Research Article

Avifauna species diversity across habitat types in Ardo-Kola and Yorro in Taraba state, Nigeria

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Abstract

The aim of this study was to determine and compare avifauna diversity Ardo-kola and Yorro local Government area. The habitats were divided into Open Habitat, Montane Forest and Plantation Habitat. Point count method was used to collect data on avifauna diversity. Shannon Wiener diversity index (H) was used to determine species diversity. Higher diversity was observed during the wet season in the montane forest (3.034) and during the dry season, higher diversity was observed in the open habitat (3.203). The findings from this study provide evidence that open habitat can serve as a refuge for avifauna species. Therefore, there is need for conservation attention.

Introduction

Birds are visible and integral part of the ecosystem. Their occurrences have been helpful as environmental health indicators, crop plants pollinators and seed dispersal as well as pest control (Bideberi, 2013). Bird's species diversity and distributions along the landscape is not uniform (Bibby *et al.,* 1992). Their patterns are strongly related to environmental factors (climatic condition, topography and habitats) and human interventions which determine bird species diversity (Rodriquez-Estrella, 2007; Jankowiski, 2009).

Diversity has been referred to as the quantitative measure that reflects how many different species are in existence in a data set. A variety of objective measures have been created in order to measure diversity. The basic idea is to obtain a quantitative estimate of biological variability that can be used to compare biological entities, composed of direct components, in space or time (Albert, 2012).

Species diversity is often measured as an index that incorporates the interplay between species richness and abundance (Ramchandra, 2013). Quantifying the avifauna species abundance and diversity in communities has gained increasing importance in environmental impact assessment especially in conservation planning and ecological research (Ali *et al.,* 2019). Species inventories not only help in understanding species losses but also help determine the characteristics of species that are vulnerable to habitat perturbations (Kwaga *et al.,* 2019). Assessment of avifauna species is essential for sustainable development. The lack of it, results in weak monitoring of bio-data, vegetation degradation and loss of ecosystem resources. Wrong attitude towards achieving its goal has led to reduced variety of ecosystem potentials which could have negative impact on socio-economic development of varieties of goods and services derived from the ecosystem (Ali *et al.,* 2019).

Diversity is the biological assemblage of species in its entity, which is the complete representation of all possible measures of biological diversity across space and time (Kwaga *et al.* 2017). Species diversity is often measured as an index that incorporates the interplay between species richness and abundance (Ramchandra, 2013). Quantifying the avifauna species diversity in communities has gained increasing importance in environmental impact assessment especially in conservation planning and ecological research. Species inventories not only help in understanding species losses but also help determine the characteristics of species that are vulnerable to habitat perturbations (Khobe and Kwaga, 2017). Evaluation of avifauna species is essential for sustainable development. The lack of it, results in weak monitoring of bio-data, vegetation degradation and loss of ecosystem resources (Ali *et al.,* 2019). Wrong attitude towards achieving its goal has led to reduced variety of ecosystem potentials which could have negative impact on socio-economic development of varieties of goods and services derived from the ecosystem.

Birds have been used as source of income and key model for measuring the quality of the altered biodiversity, where diversity of birds is influence by habitat stability (Ngongolo and Mtoka, 2013b). Some bird species depend on the disturbed habitat for food and shelter such as homegarden. Reduction in their habitats therefore forces the species to migrate to other areas permanently. Human activities such as farming, settlement, charcoal making, pole cutting and firewood collection have contributed in removal of forests (degradation) which has extensively damaged the natural habitat of birds, affecting their variety and variability (Storch *et al.,* 2003). Different Studies found different birds diversity in Uluguru Mountains. While Doggart *et al.* (2005) found about 140 species from 40 families, Frontier-Tanzania (2005) found 95 species from 34 families of birds respectively within the protected land. Previous researches on avifauna within the state focuses on the pattern of seasonal abundance and diversity of avifauna in wetland, deforestation and other related research topics. Therefore, there is urgent need to understand and precisely predict the likely consequences of changes in bird's habitat due to natural or anthropogenic activities (examples; logging, and pollution) on species distribution, diversity and abundances which is a major requirement for achieving the conservation of biodiversity. For such changes to be known or detected, considering the importance of birds to our environment or society, this will uncover the need to safeguard the avifauna species and the decline in their population and diversity within the study area, assess the problem (habitat loss) to safeguard the avifauna species and produce more information about avifauna species. For such changes to be known or detected, considering the importance of birds to our environment or society, this will uncover the need to safeguard the avifauna species and the decline in their population and diversity within the study area, assess the problem (habitat loss) to safeguard the avifauna species and produce more information about avifauna species. The aim of this research work is to determine and compare the diversity of avifauna species of the study area.

There is limited or no research work carried out around the study area to checkmate or come up with information on avifauna diversity. This study seeks to collect baseline data to come up with appropriate major to conserved the environment and to provide information on birds diversity and Therefore, information on the avifauna of the Ardo-kola and Yorro Local Government will help to fill in the gaps and update the scanty information available, and this will help reaching sound decision on matters pertaining to conservation of biological diversity of the area as a constituent of the universe.

Materials and Methods

Description of the Study Areas

The study was carried out in Ardo-kola and Yorro Local Government Area of Taraba State, Nigeria (Figures 2)

Ardo-kola Local Government is situated between latitude $9^0 00$'N and $9^0 30^/$N and longitude $11^0 00$'E and $12^0 00$'E. The Local government lies to the west of Jalingo main town it about 10 minutes drive to Sunkani, Ardo-Kola local government administrative headquarters. Yorro Local Government Area is located between latitude $8^0 42$'N to $9^0 12$'N and longitude 11^0 20'E to 11^0 45'E. Yorro LGA.

Rainfall

Taraba State lies entirely North of the equator and within the tropics. The rainy season coincides with the Northern hemisphere summer. The mean annual rainfall here is between 900mm 1600mm isohytes. Rainy season last for about 6-7 months. Rainfall varies widely from place to place to year except in a few mountainous localities. The year has been divided into two seasons: wet and dry seasons. The total annual rainfall season from South to the North (Elgood, 1994).

Vegetation

There is hardly any vegetation that has not been affected by human activities in the state. Farming, logging, hunting, urbanization, road construction and other development activities as well as the rapid expanding population have together reduced the state natural plant cover to isolated remnants. Based on the edaphic and climatic conditions, the following vegetation zones are recognized in Taraba State Southern: Guinea Zone, Northern Guinea Zone, Montane Forest, and Montane Grassland (Federal Ministry of Environment, (FMEN) 2001).

Socio-Economic Activities

Hunting is the traditional occupation of the people while farming is the most important economic activity. Cattle rearing and petty trading are also carried out in the area. Important crops produced in the area include yam, maize, groundnut, guinea corn, bambara nut, millet, tiger nut and cassava (Ahmed *et al.,* 2011).
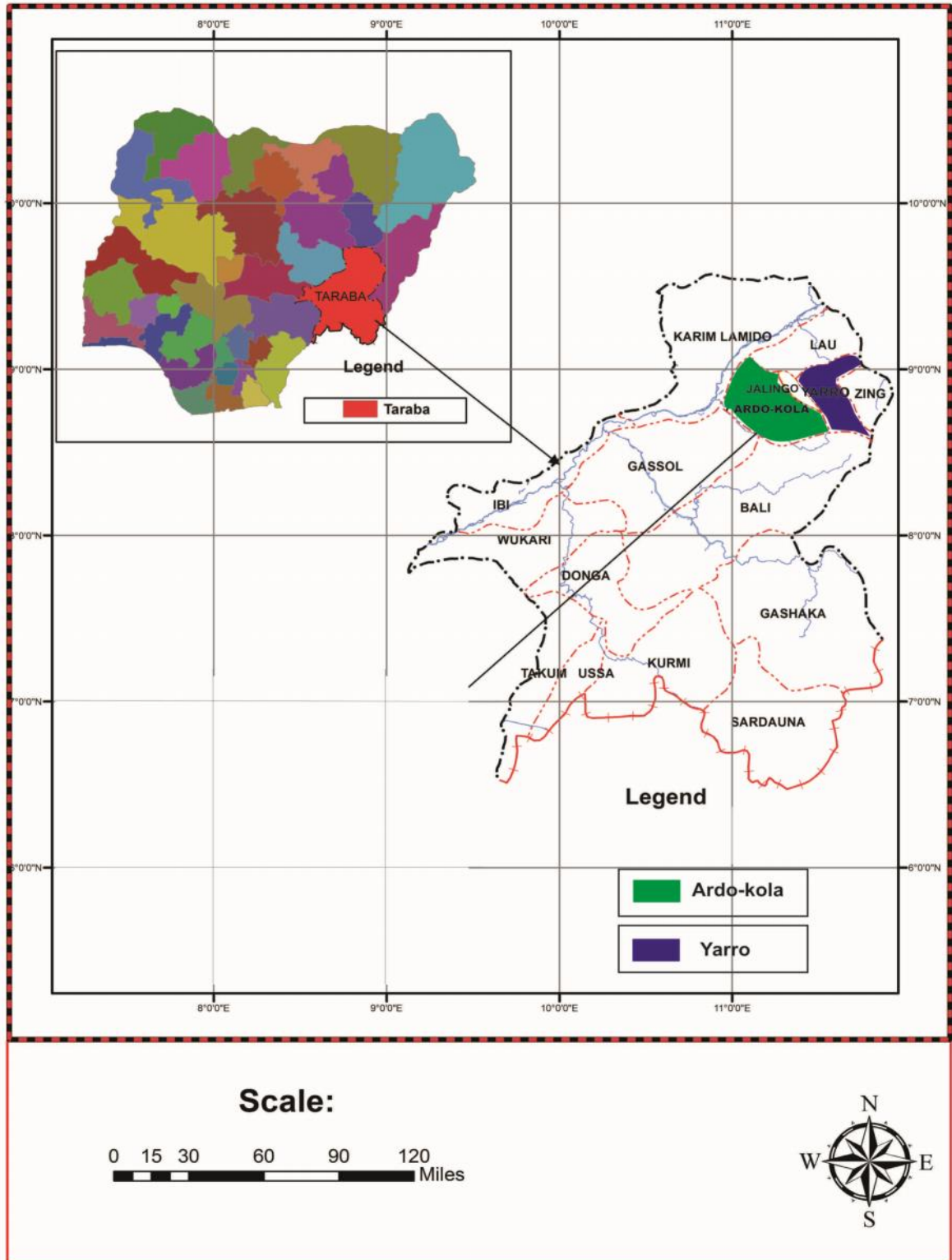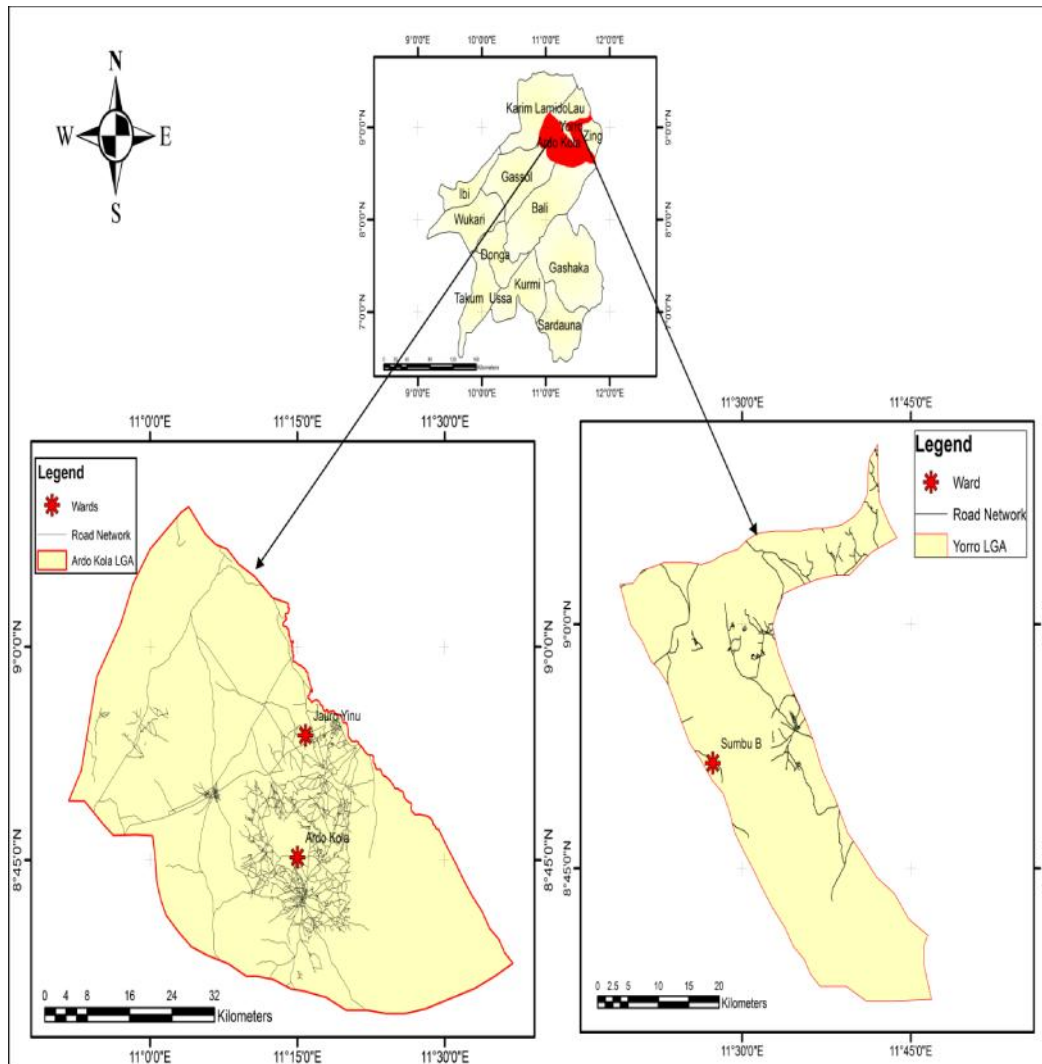
Figure. 1. Map of Nigeria Showing Taraba State

Figure.2. Map of Taraba State showing Study Area

Study Design and Data Collection Techniques

The study was conducted in Ardo-kola and Yorro Local Government Area of Taraba. Data were collected during the wet season and dry season (September 2021-February 2022) for 15 days every month. The area was stratified into Montane forest, Plantation habitat and Open habitat. Montane forest was defined as an area with density of trees and mountains ; plantation habitat as an area of covered with economic trees and farm lands; open habitat was defined as vegetation characterized by height of two (2) meters but not exceeding eight (8) meters. The coordinate of each habitat were taken using hand held GPS (eTrex 20X GARMIN).

Point Count Method was used for bird census at the study area. Hence, counting station was established systematically and land marks such as stones, posts or tree were used to mark with conspicuous water resistant paint. The number of counting stations was 30 point for each habitat. However, the stations were spaced in such a way to ensure that they were not overlapping in the counting of avifauna species. The spacing distance was 100m to avoid counting of individual avifauna species for more than one counting station, which could spuriously inflate the sample size and influence the result. This is because if the space is too small other species would be overlooked and if it's too long there will be overlapping.

Point Count Method as outlined by Bibby*et al.* (1992), Ralph *et al.* (1993) and Sutherland (1997) were used for the census of birds on each study site. Proper data sheet was used for recording of data. Binocular, field guides and watch was used for the censuses. Birds census was taken from 6:30am to 8:30am during the day; this is because birds are more active and can be easily seen during the early hour of the day. On arrival at a counting station, the observer waited for 3 minutes before counting began (Bryan *et al.,* 1984). This was done to allow the birds to settle down following expected disturbance by the arrival of the observer. The observer positioned himself at the counting station and recorded all the birds identified by sight or calls within a fixed distance of 25m and beyond the distance separately. Each avifauna species was counted only once.

Data Analysis

From the data collected, avifauna species diversity was analysed using Shannon Weiner Diversity Index (Usher, 1991). The index is stated as follow:

$$H^1 = -\sum Pi(\ln Pi)$$

Where: H^I = the Shannon Index, Pi is the proportion of the ith species in the sample, ieni/N (ni= abundance of each species and N = total number of individual species), and InPi is the natural logarithm of the species proportion.

Results

Bird species diversity for the 3 habitats during the wet season shows that for Shannon Weiner Diversity Index, Montane forest (3.034) took the lead, followed by Open habitat (2.978) then the least Plantation habitat (2.865).

In terms of species richness, Open habitat (3.583) recorded the highest, followed by Montane forest (3.258) and the least was Plantation habitat (3.219). Also in terms of evenness, Montane forest (0.931) was the most even, followed by Plantation habitat (0.890) and the least Open habitat (0.831). (Table I)

Table 1: Bird Species Diversity across Habitat Types during Wet Season in Ardo-kola and Yorro L.G.A, TarabaState , Sept-Nov. 2022

Diversity measure	Open habitat	Plantation habitat	montane forest
Shannon (H)	2.978	2.865	3.034
Richness (Ins)	3.583	3.219	3.258
Evenness (H/Ins)	0.831	0.890	0.931

Bird species diversity for the 3 habitat types during the dry season shows that for Shannon Wiener Diversity Index, Open habitat (3.203) took the lead, followed by Plantation habitat (2.750) then Montane forest (2.661). In terms of species richness, open habitat (3.584) recorded the richest, followed by Plantation habitat (3.178) and the least was Montane forest (2.996). In terms of evenness, Open habitat (0.894) was the most even, followed by Montane forest (0.888) then the least Plantation habitat (0.867).(Table 2)

Table 2: Bird Species Diversity across Habitat Types during Dry Season in Ardo-kola and Yorro L.G.A, Taraba State, Dec. 2021-Feb. 2022

Diversity measure	Open habitat	Plantation habitat	Montane forest
Shannon (H)	3.203	2.750	2.661
Richness (Ins)	3.584	3.178	2.996
Evenness (H/Ins)	0.894	0.867	0.888

Discussion

In the wet season, avifauna species diversity was found to be higher in the Montane forest, this could be due good cover/breeding sites, water and availability of food. This agrees with the finding of Gloria (2013) who reported that differences in resource availability between habitats such as breeding sites, nesting materials, cover, food and water could restrict some species to certain habitat type while allowing others to be widely distributed. The lower avifauna species diversity observed in the Open habitat and Plantation habitat could be caused by continuous clearance of natural vegetation for farming purposes. It could also be because of the month interval of identification. These concur with Environmental system research institute ESRI. (2012) who reported that environmental changes due to forest loss and fragmentation are highly likely to affect bird dispersal ability and resource use as well as the role of birds in ecosystem functioning such as pollination, seed dispersal and insect pest controls. Among the three habitat types, Open habitat recorded the highest species richness during the wet season. This could be attributed to the weather condition and openness of the habitat which supports shrub that provides food and cover for different avifauna species. This is in agreement with Parmesan (2005),Shochat*et al.* (2010) and Gloria (2013) and who reported that weather condition determines bird diversity by spatial temporal shift of the species from one habitat to the other seeking for favourable conditions. It could also be the persistence of native species that are only peculiar to a particular habitat and generalist species birds that are found in all habitats like a large number of Cattle egret *Bubulcus ibis*, Pied Crow *Corvusalbus*, West African thrush *Turduspelios*, Senegal coucal *Centropussenegalensis* Black-billed wood dove *Turturabyssinicus*, Ring-necked dove *Streptopeliacapicola*, Piapiac*Ptilostomusafer*, Little sparrow hawk *Accipiter minullus*, Laughing dove *Streptopeliasenegalensis* and Common kestrel *Falco tinunculus*etc (Pennigton and Blair., 2011). Montane forest showed the highest evenness than the other two habitats. This could be due to availability of food, cover and breeding sites. This agrees with the findings of Begon, *et al*. (2008) who stated that the increase in vegetation physical structure complexity increases potential foods, shelters, protections and nesting resources which gives rise to abundance and diversity of birds.

During the dry season, significant changes were observed; Open habitat had the highest avifauna in terms of diversity, richness and evenness. This could be due to the habitat types which provide vital species requirements (vegetation cover, water, food and resting/preening sites). This is in line with the works of Earnest *et al*. (2012) and Tanalgo *et al*. (2015) who reported that vegetation type plays a critical role in structuring birds' communities.

Slight decrease in diversity was observed in the dry season specifically in the plantation habitat and Montane forest. This could probably be due to the impact of the weather condition was hazy. This is in agreement with the findings of Waterhouse *et al*. (2002) who reported that bird's diversity is impacted by weather condition or season (temperature and precipitation); It could also be due spatial migration of species from one habitat to another. Parmesan (2005) also reported that weather condition determines birds' diversity by spatial temporal migration of the species to other habitats seeking for favourable atmosphere.

Generally, in terms of diversity, Open habitat had the highest diversity when the sampling period were pooled together. This could probably be due to availability of food, water (because of the stream around the habitat) which could have been the center for attraction/hotspot and it could also due to the openness of the habitat that allows shrubs to sprout abundantly. The result was not in agreement with Azeria *et al*. (2007), Combell and John (2012) and Askins *et al*. (2012) who concluded that forest is the main habitat which harbours large bird's species diversity. Therefore, these studies suggest that rapid intervention must be given to the habitats in term of conservation.

Conclusion

The study concluded that the study areasareheterogeneous and that area with less human activities habour more bird than in areas with much human activities. The higher diversity suggests higher ecological stability compared to human disturbed habitats where few species occur.

The study also provides evidence that season plays vital role in avifauna diversity of a particular area, species fluctuation was observed across habitat types due season.

Recommendations

i. The study recommend that areas with human activities need to be conserved because it also houses more bird species.

ii. It was observed during the field visit that the communities were oblivious of the fact that avifauna are significant part of the ecosystem, as indicator of a good environment, agents of pollination, sources of protein (sustainably use), scavengers and provide sanitary services and pest controller, therefore, there is need for enlightenment to the people of the community.

iii. Further research should be carryout on diversity of avifauna on wetland habitat around the study area.

Acknowledgments

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