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Bird Species Composition, Abundance and Diversity across Habitat Types in Shere Hills Reserve, Plateau State, Nigeria

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Abstract

This study examined bird species composition, abundance and diversity in Shere Hills Reserve, Plateau State, North-central Nigeria. The region, characterized by a savanna ecosystem interspersed with rocky outcrops and gallery forests, has a mean annual rainfall of 1,260 mm and a temperature range of 19.4 to 34.5°C. Bird surveys were conducted across 65 points using the point count method, and points were selected using stratified random sampling method. Observations were made daily between 6:30 a.m. and 10:30 a.m., and species were identified using '*Birds of Western Africa'* field guide. A General Linear Model (LM) was used to calculate bird diversity and abundance across the different habitat types. A total of 6,427 birds representing 142 species and 53 families were recorded. Gallery forests exhibited the highest species composition (121 species), followed by savanna (111 species), and rocky outcrops (108 species). Common species included Blue-breasted Kingfisher in gallery forests, Chestnut-backed Sparrow Lark in savannas, and Rock-loving Cisticola in rocky habitats. Despite these differences in species composition, bird abundance and diversity did not vary significantly across habitats ($F_{2, 585} = 0.59$, $p = 0.56$). The savanna (1.92 ± 0.03) and gallery forest (1.91 ± 0.03) had slightly higher diversity compared to rocky outcrops (1.87 ± 0.03). These findings highlight the critical role of habitat heterogeneity in sustaining avian biodiversity within the Shere Hills Reserve, as each habitat type supports unique bird species, thereby underscoring the need for targeted conservation strategies that preserve the ecological integrity and functionality of these diverse habitats to maintain overall biodiversity.

Keywords: Abundance, birds, composition, diversity, habitat, Shere Hills Reserve

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Introduction

Bird species are critical components of ecological systems, contributing to processes such as pollination, seed dispersal, pest control, and nutrient cycling [1, 2, 3]. Additionally avian species are indicators of environmental health. They offer information, about the quality of habitats, the diversity of species present and the stability of ecosystems [4]. Various species are helpful in monitoring changes due to their diverse nature and abundance. These factors mirror the conditions of their habitat [5]. Conservation strategies should account for the ecological characteristics of different habitats and the specific interactions between species, fostering community involvement in conservation initiatives [6]. Understanding the abundance, diversity, and composition of bird species in specific habitats is crucial for monitoring ecosystem changes and guiding conservation efforts. Additionally, understanding the relationship between natural land cover and avian diversity can inform land management practices, emphasizing the importance of balanced land use approaches [7]. Habitat structure and vegetation composition significantly influence the distribution and abundance of bird species, highlighting their dependence on habitat quality [8]. Numerous studies emphasize the complex interactions between bird assemblages and their environments, stressing the role that vegetation traits play in regulating species abundance and richness [9]. Both resident and migratory birds' habitats and movements are greatly influenced by climate, with different species adjusting to certain biomes [10]. Bird populations and their migration patterns may be impacted by changes in climate variables like temperature and precipitation, which can also change the availability and quality of habitat [11]. Anthropogenic activities that degrade and destroy avian habitats are a major factor in decreasing biodiversity globally [12]. According to research, the main causes of these declines, which mostly impact bird populations and their ecosystems, are habitat degradation, pollution, and climate change [13].

Effective conservation decision-making, such as determining habitat protection and restoration goals to preserve significant ecological phenomena like species–area thresholds, depends on understanding interspecific variation in species' responses to human disturbances [14]. Although it is commonly believed that protected areas conserve ecological communities [15], protected

areas usually fall short of this goal, especially in poor nations with limited funding and national conservation and protected area plans. Shere Hills Reserve in Plateau State, Nigeria, presents a diverse ecological landscape that supports various avian communities across its distinct habitat types. The interaction of dense gallery forests, open savannas, and rugged rocky outcrops creates unique conditions that affect bird species richness and abundance [16]. This research aimed to examine the diversity, abundance and richness of bird species in these Shere Hills habitat types. Diverse ecological communities across contrasting habitats are seriously threatened by human activities including agriculture, deforestation, and urbanization. These actions ultimately affect biodiversity and ecosystem services by causing habitat destruction, fragmentation, and degradation [17].

For conservation and habitat management to be effective, it is essential to understand how bird communities react to different environments. Research indicates that avian species exhibit distinct responses to different habitat types, influenced by factors such as anthropogenic impacts, ecological characteristics, and land use [6]. Adapting conservation strategies to particular ecological situations requires this knowledge. In order to maintain avian diversity and the ecological services that birds offer, including pollination, seed dispersal, and pest control, the knowledge gathered from this study are intended to provide baseline data for habitat-specific conservation measures. This study emphasizes the importance of habitat heterogeneity in maintaining ecological resilience and stability by showcasing the distinct contributions made by each habitat to total biodiversity.

Materials and Methods

Description of the study area

This research was carried out in Shere Hills, Jos Plateau in North Central Nigeria. The Hills lie between latitudes (9^o 51’ 18’’N and 10^o 00’ 00’’N) and longitude (8^o54’10’’E and 9^o 6’41’’E). It has numerous high peaks, with the highest peak reaching a height of about 1, 829 metres or 6,001 feet above sea level. It is the highest point of the Jos Plateau and is characterized by a mean annual rainfall of 1,260 mm (1,050–1,403 mm), peaking between July and August. The mean annual temperature is about 22^oC, but mean monthly values vary between 19.4^oC in the coolest month of December when the area comes under the influence of the cool and dry desiccating north-easterly tropical continental air mass (harmattan) and 34.5^oC in the hottest month of April [18]. The dominant habitat type in this ecosystem is the rocky outcrop and savanna with patches of gallery forest. The vegetation of the main area is typically that of the Jos plateau with mainly scattered bushes and grasses, rocky outcrops and fragments of riparian forest [19]. The bushes are usually cleared for farming, fuel wood and charcoal production.

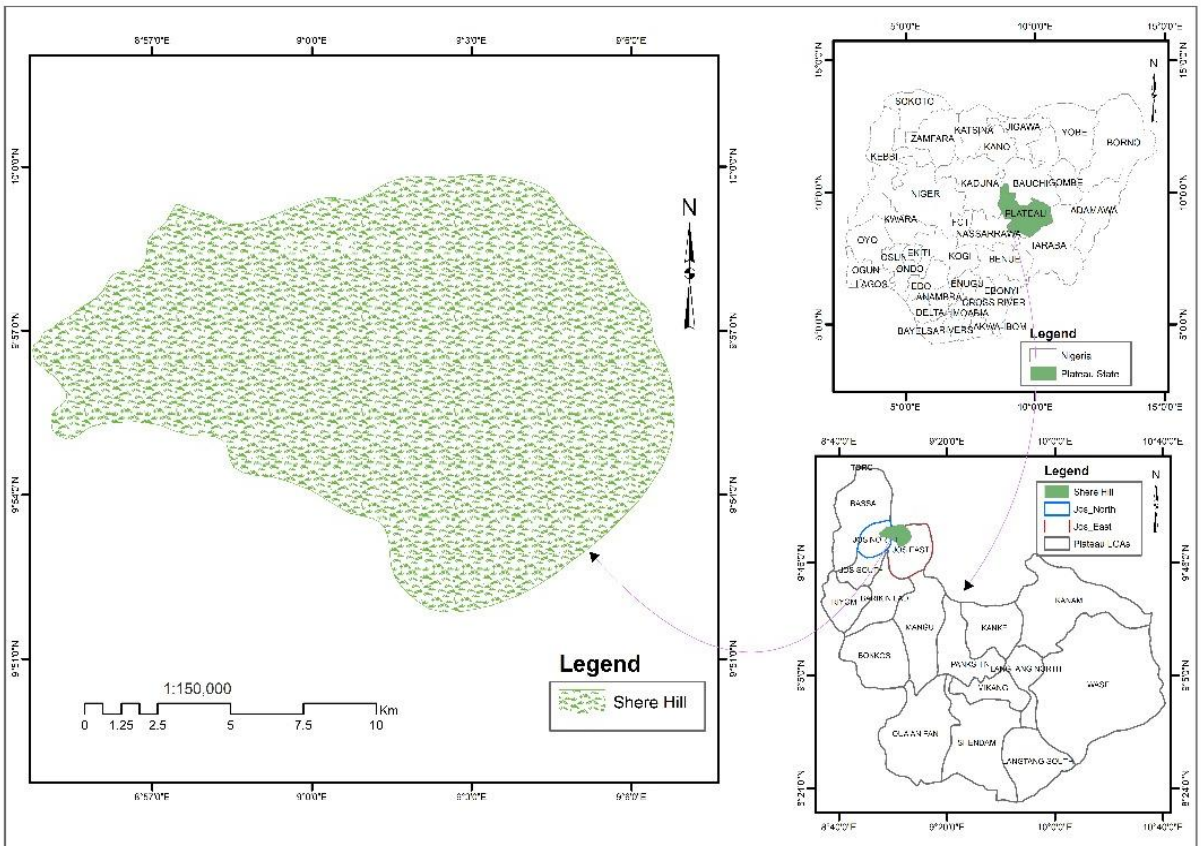

Figure 1: Map of Shere Hills reserve

Bird survey

Bird surveys were conducted using the point count method. A total of 65 points were selected across different habitat types using stratified random sampling. Each point within the three habitat types was spaced 300 meters apart, as described by Bibby *et al*. [20]. The habitat types surveyed included gallery forest, savanna, and rocky outcrop. The rocky habitat was characterized by more than 70% rocky ground cover, savanna habitats had over 70% grass cover, and gallery forests were dominated by trees with more than 50% canopy cover, typically accompanied by flowing water.

The number of points per habitat type varied due to differences in the proportional extent of each habitat, with savanna and rocky habitats being more prevalent: Rocky (23 points), Savanna (24 points), and Gallery Forest (18 points). To minimize the influence of the time of day on bird activity, the daily starting point for surveys was alternated among the sites.Since the majority of bird species are known to be most active during this time, surveys were carried out every day between 6:30 and 10:30 a.m., which is the best time to find and identify avian populations. Due to cooler temperatures, less disturbance, and the necessity of establishing territories and feed after the night's sleep, birds are usually active in the early morning hours. Although evening foraging activity is significant, it is typically less intense and lasts shorter than morning activity [20, 21]. For this reason, morning observations are prioritized, which is in line with standard ornithological practices and guarantees higher data quality and consistency. These behaviors improve detectability through both visual and auditory cues, providing more comprehensive data on species presence and abundance. Bird calls were identified in the field by a trained ornithologist, supplemented by recordings captured using a digital voice recorder which was subjected to further analysis to ascertain birds' identity outside the field. Bird species were identified directly using a pair of oblivion binocular and confirmed with *Birds of Western Africa* field guide [22].

Data analysis

Bird species alpha diversity was calculated using the indices q = 0 representing the species richness and q = 1 representing the exponential value of the Shannon index as well as considering the species and their abundances- ecological diversity [23]. This was estimated using the diversity function in the vegan R package [24]. Bird abundance was estimated as the total number of individual species found at a point at each sampling time. A test of normality was carried out using the Shapiro-Wilks test and histogram. The assumption of a normal distribution was not met for bird abundance, and was logarithmically transformed using the function "log" in R. Using a General Linear Model (LM), bird diversity and abundance was compared across the different habitat types. The Venn diagram function within the Venn Diagram package was used to visualize species composition across the various habitat types through a Venn diagram. Finally, a rank abundance plot of bird species in the different habitats was constructed to investigate species composition. All statistical analyses were performed using R 4.3.1 statistical software [25].

Results and Discussion

Bird species composition across Shere Hills' habitat types

The study recorded a total of 6,427 individual birds, representing 142 bird species belonging to 53 families across the three habitat types, across the three main habitat types: rocky outcrops, gallery forests, and savannas (Table 1, Fig. 2). Among the habitats, the gallery forest had the highest species richness, with 121 species observed. Some specialist birds recorded in the gallery forest included Blue-breasted Kingfisher, Giant Kingfisher, Pied Kingfisher, Red-billed Hornbill, Brown Babblers, Black-capped Babblers, Beautiful Sunbird, and Copper Sunbird, among others.

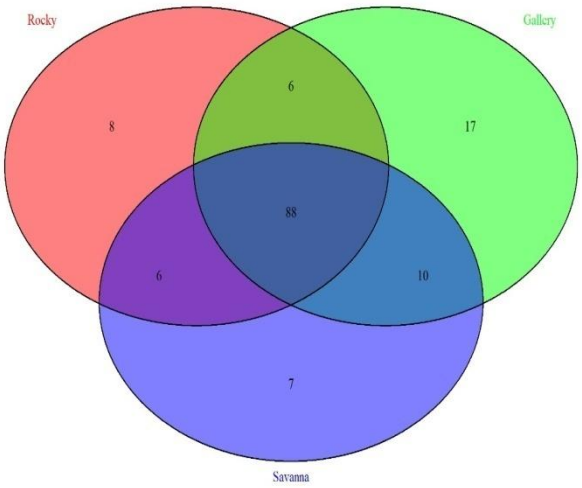

Figure 2: Composition of bird species across habitat types in Shere Hills Reserve

The savanna habitat recorded 111 species, including habitat-specific species such as the Chestnut-backed Sparrow Lark, Crested Lark, and Flappet Lark. In contrast, the rocky outcrop supported 108 species, with notable birds such as the Stone Partridge and Rock-loving Cisticola being characteristic of this habitat.

The high species composition in the gallery forest highlights the importance of its complex vegetation structure, which provides abundant resources and diverse microhabitats for birds. This aligns with the findings by [26], who noted that the structural complexity of gallery forests enhances local species diversity by offering multiple layers and niches. In contrast, the savanna supports slightly fewer species, favoring birds adapted to open spaces with access to ground-level food resources [27]. The rocky outcrop, with its sparse vegetation, hosts the fewest species due to limited resources and nesting areas but supports species specialized for rugged terrain [28].

The gallery forest hosted several specialist bird species, such as Bruce's Green Pigeon, Beautiful Sunbird, Copper Sunbird, Tambourine Dove, and Bearded Barbet, which were exclusively observed in this habitat. These specialists thrive in specific environments due to their reliance on unique resources and adaptations. Furthermore, generalist species like the Variable Sunbird and Scarlet-chested Sunbird, which serve as avian pollinators, were found across all habitat types, demonstrating their ability to adapt to different environments, including disturbed areas like Shere Hills Reserve which is severely degraded. This distribution underscores how important it is to have diverse habitats in Shere Hills, for upholding avian diversity.

Table 1: Composition of bird species in the habitat types of Shere Hills Reserve

S/N	Bird Species	Scientific names	Family	Gallery	Savanna	Rocky
1	Yellow-billed Kite	*Milvus aegyptius*	Accipitridae	✓	✓	
2	Chestnut-backed Sparrow-Lark	*Eremopterixleucotis*	Alaudidae		✓	✓
3	Crested Lark	*Galerida cristata*			✓	✓
4	Flappet Lark	*Mirafrarufocinnamomea*			✓	✓
5	Sun Lark	*Galerida modesta*		✓	✓	✓
6	African Pygmy Kingfisher	*Ispidina picta*	Alcedinidae	✓	✓	✓
7	Blue-breasted Kingfisher	*Halcyon malimbica*		✓		
8	Giant Kingfisher	*Megaceryle maxima*		✓	✓	
9	Grey-headed Kingfisher	*Halcyon leucocephala*		✓		
10	Malachite Kingfisher	*Alcedo cristata*		✓		
11	Pied Kingfisher	*Ceryle rudis*		✓	✓	
12	White-faced Whistling Duck	*Dendrocygnaviduata*	Anatidae	✓	✓	
13	Common Swift	*Apus apus*	Apodidae		✓	✓
14	African Palm-Swift	*Cypsiurus parvus*		✓		
15	Cattle Egret	*Bubulcus ibis*	Ardeidae	✓	✓	
16	Green Heron	*Butorides virescens*		✓		
17	Grey Heron	*Ardea cinerea*		✓		✓
18	Little Egret	*Egretta garzetta*			✓	
19	White-backed Night-Heron	*Gorsachiusleuconotus*		✓	✓	
20	African Grey Hornbill	*Tockus nasutus*	Bucerotidae	✓	✓	✓
21	Red-billed Hornbill	*Tockuserythrorhynchus*		✓		
22	Yellow-billed Oxpecker	*Buphagus africanus*	Buphagidae	✓	✓	
23	Senegal Thick-knee	*Burhinus senegalensis*	Burhinidae		✓	
24	Red-shouldered Cuckooshrike	*Campephagaphoenicea*	Campephagidae	✓		✓
25	African Wattled Lapwing	*Vanellus senegallus*	Charadriidae	✓	✓	✓
26	Croaking Cisticola	*Cisticola natalensis*	Cisticolidae	✓		
27	Grey-backed Camaroptera	*Camaroptera brevicaudata*		✓	✓	✓
28	Oriole Warbler	*Hypergerusatriceps*		✓	✓	
29	Red-faced Cisticola	*Cisticolaerythrops*		✓		
30	Red-winged Prinia	*Heliolaiserythropterus*		✓		
31	Rock-loving Cisticola	*Cisticola aberrans*		✓	✓	✓
32	Senegal Eremomela	*Eremomela pusilla*		✓	✓	✓
33	Singing Cisticola	*Cisticola cantans*		✓	✓	✓
34	Tawny-flanked Prinia	*Prinia subflava*		✓	✓	✓
35	Speckled Mousebird	*Colius striatus*	Coliidae	✓	✓	✓
36	Adamawa Turtle-Dove	*Streptopeliahypopyrrha*	Columbidae	✓	✓	✓
37	Black-billed Wood-Dove	*Turturabyssinicus*		✓		
38	Bruce's Green-Pigeon	*Treron waalia*		✓		
39	Laughing Dove	*Spilopelia senegalensis*		✓	✓	✓
40	Red-eyed Dove	*Streptopeliasemitorquata*		✓	✓	✓
41	Speckled Pigeon	*Columba guinea*		✓	✓	✓
42	Tambourine Dove	*Turturtympanistria*		✓		
43	Vinaceous Dove	*Streptopeliavinacea*		✓	✓	✓
44	Pied Crow	*Corvus albus*	Corvidae	✓	✓	
45	Dideric Cuckoo	*Chrysococcyxcaprius*	Cuculidae	✓	✓	
46	Klaas's Cuckoo	*Chrysococcyxklaas*			✓	✓
47	Red-chested Cuckoo	*Cuculus solitarius*		✓	✓	✓
48	Senegal Coucal	*Centropus senegalensis*		✓	✓	✓
49	Gosling's Bunting	*Emberizagoslingi*	Emberizidae	✓	✓	✓
50	African Quailfinch	*Ortygospizaatricollis*	Estrildidae		✓	✓
51	Bar-breasted Firefinch	*Lagonostictarufopicta*		✓	✓	
52	Black-bellied Firefinch	*Lagonosticta rara*		✓	✓	
53	Black-rumped Waxbill	*Estrilda troglodytes*			✓	
54	Bronze Mannikins	*Lonchura cucullata*		✓	✓	✓
55	Grey-headed Oliveback	*Nesochariscapistrata*		✓		
56	Lavendar Waxbill	*Estrildacoerulescens*		✓	✓	✓
57	Orange-cheeked Waxbill	*Estrildamelpoda*		✓	✓	✓
58	Red-billed Firefinch	*Lagonostictasenegala*		✓		✓
59	Red-cheeked Cordon-bleu	*Uraeginthusbengalus*		✓	✓	✓
60	Rock Martin	*Ptyonoprognefuligula*		✓	✓	✓
61	Rock Firefinch	*Lagonostictasanguinodorsalis*		✓	✓	✓
62	Common Kestrel	*Falco tinnunculus*	Falconidae		✓	✓
63	Fox Kestrel	*Falco alopex*			✓	
64	Grey Kestrel	*Falco ardosiaceus*				✓

65	Lanner Falcon	*Falco biarmicus*		✓	✓	✓
66	Streaky-headed Seedeater	*Crithagra gularis*	Fringillidae	✓		
67	Yellow-fronted Canary	*Crithagramozambica*		✓	✓	✓
68	Fanti Sawwing	*Psalidoprocne obscura*	Hirundinidae	✓	✓	✓
69	Lesser Striped Swallow	*Cecropisabyssinica*		✓		
70	Red-rumped Swallow	*Cecropisdaurica*		✓	✓	✓
71	White-rumped Swallow	*Tachycinetaleucorrhoa*		✓	✓	✓
72	Greater Honeyguide	*Indicator indicator*	Indicatoridae	✓		
73	Yellow-billed Shrike	*Corvinella corvina*	Laniidae	✓	✓	✓
74	Brown Babbler	*Turdoidesplebejus*	Leiotrichidae	✓		
75	Bearded Barbet	*Lybius dubius*	Lybiidae	✓		✓
76	Vieillot's Barbet	*Lybiusvieilloti*		✓	✓	✓
77	Yellow-fronted Tinkerbird	*Pogoniuluschrysoconus*		✓	✓	✓
78	Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*		✓	✓	✓
79	Northern Crombec	*Sylviettabrachyura*	Macrosphenidae	✓	✓	✓
80	Black-crowned Tchagra	*Tchagrasenegalus*	Malaconotidae	✓	✓	✓
81	Brubru	*Nilaus afer*			✓	
82	Northern Puffback	*Dryoscopusgambensis*		✓		
83	Sulphur-breasted Bushshrike	*Telophorussulfureopectus*		✓	✓	
84	Tropical Boubou	*Laniarius aethiopicus*		✓	✓	✓
85	Yellow-crowned Gonolek	*Laniariusbarbarus*		✓	✓	✓
86	Little Bee-eater	*Merops pusillus*	Meropidae	✓	✓	✓
87	African Paradise-Flycatcher	*Terpsiphoneviridis*	Monarchidae	✓		✓
88	Yellow-throated Longclaw	*Macronyx croceus*	Motacillidae			✓
89	Common Wattle-eye	*Platysteira cyanea*	Muscicapidae	✓	✓	
90	Familiar Chat	*Oenanthe familiaris*		✓	✓	✓
91	Mocking Cliff Chat	*Thamnolaeacinnamomeiventris*		✓	✓	✓
92	Northern Black-Flycatcher	*Melaenornisedolioides*		✓	✓	✓
93	Pale Flycatcher	*Melaenornis pallidus*		✓	✓	✓
94	Pied Flycatcher	*Ficedula hypoleuca*		✓	✓	✓
95	Snowy-crowned Robin-Chat	*Cossyphaniveicapilla*		✓	✓	✓
96	White-fronted Black-Chat	Oenanthe *albifrons*			✓	
97	Violet Turaco	*Musophaga violacea*	Musophagidae	✓	✓	✓
98	Western Grey Plantain-eater	*Crinifer piscator*		✓	✓	✓
99	Beautiful Sunbird	*Cinnyris pulchellus*	Nectariniidae	✓		
100	African Paradise-Flycatcher	*Terpsiphoneviridis*	Monarchidae	✓		✓
101	Copper Sunbird	*Cinnyris cupreus*		✓		
102	Green-headed Sunbird	*Cyanomitraverticalis*		✓	✓	
103	Pygmy Sunbird	*Hedydipnaplatura*			✓	✓
104	Scarlet-chested Sunbird	*Chalcomitra senegalensis*		✓	✓	✓
105	Variable Sunbird	*Cinnyris venustus*		✓	✓	✓
106	Stone Patridge	*Ptilopachuspetrosus*	Odontophoridae	✓	✓	✓
107	White-Shouldered Black Tit	Parus guineensis	Paridae	✓		✓
108	Northern Grey-Headed Sparrow	*Passer griseus*	Passeridae	✓	✓	
109	Black-capped Babbler	*Pellorneumcapistratum*	Pellorneidae	✓		
110	Double-spurred Francolin	*Pternistisbicalcaratus*	Phasianidae	✓	✓	✓
111	Green Wood Hoopoe	*Phoeniculus purpureus*	Phoeniculidae	✓	✓	
112	Cardinal Woodpecker	*Dendropicosfuscescens*	Picidae	✓	✓	✓
113	Common Wattle-Eye	*Platysteira cyanea*	Platysteiridae	✓	✓	
114	Senegal Batis	*Batis senegalensis*		✓		✓
115	Black-necked Weaver	*Ploceus nigricollis*	Ploceidae	✓	✓	✓
116	Black-winged Bishop	*Euplecteshordeaceus*		✓	✓	✓
117	Chestnut-crowned Sparrow-Weaver	*Plocepassersuperciliosus*		✓	✓	✓
118	Little Weaver	*Ploceus luteolus*		✓	✓	✓
119	Northern Red Bishop	*Euplectesfranciscanus*		✓	✓	✓
120	Red-headed Weaver	*Anaplectesrubriceps*		✓	✓	
121	Speckled-fronted Weaver	*Sporopipes frontalis*		✓	✓	✓
122	Village Weaver	*Ploceus cucullatus*		✓	✓	✓
123	Vitelline Masked-Weaver	*Ploceus vitellinus*		✓		
124	Yellow-mantled Widowbird	*Euplectes macroura*		✓		
125	Senegal Parrot	*Poicephalussenegalus*	Psittacidae	✓	✓	
126	Common Bulbul	*Pycnonotus barbatus*	Pycnonotidae	✓	✓	✓
127	Yellow-throated Leaflove	*Atimastillasflavicollis*		✓	✓	✓
128	Yellow-fronted Tinkerbird	*Pogoniuluschrysoconus*	Ramphastidae	✓	✓	✓
129	Yellow Penduline Tit	*Anthoscopusparvulus*	Remizidae	✓	✓	✓
130	Hamerkop	*Scopus umbretta*	Scopidae	✓	✓	
131	African Blue Flycatcher	*Elminia longicauda*	Stenostiridae	✓	✓	
132	Long-tailed Glossy Starling	*Lamprotornis caudatus*		✓		
133	Neumann's Starling	*Onychognathusneumanni*		✓	✓	✓
134	Purple Glossy Starling	*Lamprotornis purpureus*		✓	✓	✓
135	Violet-Backed Starling	*Cinnyricinclus leucogaster*		✓		✓
136	Moustached Warbler	*Melocichla mentalis*	Sylviidae	✓	✓	✓
137	Garden Warbler	*Sylvia borin*		✓	✓	✓
138	Willow Warbler	*Phylloscopus trochilus*			✓	✓
139	African Thrush	*Turdus pelios*	Turdidae	✓	✓	✓
140	Jos Plateau Indigobird	*Viduamaryae*	Viduidae		✓	✓
141	Pin-tailed Whydah	*Vidua macroura*			✓	✓
142	African Yellow White-Eye	*Zosterops senegalensis*	Zosteropidae		✓	✓

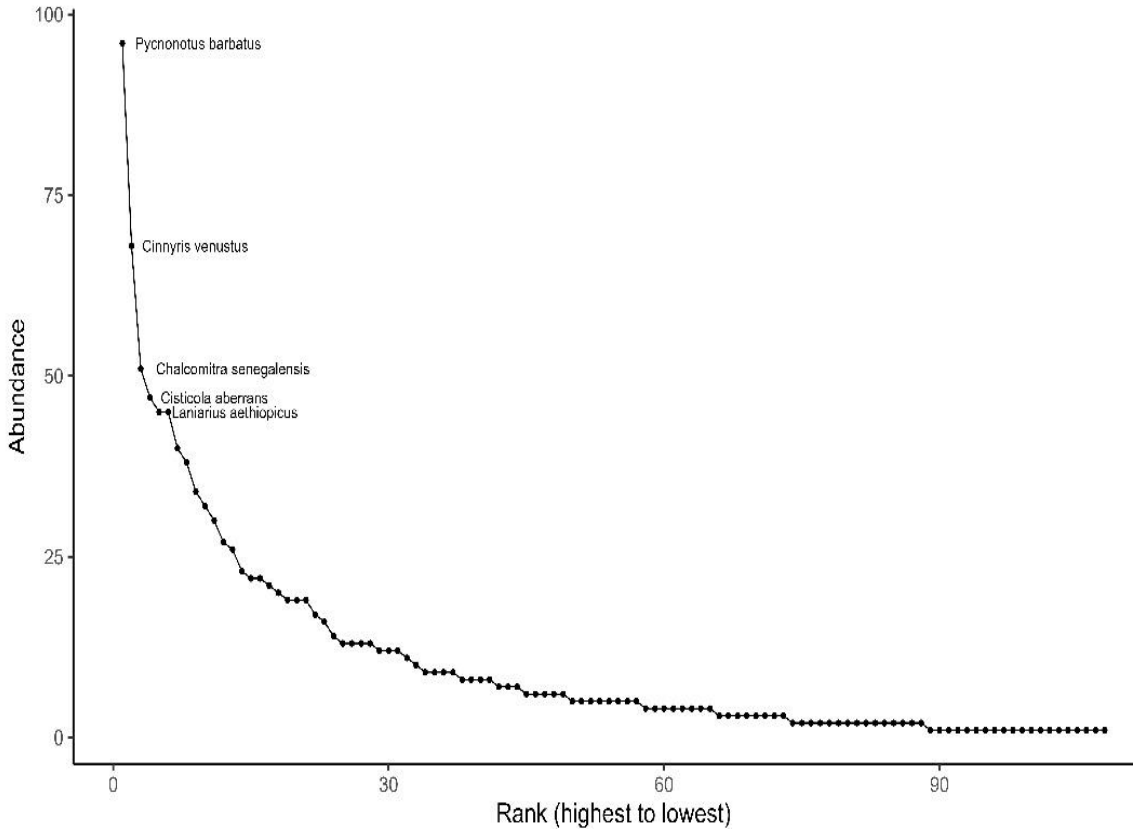

Figure 3: Rank Abundance of Bird Species in Shere Hills Reserve

Abundance for bird species in Shere Hills Reserve

Figure 3 revealed the first five species that ranked the highest in the rocky habitat which includes: *Pycnonotus barbatus*- Common Bulbul (96), *Cinnyris venustus*- Variable Sunbird (68), *Chalcomitra senegalensis*- Scarlet-chested Sunbird (51), *Cisticola aberrans*- Rock-loving Cisticola (47) and *Laniarius aethiopicus*- Tropical Boubou (45).

Bird abundance did not differ across the various habitat-types ($F_{2, 585} = 0.59$, $p = 0.56$), Fig. 4. However, bird diversity was relatively higher in the Savanna (1.92 ± 0.03) and Gallery forest (1.91 ± 0.03) while the rocky outcrop harbored the least bird diversity (1.87 ± 0.03).

The Common Bulbul, Variable Sunbird, and Scarlet-chested Sunbird were the most frequently observed species across all habitat types, highlighting their role as generalist avian species in the Shere Hills Reserve. These species play critical ecological roles, with the Variable and Scarlet-chested Sunbirds acting as active pollinators, while the Common Bulbul contributes to seed dispersal and ecosystem regeneration in degraded areas. As a widely distributed omnivore, the Common Bulbul consumes various fruits and invertebrates, thriving in wooded and bushy habitats except in unbroken forests, open grasslands, and treeless deserts [29, 22].

The dominance of nectarivorous and frugivorous species underscores their importance in restoring degraded ecosystems. This finding aligns with [30], who observed that diverse habitats support generalist species capable of thriving in various environments, including urban and protected landscapes. Their ability to thrive in various habitats highlights their strength and importance, in the ecosystem [27]. Their adaptability and ecological contributions emphasize the need for conservation efforts to prioritize resources that sustain these dominant species, as they are essential for maintaining ecosystem functions across all habitat types.

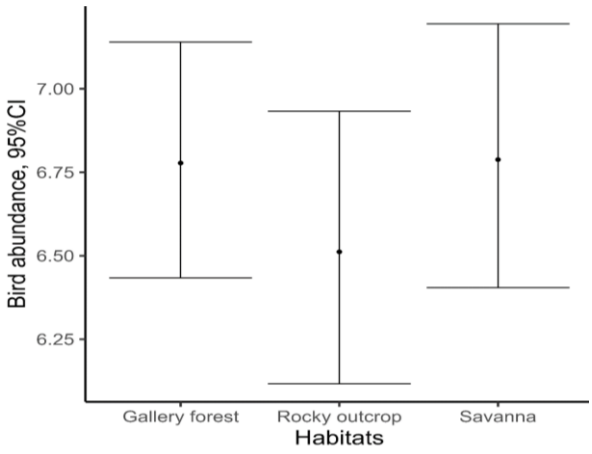

Figure 4: Bird abundance in habitat types found in Shere Hills Reserve

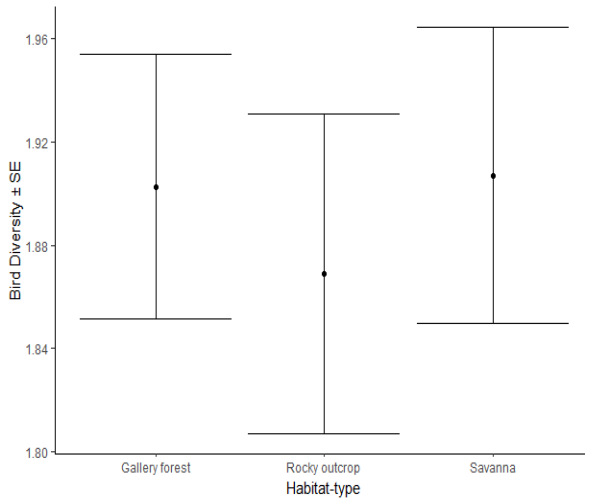

Figure 5: Bird diversity across the habitat types found in Shere Hills Reserve

Bird diversity across habitat types in Shere Hills

Bird diversity did not significantly differ across the various habitat-types ($F_{(2,\ 585)}$ = 0.4682, p = 0.63) as shown in Fig. 5. However, bird diversity was relatively higher in the savanna (1.91 ± 0.03) compared to the gallery forest (1.90 ± 0.03) while the rocky outcrop haboured the least bird diversity (1.87 ± 0.03).

Shere Hills Reserve supports diverse bird species across its mixed habitat types; savanna, gallery forest, and rocky outcrops, despite their structural differences and varying resource availability. The savanna showed slightly higher diversity, possibly due to its blend of open and sheltered resources that attract a variety of species [32]. The gallery forest, with its dense vegetation and water availability, also exhibited high diversity, while the rocky outcrop had lower diversity due to its limited resources, which constrain bird activities such as foraging and nesting [33]. Despite these differences, all habitats contribute uniquely to the overall bird diversity of the area.

Bird mobility and habitat interconnectivity influence resource use, with birds utilizing multiple habitats for food, shelter, and breeding. The study noted that degraded areas, such as rocky outcrops and fringe gallery forests, still hold conservation value by supporting unique species. This aligns with findings by [34, 35], which emphasize the conservation potential of multi-use landscapes alongside strictly protected areas.

The observed species richness and habitat preferences underscore the importance of habitat selection based on birds' needs for food, shelter, and reproduction [36]. Specific species were found only in particular habitats, highlighting the influence of habitat structure on avian diversity [37]. The study agrees with [38, 39] in demonstrating the utility of bird populations and their habitats as indicators for environmental monitoring and conservation planning.

Overall, Shere Hills' diverse and interconnected habitats collectively support a stable bird population. Conserving all habitat types is critical to maintaining this balance and supporting both common and rare bird species.

Conclusion

This study highlights the significance of habitat heterogeneity in sustaining avian biodiversity within Shere Hills Reserve, Plateau State. The diversity of bird species across the gallery forest, savanna, and rocky outcrop habitats emphasizes the critical role these ecosystems play in maintaining ecological balance and supporting a wide range of avian life. Although gallery forests exhibited the highest species composition, all three habitats contributed unique species, showcasing the complementary value of varied habitat types.

The lack of significant variation in bird diversity and abundance across habitats suggests that the interconnectedness of these ecosystems is vital for avian conservation. These findings provide a foundation for future biodiversity assessments and emphasize the need for strategies to preserve the integrity of these habitats, ensuring the continued survival of bird populations and the ecological services they provide in Shere Hills Reserve.

Conflict of interest: The authors declare that there is no conflict of interest regarding the publication of this research.

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