Journal of Basics and Applied Sciences Research (JOBASR)
ISSN (print): 3026-9091, ISSN (online): 1597-9962
Volume 4(1) January 2026
DOI: https://dx.doi.org/10.4314/jobasr.v4i1.20

Assessment of bird diversity in selected landscape types in Awka, Anambra State Nigeria

Obudulu, C. [1*]
[1]**Department of Zoology, Nnamdi Azikiwe University, Awka.**
[*]Corresponding Author Email: obuduluchibuzor@gmail.com

ABSTRACT
This study assesses bird diversity across various landscape types, revealing significant differences in bird abundance, species richness, and diversity metrics. A total of 426 birds encompassing 55 species were recorded, averaging 85 birds per site. The forest exhibited the highest mean bird abundance (116) and species richness (28), significantly surpassing the oil palm plantations (101 abundance, 16.5 richness) and shrub lands (54 abundance, 15 richness). Statistical analyses confirmed significant differences in bird abundance (F=44.49, P=0.006) and species richness (F=121.4, P=0.001) among these landscapes. The Yellow-billed barbet was the most prevalent species, while a range of orders, particularly Passeriformes, showed high occurrence rates. Diversity indices demonstrated significant variations, with the forest (3.012) showing the highest diversity, while mean dominance was highest in palm plantations (0.105). Evenness metrics indicated no significant differences across landscapes (F=4.41, P=0.1277). The study also categorized feeding guilds, identifying 15 distinct categories, with variations in abundance linked to landscape type. Overall, the findings emphasize the importance of forest habitats for avian diversity and highlight the impact of landscape types on bird communities, providing critical insights for conservation efforts and landscape management.

Keywords:
Bird diversity,
Land-use types,
Shrub land,
Palm plantation,
Forest

INTRODUCTION

The rapid transformation of landscapes due to various land use practices poses significant challenges to biodiversity, particularly in avian species (Sabo *et al.* 2025). Understanding bird diversity in different land use types is crucial for biodiversity conservation and sustainable land management. Recent studies indicate that land use changes significantly affect species composition and richness (Jaman *et al*., 2025; Lakatos *et al*., 2025). However, there remains a significant gap in knowledge regarding how specific land use types, particularly in tropical regions, contribute to or mitigate declines in bird diversity.

Furthermore, there remains a notable research gap in the comprehensive assessment of bird diversity across specific land use types such as shrubland, palm plantations, and forests within local communities.

While existing literature has explored the avian diversity in forest habitats extensively (Cours and Duflot, 2025), the impacts of palm plantations and shrubland, which are often subjected to conversion under agricultural policies, are less understood (Galindo *et al*., 2022).

Recent research indicates that palm plantations can host diverse bird populations, though often less rich than those found in natural forests (Korejs *et al.*, 2025). Furthermore, the role of shrubland as a transitional habitat has been overlooked, despite its potential importance for supporting certain bird species (Broughton *et al.*, 2022; Zwarts *et al*., 2023).

This study aims to fill this research gap by conducting a comprehensive assessment of bird diversity across selected land use types—shrubland, palm plantations, and forests—highlighting how these habitats support avian populations. By identifying the specific characteristics and conditions that promote bird diversity in these environments, this research seeks to inform land management practices that enhance avian conservation in changing landscapes.

MATERIALS AND METHODS

Study Area

How to cite this article: Obudulu C. (2026). Assessment of bird diversity in selected landscape types in Awka, Anambra State Nigeria. *Journal of Basics and Applied Sciences Research*, 4(1), 182-187. https://dx.doi.org/10.4314/jobasr.v4i1.20

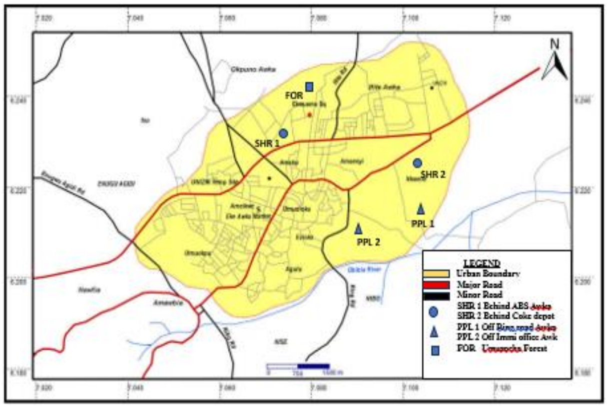

Fig 1. Map of the study area (Awka, Anambra State) (Iheukwumere *et al*., 2020)

The study was conducted in Awka, the capital city of Anambra State, Nigeria (6°12'N, 7°04'E), a rapidly urbanizing region characterized by a tropical climate with distinct wet (April–October) and dry (November–March) seasons. Annual rainfall averages 1,800–2,000 mm, and temperatures range from 28°C to 33°C (Okeke *et al*., 2021). Five sites were selected to represent varying levels of human disturbance and habitat heterogeneity: two shrub lands (Shrub land behind ABS Awka (6.2151° N, 7.0764° E) and Shrub land behind coke depot Awka (6.2235° N, 7.0867°), two palm plantations (Palm plantation off Ring road (6°13'37.873"N, 7°4'52.972"E**)** and Palm plantation off Nigerian Immigration office, Awka (6.214° N, 7.087° E), and a forest site Umuzocha forest by Ekwueme square, Awka (6°14′06″N 7°04′49″E). These sites were chosen based on their accessibility, representation of common land-use types, and preliminary reconnaissance surveys indicating potential bird activity. Each site covered an approximate area of 2–3 hectares, with shrub land featuring low growing woody vegetation, palm plantation dominated by uniform rows of oil palm trees, and the forest area consisting of densely wooded areas with high tree cover.

Sampling design

The sampling design for this study employed a stratified sampling approach to assess bird diversity across different land-use types. The study area was stratified into three categories based on different ecosystem and habitat characteristics including shrub land sites, oil palm plantation site, and forest sites. The study focused on five distinct sites, comprising two shrub land sites, two palm plantation sites, and a forest site. The sites were selected to represent different ecosystems with varying vegetation structure which influence bird species composition and abundance. Three-point count stations were established within each site, allowing for a uniform assessment of avian diversity (Pacheco-Munoz *et al*., 2025).

Bird Survey

Bird diversity was assessed using point count methodology, a standardized protocol suitable for urban environments (Bibby *et al*., 2000). A total of three-point count locations were established in each site, with a minimum distance of 100 meters between them to reduce the potential for double counting individuals. Surveys were conducted twice a day during peak bird activity periods, specifically early morning (06:00–09:00 hours) and late afternoon (16:00–18:00 hours), to capture diurnal patterns. A 5-minutes acclimatization period was observed upon arrival at a point to minimize disturbance to the birds. Following acclimatization, a 10-minute observation period was initiated. During this time, all avian species observed and sound heard within a 50-meter radius from the point were recorded. Data were collected using Nikula binoculars (10 x 50) and field guides (Fry and Keith, 2020) to ensure accurate species identification. Photographs were taken using a Canon DSLR camera 2000D to confirm the identity of some of the species not easily identified in the field by checking with the field guides. Calls of unfamiliar birds were recorded with a recording device for further analysis. Global Positioning System reading was employed to locate the bird counting points and record the locations of the study area. All samplings were done by the same observer to minimize observer bias.

Data Analysis

Statistical analyses comparing bird species diversity and abundance across sites were performed using Statistical Package for Social Science 2020. bird species diversity was evaluated with the ShannonWiener diversity index (H), calculated as $H = -\Sigma(pi * \ln(pi))$, where pi is the proportion of each species (Shannon and Weaver, 1949). Species richness (r) was determined for each habitat by counting the number of species observed (Deitmers *et al*., 1999), while species evenness (E) was assessed using the Evenness Index (J′), calculated as $J' = H'/H$ max, where H′ is the Shannon index and H max is the natural logarithm of the total number of species (Kiros *et al*., 2018). The Simpson Index (D), which measures the likelihood of two randomly selected individuals belonging to different species, was calculated using $D = 1-\Sigma n(n-1)/N(N-1)$, where n is the number of individuals of a species and N is the total number of individuals across all species (Gregorius and Gillet, 2008).

Ethical Considerations

The study was conducted in compliance with ethical guidelines for wildlife observation. Bird species were not captured or disturbed during surveys, and local permits were obtained to conduct the study in the sites. Researchers adhered to principles of minimizing disturbance to both the avian population and local communities.

RESULTS AND DISCUSSION

The result of the study on survey of bird diversity on selected landscape types is shown below

A total of four hundred and twenty-six (426) birds were recorded throughout the study, resulting in an average of 85.2± 13.097 per site. The forest site had the highest mean bird abundance at 116±0.0, followed by the oil palm plantation at 101±3.0, while the shrub lands had the lowest mean abundance at 54±3.0. The analysis of variance revealed a significant difference in bird abundance among the sites (F=44.49, P=0.006, P<0.05). The Yellow billed barbet (*Trachyphonus purpuratus*) was the most common bird species, with a mean abundance of 7.4± 4.53, followed by the Black and white manakin (*Lonchura bicolory*) at 6± 2.59, African palm swift (*Cypsiurus parvus*) at 5.4± 3.31and Blue spotted wooddove (*Turtur afer*) at 4.8± 3.34. The Bannennan weaver (*Ploceus bannerman*), Forest canary (Serinus Scotops), Alpine chough (*Pyrrhocoras graculus*), Fulvous babbler (*Turdoides fulva*), Rud apalis (*Apalis ruddi*), Black-billed cuckoo dove (*Macropygia nigriostris*), Yellow billed Malkoha (*Rhamphococcyx* calyorhynchus), Little greenbul (*Andropadius virens*), Spotted flycatcher (*Musciapa straita*) and the Dusky sunbird (*Cinnyris fuscus*) had the lowest mean abundance at 0.2±0.2.

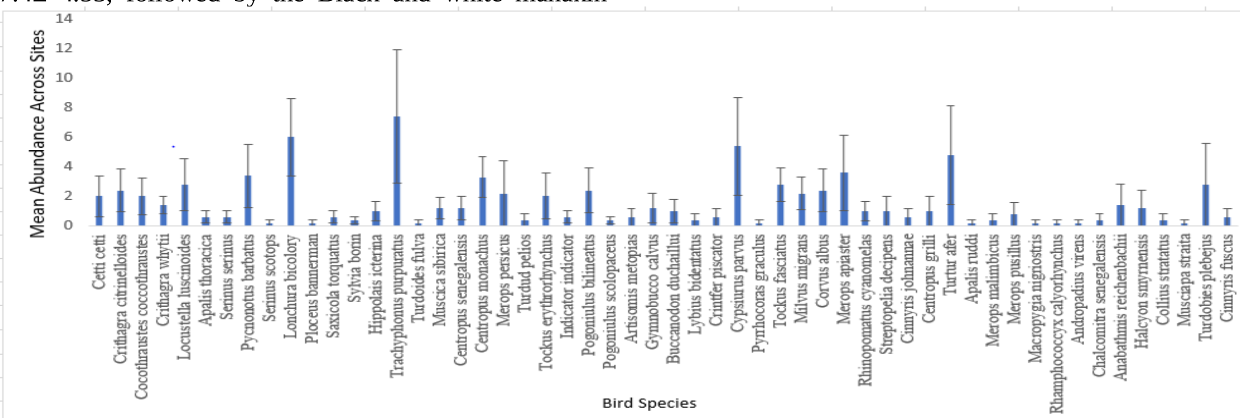

Fig 2. Bird species mean abundance in the study

A total of fifty-five bird species were identified during the study, with Yellow spotted barbet (*Buccanodon duchaillui*), Alpine chough (*Pyrrhocoras graeulus*), African pied hornbill (*Tockus fasciatus*), and African black kite (*Milvus migrans*), being the most prevalent. The forest exhibited the highest average species richness at 28.0±0.0, followed by the palm plantations at 16.5±0.5. In contrast, the shrub lands had the lowest average richness at 15±1.0. The analysis of variance for bird species richness across different sites showed significant difference (F=121.4, P=0.001, P<0.05). The orders Passeriformes was the most widely distributed, occurring in 100% of the sample, while Accipitriformes, Cuculiformes, Columbiformes, Bucerotiformes and Piciformes had 60% occurrence rate each. Apodiformes with 40% and Musophagiformes and Coliiformes with 20% were the least represented.

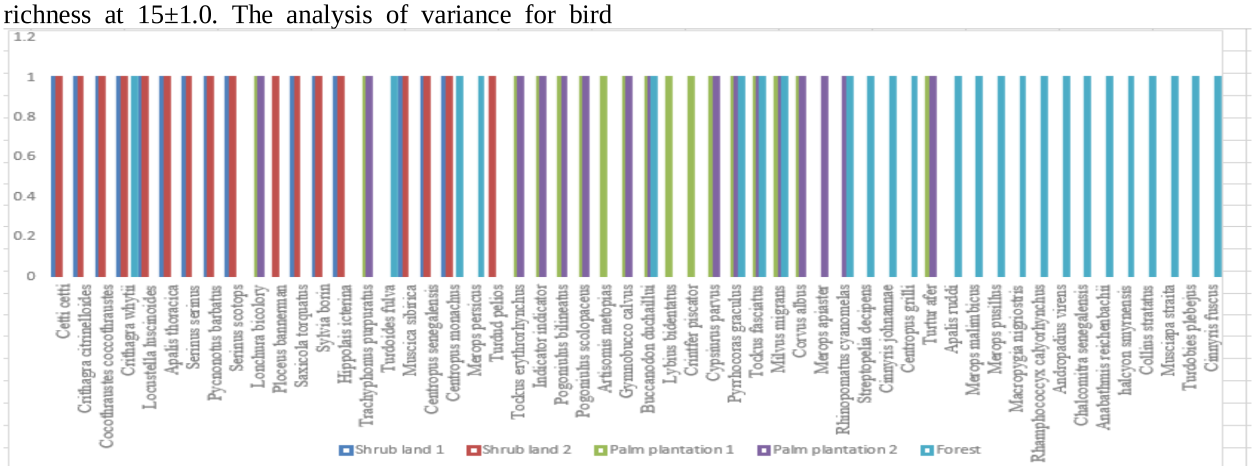

Fig. 3. Showing bird species richness in study sites

The forest site (3.012±0.0) and shrub lands (2.4895±0.09) displayed the highest diversity indices. This was closely followed by the palm plantations (2.47±0.003) which showed the lowest. The variance analysis for the diversity index was significant (F=32.40, P=0.009, P<0.05). In terms of mean species richness, the forest site (28.0±0.0) rank highest followed by the palm plantations (16.5±0.5) and shrub lands (15±1.0) with the lowest. The variance analysis for species richness was significant (F=121.4, P=0.001, P<0.05). Regarding the mean dominance index, the palm plantation (0.105±0.001) and shrub lands (0.098±0.011) exhibited the highest values, while the forest site (0.061±0.0) had the lowest. The variance analysis for dominance was significant (F=13.75, P=0.031, P<0.05). In terms of evenness, the shrub lands exhibited the highest value (0.92±0.012), closely followed by forest site (0.904±0.0) and palm plantation with the lowest value (0.8815±0.0105). The analysis of variance for evenness did not show significant differences (F= 4.41, P=0.1277, P>0.05).

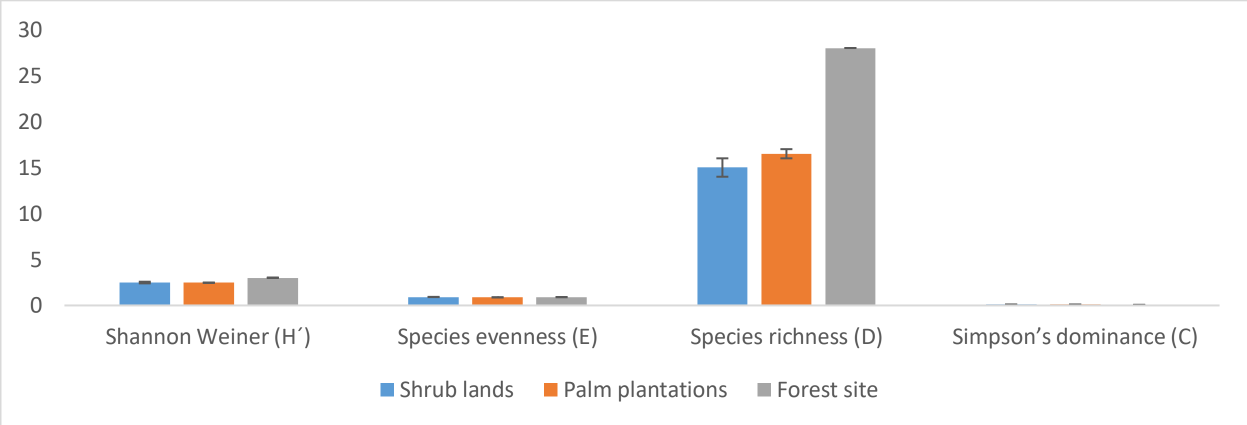

Fig. 4 showing Bird diversity metrics on selected study sites

The research identified fifteen distinct feeding categories among the collected Carnivore, Insectivore, Omnivore, Frugivore-insectivore, Cerophagore-insectivore, Granivore, Nectarivore, Insectivore-gleaning, Frugivore-granivore, Omnivore-insectivore, Frugivore, Nectarivore-insectivore, Omnivore-scavenger, Carnivore-insectivore and Frugivore-folivore. The Forest site exhibited the highest mean abundance of carnivores (2±0.0), insectivore (7±0.0), nectarivore-insectivore (3±0.0), nectarivore (1±0.0). It had the least mean abundance of granivores (1.5±1.5). The palm plantations had the highest mean of frugivore-insectivore (5.5±0.5), followed by the forest site (3±0.0), while the shrub lands had the least (1±0.0). The forest had the highest mean abundance of omnivores (2±0.0), closely followed by the shrub lands (1.5±0.5), while the palm plantations had the least (1±0.0). There was absence of nectarivores, insectivore-gleaning, nectarivore-insectivore and frugivore-folivore in the shrub lands and palm plantation but present in the forest. Cerophagore-insectivores and omnivore scavengers were present in the palm plantations, but absent in the forest and shrub lands. Omnivore-insectivore, frugivore and carnivore were present in the palm plantations and forest but absent in the shrub lands, while frugivore-granivores and carnivore-insectivores were present in the shrub lands and forest but absent in the palm plantations.

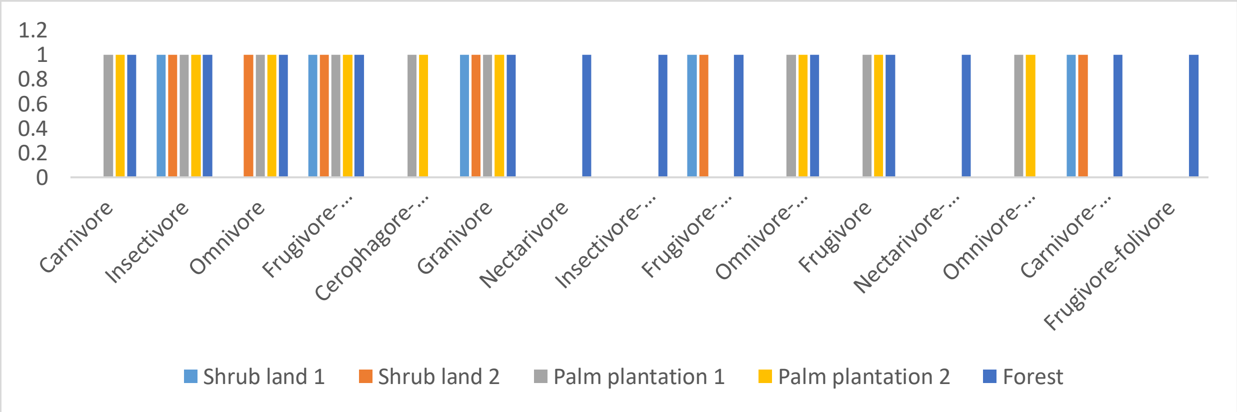

Fig. 5 showing Bird feeding guild on selected study sites

The study recorded 426 birds across different landscapes, with an average of 85.2 ± 13.097 birds per site. The forest showcased the highest mean abundance of 116 ± 0.0, followed by oil palm plantations at 101 ± 3.0, and shrub lands at 54 ± 3.0. This aligns with findings by Liu *et al*. (2024), which indicated that forest habitats often support higher avian populations due to greater structural complexity and resource availability. The significant difference in means (F=44.49, P=0.006, P<0.05) suggests that habitat type significantly influences bird abundance, corroborating earlier works such as those by Tu *et al*. (2020).

The Yellow-billed Barbet (*Trachyphonus purpuratus*) emerged as the most common species, which resonates with previous observations made by Mahamoud-Issa *et al*. (2025), highlighting the species' widespread and emblematic nature, occupying a variety of habitats

The study identified a total of 55 bird species, with the forest exhibiting the highest species richness (28.0 ± 0.0), followed by oil palm plantations (16.5 ± 0.5) and shrub lands (15 ± 1.0). The significant difference documented (F=121.4, P=0.001, P<0.05) supports findings from Yan *et a*l. (2023), which emphasized the role of habitat heterogeneity in fostering species richness. The dominance of Passeriformes across all sites (100% occurrence) underscores the adaptability of this order, aligning with regional studies by Varys (2024). The lower occurrences of other orders may indicate ecological constraints as indicated by Schmitt and Edwards (2022).
The calculated diversity indices revealed that forest sites (3.012 ± 0.0) and shrub lands (2.4895 ± 0.09) had the highest diversity, while palm plantations had the lowest (2.47 ± 0.003). The variation in diversity indices (F=32.40, P=0.009, P<0.05) suggests that habitat type influences not just abundance but also the even distribution of species. This aligns with the findings from Wen *et al.* (2026), who noted that more diverse habitats generally maintain a greater variety of ecological niches.
The study identified 15 feeding categories, with the forest being the most diverse in feeding strategies. The predominance of carnivores (2 ± 0.0) and insectivores (7 ± 0.0) in forests supports the hypothesis put forth by Perala *et al*. (2024), which indicates that intricate ecosystems support more specialized feeding behaviors. Conversely, the absence of several feeding guilds in shrub lands and palm plantations mirrors the findings in Panda *et al*. (2021), suggesting that simplistically structured habitats reduce feeding diversity.

CONCLUSION

This study demonstrates significant disparities in bird diversity across different land use types, with forests supporting the highest abundance and richness of bird species compared to oil palm plantations and shrublands. The findings highlight the critical role of forest habitats in promoting avian populations and underscore the need for focused land management strategies that enhance biodiversity conservation in agricultural and altered landscapes. By identifying specific habitat characteristics conducive to bird diversity, this research provides valuable insights for effective conservation measures in these changing environments.

REFERENCE

Bibby, C. J., Burgess, N. D., Hill, D. A. and Mustoe, S. A. (2000) Bird census techniques. Second edition. London: Academic Press

Broughton, R. K., Bullock, J. M., George, C., Gerard, F., Maziarz, M., Payne, W. E., ... & Pywell, R. F. (2022). Slow development of woodland vegetation and bird communities during 33 years of passive rewilding in open farmland. *PLoS One*, *17*(11), e0277545.

Cours, J., & Duflot, R. (2025). Effects of landscape heterogeneity on bird communities in temperate, boreal, and montane forests–a review. *Journal of Avian Biology*, *2025*(3), e03458.

Deitmers, R., Buehler, D. A., Bartlett, J. G. and Klaus, N. A. (1999). Influence of point count length and repeated visits on habitat model performance. The Journal of Wildlife Management, 63 (3), pp. 815–823.

Fry, C. H., & Keith, S. (2020). The Birds of Africa: Volume VI. Bloomsbury Publishing.

Galindo, V., Giraldo, C., Lavelle, P., Armbrecht, I., & Fonte, S. J. (2022). Land use conversion to agriculture impacts biodiversity, erosion control, and key soil properties in an Andean watershed. *Ecosphere*, *13*(3), e3979.

Gregorius, H. R., and Gillet, E. M. (2008). Generalized simpson-diversity. *Ecological Modelling*, *211*(1-2), 90-96.

Iheukwumere, S., Nkwocha, K., & Tonnie-Okoye, N. (2020). Stemming Plastic Bag Pollution In Anambra State: Willingness Of The Public To Accept Alternative Bags. *coou African Journal of Environmental Research*, *2*(1), 17-32.

Jaman, M. F., Barua, P., Shome, A. R., Saha, A., Rabbe, M. F., Rahman, M. M., & Alam, M. M. (2025). Effects of urbanization on bird diversity and community structure in urban cities of Bangladesh. *Global Ecology and Conservation*, e03844.

Kiros, S., Afework, B. and Legese, K. (2018). A preliminary study on bird diversity and abundance from Wabe fragmented forests around Gubre subcity and Wolkite town, southwestern Ethiopia. *International Journal of Avian & Wildlife Biology*, 3(5), 333– 340.

Korejs, Kryštof, et al. "Bird species richness, assemblage density, and feeding guild composition in human-modified lowland rainforests of Papua New Guinea." *Journal of Field Ornithology* 96.1 (2025).

Lakatos, T., Báldi, A., Gallé, R., Korányi, D., Kovács, I., László, Z., & Batáry, P. (2025). Functional trait filtering and decline in species richness in urban parks hinder ground-breeding and insectivorous birds. *Urban Forestry & Urban Greening*, 128988.

Liu, Z., Zuo, Y., & Feng, G. (2024). Primary forests harbour more bird taxonomic, phylogenetic and functional diversity than secondary and plantation forests in the pantropics. *Journal of Biogeography*, *51*(12), 2338-2355.

Mahamoud-Issa, M., Sikora, B., Łosak, K., Rusiecki, S., & Osiejuk, T. S. (2025). The communal roosting behaviour and nesting of a group-living species, the Yellow-breasted Barbet Trachyphonus margaritatus in Djibouti. *Scopus: Journal of East African Ornithology*, *44*(2), 1-13.

Okeke, J. J., Obudulu, C., Mmayie, F., Udeh, N. P., Okpoko, V. O., Ezewudo, B. I. and Okeke, P. C. (2021). Bird diversity and distribution in three land-use types in Nnamdi Azikiwe University Awka, Anambra State, Nigeria. *The Bioscientist Journal*, *9*(1), pp. 87-98.

Pacheco-Munoz, R., Ceja-Madrigal, A., & Schondube, J. E. (2025). Migratory birds benefit from urban environments in a highly anthropized Neotropical region. *PLoS One*, *20*(1), e0311290.

Panda, B. P., Prusty, B. A. K., Panda, B., Pradhan, A., & Parida, S. P. (2021). Habitat heterogeneity influences avian feeding guild composition in urban landscapes: evidence from Bhubaneswar, India. *Ecological Processes*, *10*(1), 31. Tu, H. M., Fan, M. W., & Ko, J. C. J. (2020). Different habitat types affect bird richness and evenness. *Scientific reports*, *10*(1), 1221.

Perala, T., Kuisma, M., Uusi-Heikkilä, S., & Kuparinen, A. (2024). Food-web complexity, consumer behavior, and diet specialism: impacts on ecosystem stability. *Theoretical Ecology*, *17*(2), 131-141.

Sabo Babura, B., Ali Madaka, U., Sulaiman Muhammad, M., Gambo, J., & Ahmad, D. (2025). Diversity, abundance, and conservation status of indigenous tree species in Binyaminu Usman Polytechnic, Hadejia, Jigawa State, Nigeria.

Schmitt, C. J., & Edwards, S. V. (2022). Passerine birds. *Current Biology*, *32*(20), R1149-R1154.. Passerine birds. *Current Biology*, *32*(20), R1149-R1154.

Shannon, C. E. and Weaver, W. (1949). The mathematical theory of communication. Urbana, IL: The University of Illinois Press, p. 117.

Varys, O. (2024). Passeriformes as indicators of biodiversity conservation in the frontline zone of the Sumy region. *Ekológia*, *43*(2), 175-182.

Wen, Y., Tan, S., Xiang, Y., Gao, W., Guo, P., Dong, B., & Wu, Y. (2026). Habitat heterogeneity drives niche partitioning and morphological divergence in two sympatric Diploderma lizard species.

Yan, Y., Jarvie, S., Zhang, Q., Han, P., Liu, Q., Zhang, S., & Liu, P. (2023). Habitat heterogeneity determines species richness on small habitat islands in a fragmented landscape. *Journal of Biogeography*, *50*(5), 976-986.

Zwarts, L., Bijlsma, R. G., & Van der Kamp, J. (2023). Effects on birds of the conversion of savannah to farmland in the Sahel: habitats are lost, but not everywhere and not for all species. *Ardea*, *111*(1), 251-268.