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Full Length Research Article

BIRD SPECIES RICHNESS AND ABUNDANCE IN AN URBAN DISTURBED WOODED SAVANNA

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ABSTRACT
Changes in natural habitats by man in the tropics, especially through change in land use constitute a great threat to biodiversity. Habitat modification as a result of human population growth and development activities are the leading causes of biodiversity loss, including decline in bird species abundance and richness. Human activities such as bush burning, felling of trees, indiscriminate dumping of refuse, illegal mining activities are common sight at the Jos Wildlife. This study determined the distribution of bird species abundance and richness in disturbed areas of the Jos Wildlife Park namely mining, logged, gallery forest and savanna sites at the Jos Wildlife Park. The Jos Wildlife Park is located within the Jos Plateau of Plateau State, North-central Nigeria (09°53'N and 08°58'E). This forms a unique vegetation unit, within the Guineo-Congolian/Sudanian Regional Transition Zone. SPSS statistical software was used to analyze data. A total of 527 individual birds, 66 bird species in 35 families were recorded in July 2023. Although there was no significant difference in bird species abundance across the savanna, logged, mining and gallery forest sites, data showed that Savanna Site had the highest bird species abundance. There was no significant difference in bird species richness across the savanna, logged, mining and gallery forest sites, although data showed that Gallery Forest had the highest bird species richness. We conclude that bird species abundance and richness at the Jos Wildlife Park were recorded in denser vegetation compared with areas with less dense and sparsely distributed vegetation.

Keywords: Birds, Urban Disturbed, Wildlife Park.

INTRODUCTION

Urbanization is an important threat to biodiversity and conservation, including bird conservation. This threat has raised a lot of concerns over the future of biodiversity with the ever-growing urbanization around protected areas (Evans *et al.*, 2011). In many developing countries where biodiversity is high, a large number of wildlife survive outside conserved areas such as farmlands, pasturelands, and in urban areas (Hitchmough & Dunnett, 2004; Bolwig *et al.*, 2006). Among all wildlife, birds are one of the most common wildlife in urban areas, in neighborhoods and cities, and bird populations have shown a steady decline due to landscape modifications, urban expansion and human population growth (Austin & Smith, 1972; Coppedge *et al.*, 2001; Evans *et al.*, 2009; Strohbach *et al.*, 2009). Because of the significant roles that birds play in the establishment of climax community, conservationists seek their protection to manage biological threats and efficiently protect the environment (Stevenson & Fanshawe, 2002).

Birds play several ecological functions in their habitats. For example, they are bioindicators of the health of ecosystems (Mistry *et al.*, 2008; Slabbekoorn & Ripmeester, 2008). Frugivorous birds play important role in seed dispersal of fleshy fruit producing plants (Stevenson & Fanshawe, 2002), plant pollination as demonstrated by sunbirds, which participate in crossbreeding of flowering plants, especially those with bird-pollination syndrome (Judd *et al.*, 2008). In view of the role that birds play on planet earth, they receive special attention from people all over the world, who seek their protection and help to reduce environmental threats (Stevenson and Fanshawe, 2002).

The importance of landscapes and habitat characteristics in predicting bird species richness undoubtedly vary in influence, depending on spatial scale (Bohning-Gaese, 1997). In particular, strong evidence indicates that the influence of some habitats, landscape and environmental predictors of bird species richness vary among local, regional and global spatial scales (Ricklefs, 1987; Currie, 1991; Levin, 1992).

Conversion of natural habitats by man in the tropics, especially through change in land use poses a great threat to biodiversity (Green *et al.*, 2005). Habitat modification caused by growth in human population and human development activities are the leading cause of biodiversity loss. The abundance of birds, however, tends to reduce in transformed landscapes and is not suitable for birds seeking cover and food (Robinson & Wilcove, 1994; Jose *et al.*, 2009). Human activities such as bush burning, felling of trees, indiscriminate dumping of refuse, illegal mining activities are common sight at the Jos Wildlife. With these anthropogenic activities, this study is curious as to how bird's population and distribution are impacted at the Jos Wild Life Park. Specifically, we aimed to determine bird species richness and abundance in disturbed areas of the Jos Wildlife Park namely mining, logged, gallery forest and savanna sites.

MATERIALS AND METHODS

Description of Study Area

This study was conducted at the Jos Wildlife Park, Jos, Plateau State, Nigeria. The Jos Plateau has the highest landmass and forms an isolated vegetation unit, within the Guinea- Congolian Sudanian Regional transition zone. It is located in the north central region of the country with land mass of about 26,899 sq Km, it lies between Latitude 08˚ 24' North and Longitude 08˚ 32' East. Temperature varies markedly through the month reaching its minimum of 8˚c to 15˚C during the harmattan (dry) season, characterized by cool, dusty wind which occurs between November and mid-February. Great heat usually follows in March, followed by the rains in April. Temperature may rise well above 32˚C between April and October. Annual rainfall ranges from 131.15mm to 146.00mm. The rains are accompanied by extreme low

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temperatures (6˚C), leading to cold weather conditions (Payne, 1998).

The Jos Wildlife Park was established in 1972. The park is located on the South West of Jos, Plateau State, Nigeria at Latitude 9˚ 52' and Longitude 8˚ 53' and covers an area of approximately 8km^2. It is characterized by hilly and rocky topography with seasonal streams, good savannah woodland and riparian forest and also consists of some exotic plants. The Park consists of caged animals and a safari area. The park is now located in the middle of the Jos city with massive growing human settlement and development. The Jos Wildlife Park is uniquely located to serve as carbon sink to the city of Jos and the largest protected area compared with other capital cities in Nigeria.

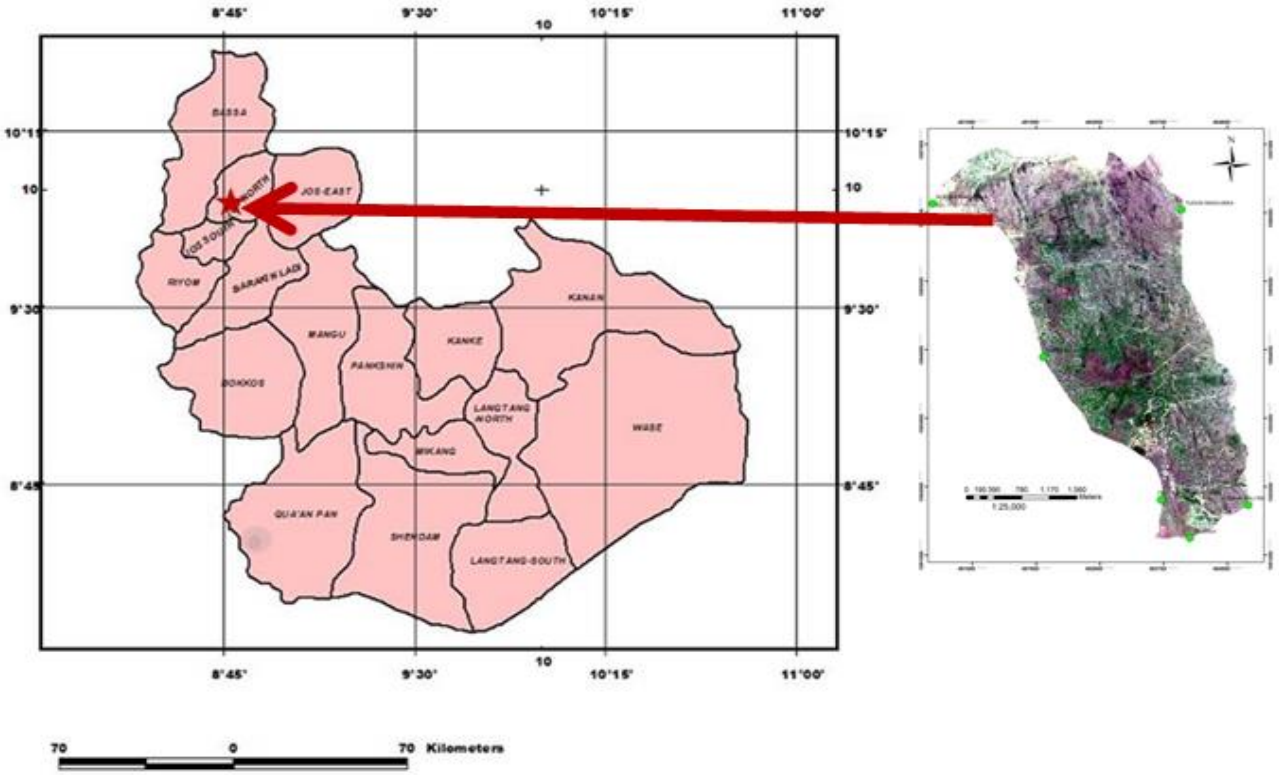

Figure 1. Map of Plateau State Indicating Satellite Image of the Jos Wildlife Park
Source: Ministry of Lands and Survey, Plateau State

Bird survey design

Point count techniques was used (Bibby *et al.*, 2000) to generate information on bird species distribution in the various sites namely the mining, gallery forest, savanna and logged sites. During the surveys, birds were identified early in the morning from 0630 hours to 1030 hours and late afternoon from 1600 hours to 1830 hours when the temperature is relatively cool but high bird's activities (Bibby *et al.*, 2000). Birds were identified with the aid of a pair of binoculars (Bushnell 10x42) and field guide (Borrow and Demey, 2008).

At each site, the number of birds seen or heard were recorded within 5 minutes. All birds heard or seen were recorded. Settling time was not observed as birds in the tropics do not remain in a site with observer presence.

All data were inputted in Excel Spread Sheet. SPSS 24 statistical software was used to analyze the data. Normality assumptions were observed. Bird species abundance followed a normal distribution and so ANOVA was used to analyze bird species abundance across sites. In the case of bird species richness, Kruskal Wallis test was used, where the data did not assume normality principle. Bird species abundance and richness values were presented on a bar chart against various disturbed sites.

RESULTS

Bird species inventory

A total of 527 individual birds, 66 bird species in 35 families were recorded in July 2023. Ninety four percent were birds recorded during transect walk whereas 6 percent outside transect walk. Of the 35 families non-passerines had 16 and passerines had 19 (Table 1).

Bird species abundance and richness

There was no significant difference in bird species abundance across the savanna, logged, mining and gallery forest sites (ANOVA: df=3, F= 2.39, P=0.07). However, data showed that Savanna Site had the highest bird species abundance. This is followed by Gallery Forest, Mining and Logged Sites (Figure 2).

There was also no significant difference in bird species richness across the savanna, logged, mining and gallery forest sites (Kruskal Wallis: df=3, H= 4.5, P=0.21). However, data showed that Gallery Forest Site had the highest bird species richness. This was followed by Savanna, logged and mining sites (Figure 3).

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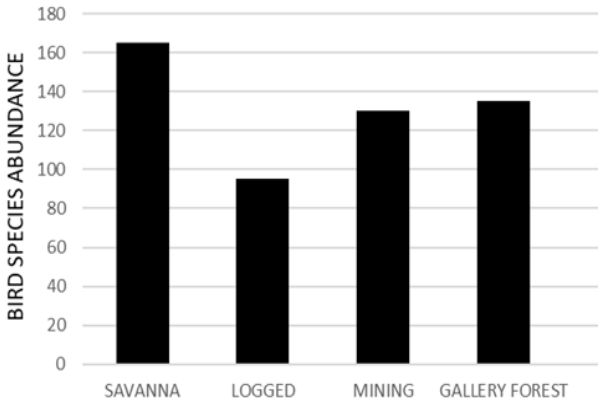

Figure 2. Bird species abundance across sites at the Jos Wild Life Park

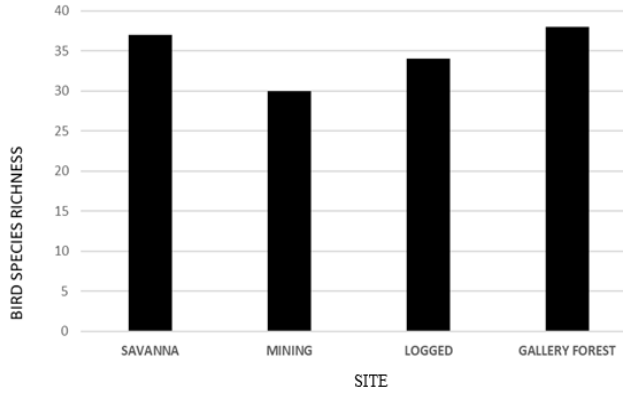

Figure 3. Bird species richness across sites at the Jos Wild Life Park

Table 1. Checklist of birds recorded at the Jos Wildlife Park

NON-PASSERINES			
Family	**Common Name**	**Scientific Name**	**Number of Sighting Records**
Falconidae	Common kestrel	*Falco tinnunculus*	1
Phasianidae	Stone Partridge	*Ptilopachuspetrosus*	3
	Double-spurred Francolin	*Francolinusbicalcaratus*	7
Charadriidae	African Wattled-lapwing	*Vanellussenegallus*	2
Columbidae	Vinaceous Dove	*Streptopeliavinacea*	7
	Laughing Dove	*Streptopelia senegalensis*	1*
	Red-eyed Dove	*Streptopeliasemitorquata*	1
	Black-billed Wood Dove	*Turturabyssinicus*	8
	Adamawa Turtle Dove	*Streptopeliahypopyrrha*	12
Psittacidae	Senegal Parrot	*Poicephalussenegalus*	6
Musophagidae	Western Grey Plantain-eater	*Crinifer piscator*	5
	Violet Turaco	*Musopghagaviolacea*	15
Cuculidae	Senegal Coucal	*Centropus senegalensis*	8
	Yellowbill	*Ceuthmochares aureus*	1
	Red-chested Cuckoo	*Cuculus solitarius*	9
	Klaas's Cuckoo	*Chrysococcyxklaas*	11
Carprimulgidae	Standard-winged Nightjar	*Macrodipteryx longipennis*	1*
Apodididae	African Palm Swift	*Cypsiurusparvus*	2
	Little Swift	*Apus affinis*	3
Coliidae	Speckled Mousebird	*Coliusstriatus*	5
Alcedinidae	Malachite Kingfisher	*Ceryxcristata*	1
Meropidae	Red-throated Bee-eater	*Meropsbulocki*	14
Bucerotidae	Red-billed Hornbill	*Tockuserythrorhyncus*	12
Capitonidae	Vieillot's Barbet	*Lybiusvieilloti*	9
	Yellow-fronted Tinkerbird	*Pogoniuluschrysoconus*	16

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Indicatoridae	Greater Honey Guide	*Indicator*	5*
Picidae	Cardinal Woodpecker	*Dendropicosfuscescens*	1
PASSERINES			
Alaudidae	Crested Lark	*Galerida cristata*	2
	Flapped Lark	*Mirafrarufocinnamomea*	2
Hirundinidae	Fanti Saw-wing	*Psalidoprocne obscura*	21
Motacillidae	Yellow-throated Longclaw	*Macronyx croceus*	13*
Pycnonotidae	Common Bulbul	*Pycnonotus barbatus*	26
	Yellow-throated Leaf-love	*Chlorocichlaflavicollis*	17
Turdidae	African Thrush	*Turdus pelios*	10
	Snowy-crowned Robin Chat	*Cossyphaniveicapilla*	6
	Familiar Chat	*Cercomelafamiliaris*	12
	White-crowned Cliff-Chat	*Thamnolaeacaronata*	1
	Northern Ant-eater Chat	*Myrmecocichla aethiops*	2*
	Yellow-throated LeaflovE	*Chlorocichlaflavicollis*	17
Sylviidae	Moustached Grass-Warbler	*Melocichla mentalis*	6
	Oriole Warbler	*Hypergerusatriceps*	1
	Northern Crombec	*Sylviettabrachyura*	2
	Senegal Eramomela	*Eremomelapusilla*	3
	Short-winged Cisticola	*Cisticola brachypterus*	4
	Singing Cisticola	*Cisticola cantans*	10
	Tawny-flanked Prinia	*Priniasubflava*	1
	Grey-backed Camaroptera	*Camaroptera brevicaudata*	66
Muscicapidae	Northern Black Flycatche	*Melaenoinisedolioides*	2
Monarchidae	African Paradise Flycatcher	*Terpsiphone iridis*	8
Platysteiridae	Senegal Batis	*Batis senegalensis*	2*
	Common Wattle-eye	Platysteiracyanea	3
Timaliidae	Brown Babbler	*Turdoidesplebejus*	6
Zosteropidae	Yellow White-ey	*Zosterops senegalensis*	13
Nectariniidae	Variable Sunbird	*Cinnyrisvenustus*	10
	Copper Sunbird	*Cinnyriscupreus*	3
	Green-headed Sunbird	*Cyanomitraverticalis*	3*
	Scarlet-chested Sunbird	*Chalcomitra senegalensis*	15
Laniidae	Yellow-billed Shrike	*Corvinella corvina*	7
Malaconotidae	Yellow-crowned Gonolek	*Laniariusbarbarus*	8
	Orange-breasted Bush Shrike	*Malaconotussulfureopectus*	11
	Tropical Boubou	*Laniariusferrugineus*	18
	Black-crowned Tchagra	*Tchagrasenegalus*	18
Sturnidae	Violet-backed Starling	*Cinnyricinclusleucogaster*	10

	Purple Glossy Starling	*Lamprotornispurpureus*	22
Passeridae	Bush Petronia	*Petronia dentata*	2
Ploceidae	Northern Red Bishop	*Euplectesfranciscanus*	2*
	Yellow-mantled Widow Bird	*Euplectesmacrorus*	1
	Little Weaver	*Ploceusluteolus*	1
	Village Weaver	*Ploceuscucullatus*	18
Estrildidae	Red-billed Firefinch	*Lagonostictasenegala*	2*
	Rock Firefinch	*Lagonostictasanguinodorsalis*	1
	Red-cheeked Cordon-bleu	*Uraeginthusbengalus*	10
	Bronze Mannikin	*Spermestescuculatus*	5*
Viduidae	Village Indigobird	*Viduachalybeata*	1
	Pin-tailed Whydah	*Vidua macroura*	1

*Birds recorded outside point countl

DISCUSSION

The high bird species abundance and richness in the gallery forest and the savanna perhaps reflects higher density of vegetation in these sites when compared with mining and logged sites (Gajera *et al.* 2013). More vegetation cover with denser tree species were observed in the gallery and savanna habitat types compared with the mining and the logged sites of the reserve where the vegetation cover is by far less densed (Chaskda and Mwansat, 2014, Turshak and Mwansat, 2021). Studies have shown that higher vegetation complexity correlates positively with animal species richness including birds. Turshak *et al.* 2011 in their study of the effects of habitat structure and altitudinal gradients on avian species diversity at Kurra Falls forest in Nigeria, suggests that tree height, tree number, and percentage canopy cover are probably the most important factors determining the species diversity (Turshak *et al.,* 2011), which could apply to species richness. Reduction in structural heterogeneity (as seen in the logged and mining sites) from woody plant densification has profound impacts on animal communities, resulting in species turnover and reduced diversity in birds, bats, and other small and large mammals (Parker *et al.* 2023). Birds and indeed other fauna rely on vegetation for their habitat, food and other resources.

Human disturbance affects biodiversity both directly through anthropogenic activities over land, and indirectly due to land use and human behaviours within urban areas (Elmqvist *et al.* 2013). It was observed that there were more shrubs and trees in the gallery forest and savanna sites of the park compared with the logged and mining sites. The mining activities ongoing at the park and cutting down of trees has led to change in the composition of the landscape, and has displaced birds or may alter or eliminate the conditions within a habitat that a species requires to survive, for example, birds such as Oriole Warblers that requires vegetation cover were observed to be confined to gallery forest where the vegetation cover was denser than savanna whereas in sites of the logged and mining sites. Human activity has the effect of decreasing, fragmenting, and isolating natural patches by altering the size, shape, and interconnectivity of the natural landscape (Elmqvist *et al.* 2013). Habitat heterogeneity is a key driver of the diversity and distribution of species. African savannas are experiencing changes in their vegetation structure causing shifts towards increased woody plant cover, with consequent vegetation structure homogenization (Parker *et al.* 2023).

This finding confirmed the studies of Parker *et al.* (2023), where plots that had higher tree density supported greater bird richness and abundance. Habitat structure and herbaceous or shrubs cover showed established drivers of animal communities (Aranda & Graciolli, 2015; Brüggeshemke *et al.*, 2022; Schmitt *et al.*, 2022), as such, any habitat management practice that affects vegetation structure and cover will also impact the animals relying on the vegetation. However, we show that these impacts are variable depending on the taxonomic group being assessed.

Heterogeneity within habitats is also an important driver of diversity and abundance of bird communities. In other systems, both bird diversity and abundance generally increase in habitats that have more complex vertical and horizontal architectures because a greater variety of resources are available and there is greater potential for segregation at the microhabitat/niche level (Brüggeshemke *et al.*, 2022). The higher density of trees likely provided important perching stations for these species. It is possible, however, that the higher visibility in the plots that had lower grass biomass (i.e., the summer mow) also enhanced insect prey catchability, similar to what was seen in the behaviour of the Red-throated Bee-eater (Brüggeshemke *et al.,* 2022). Vegetation structure is important to the influence of avian habitat selection (Chaskda and Mwansat, 2014). In avian territoriality for example, certain vegetation structures such as leaf dispersion or foliage density could serve as cues in determining food resource rich areas such as caterpillar density. This is possible in situations where food abundance and vegetation features correlate. Among other mammalian fauna recorded, the Tantalus Monkey *Cercopithecus aethiops* is perhaps the commonest mammal in the forest reserve, at the Jos Wildlife Park. There is an apparent indication that the Tantalus Monkey groups in the reserve are under threat. This is because they move in large group sizes of mostly between twelve and twenty and were only recorded in and near the camp and not in the interior of the forest.

Conclusion

This finding confirmed more bird species abundance and richness in the sites with denser vegetation compared with areas with less dense and sparsely distributed vegetation. The Jos Wildlife Park is

losing its natural vegetation at an alarming rate, especially areas bordering the Park such as Tudun Wadda and Kabong communities in Jos. These communities illegally cut trees for fuel wood with others intruding the park for mining activities and farming activities including encroachment with residential buildings. A more extended study could be carried out to ascertain bird species that are most affected by the anthropogenic activities.

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