailed Cuckoo	<i>Cercococcyx olivinus</i>	Cuculidae	Cuculiformes	R
Pale Fronted Negrofinch	<i>Nigrita luteifrons</i>	Estrildidae	Passeriformes	R
Palm Nut Vulture	<i>Gypohierax angolensis</i>	Accipitridae	Accipitriformes	R
Pipping Hornbill	<i>Ceratogymna fistulator</i>	Bucerotidae	Bucerotiformes	R
Plain Backed Pipit	<i>Anthus leucophrys</i>	Motacillidae	Passeriformes	M
Plain Greenbull	<i>Andropadus curvirostris</i>	Pycnonotidae	Passeriformes	R
Purple Headed Starling	<i>Lamprotornis purpureiceps</i>	Sturnidae	Passeriformes	R
Red Billed Dwarf Hornbill	<i>Tockus camurus</i>	Bucerotidae	Bucerotiformes	R
Red Billed Firefinch	<i>Lagonosticta senegala</i>	Estrildidae	Passeriformes	R
Red Billed Helmet-Strike	<i>Prionops caniceps</i>	Prionopidae	Passeriformes	R
Red Chested Cuckoo	<i>Cuculus solitarius</i>	Cuculidae	Cuculiformes	R
Red Eyed Dove	<i>Streptopelia semitorquata</i>	Columbidae	Columbiformes	R
Red Faced Cisticola	<i>Cisticola erythrops</i>	Cisticolidae	Passeriformes	R
Red Faced Crimsonwing	<i>Cryptospiza reichenovii</i>	Estrildidae	Passeriformes	R
Red Headed Malimbe	<i>Malimbus erythrogaster</i>	Ploceidae	Passeriformes	R
Red Rumped Tinkerbird	<i>Pogoniulus atroflavus</i>	Ramphastidae	Piciformes	R
Red Tailed Greenbull	<i>Pycnonotus cafer</i>	<u>Pycnonotidae</u>	Passeriformes	R
Red Vented Malimbe	<i>Malimbus scutatus</i>	<u>Ploceidae</u>	Passeriformes	R
Reichenbach1's Sunbird	<i>Anabathmis reichenbachii</i>	Nectariniidae	Passeriformes	R
Rufous Crowned Eremomela	<i>Eremomela badiceps</i>	Sylviidae	Passeriformes	R
Sabine's Puffback	<i>Dryoscopus angolensis</i>	Malaconotidae	Passeriformes	R

Senegal Coucal	<i>Centropus senegalensis</i>	Cuculidae	Cuculiformes	R
Shelley's Eagle Owl	<i>Bubo shelleyi</i>	Strigidae	Strigiformes	R
Shinning Drongo	<i>Dicrurus atripennis</i>	<u>Dicruridae</u>	Passeriformes	R
Simple Greenbull	<i>Chlorocichla simplex</i>	<u>Pycnonotidae</u>	Passeriformes	R
Simple Leaf Love	<i>Chlorocichla simplex</i>	Pycnonotidae	Passeriformes	R
Sooty Flycatcher	<i>Muscicapa infusate</i>	Muscicapidae	Passeriformes	R
Speckled Tinkerbird	<i>Pogoniulus scolopaceus</i>	Ramphastidae	Piciformes	R
Standard Nightjar	<i>Macrodipteryx longipennis</i>	Caprimulgidae	Caprimulgiformes	R
Tick Billed Cuckoo	<i>Pachycoccyx audeberti</i>	Cuculidae	Cuculiformes	R
Variable Sunbird	<i>Cimmyris venustus</i>	Nectariniidae	Passeriformes	R
Velliot's Barbet	<i>Lybius vieilloti</i>	Ramphastidae	Piciformes	R
Velliot's Weaver	<i>Ploceus nigerrimus</i>	Ploceidae	Passeriformes	R
Western Black Headed Oriole	<i>Oriolus brachyrhynchus</i>	Oriolidae	Passeriformes	R
Western Bluebill	<i>Spermophaga haematina</i>	Estrildidae	Passeriformes	R
Western Nicator	<i>Nicator chloris</i>	Pycnonotidae	Passeriformes	R
White Crested Hornbill	<i>Tockus albocristatus</i>	Bucerotidae	Bucerotiformes	R
White Tailed Alethe	<i>Alethe diademata</i>	<u>Musophagidae</u>	Musophagiformes	R
White Thinghed Hornbill	<i>Ceratogymna albotibialis</i>	<u>Bucerotidae</u>	Bucerotiformes	R
White Throated Bee Eater	<i>Merops albicollis</i>	Meropidae	Coraciiformes	P
Woodhouse's Antpecker	<i>Parmoptila woodhousei</i>	Estrildidae	Passeriformes	R
Yellow Breasted Apalis	<i>Apalis flavida</i>	Cisticonidae	Passeriformes	R
Yellow Casqued Hornbill	<i>Ceratogymna elata</i>	Bucerotidae	Bucerotiformes	R
Yellow Fronted Tinkerbird	<i>Pogoniulus chrysoconus</i>	Ramphastidae	Piciformes	R
Yellow Spotted Barbet	<i>Buccanodon duchaillui</i>	Ramphastidae	Piciformes	R
Yellow Wagtail	<i>Motacilla flav</i>	Motacillidae	Passeriformes	P
Blue Spotted Wood Dove	<i>Turtur afer</i>	columbidae	Columbiformes	R
Tambourine Dove	<i>Turtur tympanistria</i>	columbidae	Columbiformes	R

DISCUSSION

Our study showed that species diversity and richness of bird species in the study area were adversely affected by forest modification and land use. From the result obtained bird species recorded in the undisturbed forest were higher than the rest two compartments Fallow Area and the Farmland. The observed change in the species richness of several bird groups along the habitat gradient is remarkable because influences farms and deforestation in the study were large in size compared to the undisturbed area. This is consistent with (Petit and Petit 2003) that understory dwelling rather than canopy or edge-dwelling habit, specialized foraging strategies and restricted geographic range could be responsible for this observation. Waltert et al, (2004) identified general characteristics of forest species sensitive to deforestation and land use, in addition, they suggested that resident birds in contrast to nonbreeding visitors particularly prefer forest habitats. Lindell et al. (2004) reported that resident forest species are often behaviorally inhibited to enter the open agricultural land, functioning as a barrier for dispersal. The Fallow compartment have fewer bird species than the undisturbed forest which is consistent Turner et al. (1997) that secondary forest have a less complex vegetation structure and a lower species richness of larger trees compared to near-primary forest (Turner et al. 1997), which in turn could lead to reduced variability in foraging substrates.

Indeed, the tree diameter distribution and mean high of tree species in the study sites showed that larger trees of certain size classes were reduced in the secondary forest sites compared to a primary forest, and the architecture of secondary forests possibly was more homogeneous than near-primary forest. The relative abundance of avian species in the study area was higher in the farmland than the rest study sites. This agrees with previous work by Kormar (2006) who also reported a high abundance of bird species in cultivated areas, which could be due to food availability. This is also consistent with the result obtained by Best et al, (1990) that the extent of change in bird species composition and abundance depends on the specificity of each bird species habitat requirement, in other words, the species tolerance to changes to its environment. Species with the restricted habitat changes pattern are more vulnerable to changes in land use practices than those occupying a wider variety of environment. From the result of diversity bird species it was higher in the Unlogged Area (4.406) than the rest two other compartments logged Area (3.906) and Farmland (2.962). This result is supported by the previous work were (Kangah- Kesse et al (2008) who surveyed bird diversity in Abiriw sacred grove in Eastern Ghana and used Shannon diversity index recorded a value of 4.46 for the grove a near primary forest and 3.36 for the surrounding cultivated areas. The Undisturbed Area is a primary forest with three strata layers, bird species that utilizes tall emergence trees such the (Black and White Casqued Hornbill and Great Blue Turaco) were encountered and bird species that utilizes under story such as the (Little Greenbull, Common Bulbul, White Tailed Aletheetc.) were also sighted. This is consistent with MacArthur and MacArthur (2001) who reported that diversity increases with the number of layers in the vegetation. Pearson (2001) reported that tropical wet evergreen forest supports more rare bird species than other habitats. Manu (2000) reported that birds select vegetation variables according to the manner by which an individual habitat affects access to food, mates or its vulnerability to predators. This is also in agreement with the report that altering habitats and changing population structure affects avian population. The result also revealed the values for Shannon diversity index, showed that there was no significant difference in bird species diversity between Farmland and Fallow Area, this is expected presumably because of the edge effect in farm land area. This is supported by previous studies, edge effects are described to be remarkably diverse, ranging from changes in species abundance (Manu et al., 2007). Bird species are important indicators of environmental quality and ecological functionality. In this study, we provided data on the response of bird species to certain structural attributes of a natural forest, such as the presence of mature and heterogeneous forest stands (high level of DBH). This study shows that Undisturbed Forest Area which is near primary forest is the best habitats for the birds as far as the numbers and diversity is concerned. As the most serious loss of the biodiversity value occurs in the transformation of original landscapes to croplands due to human interference (Keith et al 1992). Reduction in habitats quality is thought to be the main underlying causes of the declines in most farmland bird species (Newton 2004)

In the farmlands, we have few trees and less (DBH) resulting in the decline of bird species abundance and richness. This is supported by previous work of Donald et al. (2006) reported that the conversion of greater areas of land to farming has reduced habitat heterogeneity and led to reductions in species richness and declines in bird species which were once common forest species.

CONCLUSION AND RECOMMENDATION

Bird species diversity was higher in the Undisturbed forest Area than Fallow area and Farmland within the study area which suggests that land use change between the three blocks was responsible for this.

Large settlement camps are springing up in the study area and these people are involved in logging, majorly cutting down commercial timber species such as *Ceiba pentandra*, *Alstonia congensis*, *Cola gigantea*, *Daniella ogea*. Farming intensification is ongoing in the area and compartments are been cleaved for the cultivation of cocoa and plantain farms. Government official allocates blocks to timber loggers without proper monitoring, and poaching is ongoing too. Deforestation and settlements by the local people should be discouraged Sustainable harvest of tree species in this area should be properly managed so that avian habitats can be supported. Land conversion for agricultural purposes is very high in this region, since most of the communities are agrarian. However, this may increase extinction risk for many threatened and endangered birds in the area, such as African Grey parrot, Black Casqued Hornbill,, Great Blue Twuracos and Crested Guinea fowl. The management of these areas should design programmes to discourage bush burning, livestock grazing, deforestation and illegal farming in the forest area.

As a result of urban settlement catching up with the study area from all directions it is like an Island in trouble. This is the reason the management of this Forest Reserve should seek assistance from other conservation agencies that should come up with technical assistance that will further impact on the management of the forest block within the study area.

Best, L.B., Whitmore, R.C., Booth, G.M. (1990) Use of cornfields by birds during the breedinseason: the importance of edge habitat. American Midland Naturalist 123: 84-99.

Borrow, Nik and Demey Ron. (2012). "A guide to the birds of western Africa". PrincetonUniversity Press

Donald,P.F., Sanderson,F.J., Burfield,I.J. & van Bommel,F.P.J. (2006). Further evidence of Continent-wide impacts of agricultural intensification on European farmland birds, 1990-2000. Agriculture Ecosystems & Environment **116**, 189-196.

Fuller, R.J., Gregory, R.D., Gibbons, D.W., Marchant, J.H., Wilson, J.D., Baillie, S.R., Carter, N. (1996) Population declines and range contractions among lowland farm birds in Britain. Conservation Biology 9: 1425-1441.

GPSU . 1998-2005. GPS Utility Version 4.20.0

Harris, R. J., and J. M. Reed. 2002. Behavioural barriers to non-migratory movements of birds. Annales Zoologici Fennici 39:275–290.

Ikemeh, (2009). Status Survey of the Idanre Forest Reserve: A February 2009 Survey . Report to the A.G. Leventis Foundation, Liechtenstein, the Nigerian Conservation Foundation, Lagos, and the Ondo State Government, Nigeria.

Ibiyomi M.O. 2010. Abundance and distribution of Black and White Colobus monkey in Old Oyo National Park, Unpublished PGD Thesis in The Department of Ecotourism and Wildlife Management, The Federal University of Technology, Akure (FUTA), Nigeria.

Isichei, (1995). Omo Biosphere Reserve, Current Status, Utilization of Biological Resources and Sustainable Management (Nigeria). Working Papers of the South-South Cooperation Programme on Environmentally Sound Socio-Economic Development in the Humid Tropics. UNESCO, Paris.

Kangah-Kesse, D. K. Attuquayefio, E. H. Owusu, and F. Gbogbo, (2008) "Bird species diversity and abundance in the abiriw sacred grove in the Eastern region of Ghana," West African Journal of Applied Ecology, vol. 11, pp. 41–50, 2007. View at Google Schola

Keay.R.W.J.,(1989), Trees of Nigeria. A review version of Nigerian trees (1960, 1964) by R. WJ Keay, C. F. A Onochie and D. P Strandfield. Claridon Press Oxford University press: Pp 476 pp.

Komar, O. (2006) Ecology and conservation of birds in coffee plantations: a., critical review. Bird Conservation International 16:1-23

Koyenikan, I.O. (2004). Impact of human activities on the primates of Okomu National

Park, Edo State, Nigeria. (Unpublished master's thesis). Federal University of Technology, Akure, Nigeria.

Luiselli, L., Amori, G., Akani, G. C., & Eniang, E. A. (2015). Ecological diversity, community structure and conservation of Niger Delta mammals. *Biodiversity and Conservation*, 24(11), 2809-2830.

Lugo, A. E. 1988. Estimating reductions in the diversity of tropical forest species. Pages 58–70 in E. O. Wilson, editor. Biodiversity. National Academy of Sciences Press, Washington, D.C., USA.

MacArthur R. H. and MacArthur J. W. (1999). On bird species diversity. *Ecology* 42, 594 - 598.

Manu, S.A., (2000) Effects of habitat fragmentation on the distribution of forest birds in south western Nigeria with particular reference to the Ibadan Malimbes and other Malimbes, PhD thesis. University of Oxford.

Manu, S., Peach, W. & Cresswell, W. (2007). The effects of edge, fragments West Africa. *Ibis* 149:287-297.

Mengistu, and Salami . (2007). Application of remote sensing and GIS inland use/land cover mapping and change detection in a part of south western Nigeria. *African Journal of Environmental Science and Technology* Vol. 1 (5), pp. 099 -109.

Newton, I. (2004) The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. *Ibis*, 146, 579-600

Olajuyigbe, and Adaja Floristic composition, tree canopy structure and regeneration in a degraded tropical humid rainforest in southwest Nigeria. *Tanzania Journal of Forestry and Nature Conservation, Volume 84(1) December 2014*

Oates, J.F., Gippoliti, S. and Groves, C.P. 2008. *Cercocebus torquatus*. The IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on 08 August 2015.

Ogunjemite, B.G., Afolayan T.A. and Agbelusi E.A. (2005) Habitat Structure of Chimpanzee Community in Ise Forest Reserve, Ekiti State, South-western Nigeria, *Afr. J. Ecol.*, 43, 396 -399

Sutherland, W.J. (2009). *From Individual Behavior to Population Ecology*. Oxford: Oxford University Press

Thiollay, J.-M. 1995. The role of traditional agroforests in the conservation of rain forest bird diversity in Sumatra. *Conservation Biology* 9:335–353

Turner, I. M., Y. K. Wong, P. T. Chew, and A. bin Ibrahim. 1997. Tree species richness in primary and old secondary tropical forest in Singapore. *Biodiversity and Conservation* 6:537–543

Waltert, M., A. Mardiatuti, and M. Mühlenberg. 2004. Effects of land use on bird species richness in Sulawesi, Indonesia. *Conservation Biology* 18:1339–1346. White, F. 1983. *The vegetation of Africa*. UNESCO, Paris,

Werre, (2001). Nigerian Lowland Ecoregion, Wild World Report, www.worldwildlife.org

Saj, T. & P. Sicotte. 2013. *Colobus vellerosus*, White-thighed colobus (Geoffroy's Pied colobus, Ursine Colobus). In J. Kingdon, D. Happold, T. Butynski, M. Hoffmann, M. Happold, J. Kalina, (Eds.), *Mammals of Africa*. Vol. II Primates (pp. 109-111). London: Bloomsbury Publishing.

Ajiboye, A. (2012). Assessment of Aesthetic Value of Old Oyo National Park. *American Journal of Tourism Management*, 1(3), 69-77.

Alarape. A. (2002). Culture and Conservation in and around Old Oyo National Park.

PhD Thesis, University of Ibadan. Baker, L. R., Tanimola, A. A., Olubode, O. Oates, J.F., S. Gippoliti & C.P. Groves. 2008d. *Procolobus verus*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Accessed January 28, 2014.

- Oates, J.F., Gippoliti, S. and Groves, C.P. 2008e. *Cercocebus torquatus*. The IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on 08 August 2015.
- Ogunjemite, B.G., Afolayan T.A. and Agbelusi E.A. (2005) Habitat Structure of Chimpanzee Community in Ise Forest Reserve, Ekiti State, South-western Nigeria, *Afr. J. Ecol.*, 43, 396 -399.
- Ogunsesan, D., Oyedepo, J., Oates, J., Adeofun, C. O., Ikemeh, R., & Bergl, R. (2012). GIS-Supported Survey of Low-Land Rain Forests in South-Western Nigeria. *COLERM Proceedings*, 1, 141-154.
- Oksanen, J., Blanchet, F. G., Kindt, R., Legendre, P., Minchin, P. R., O'Hara, R. Gavin L. Simpson, Solymos, P., Henry, M., Stevens, H., Wagner, H. (2013). Package vegan R Packag ver, 254, 20-8.