Journal of Animal Diversity

Volume 7, Issue 3 (2025)

Online ISSN 2676-685X

Research Article

https://dx.doi.org/10.22034/JAD.2025.7.3.1

Avian diversity and habitat preferences in Rangia College Campus, Assam, India

Nitul Ali and Prem Kishan Singha

Department of Zoology, Rangia College, Kamrup, Assam, India
*Corresponding author: *alinitul.rc@gmail.com*

Citation: Ali, N. and Singha, P. K. (2025). Avian diversity and habitat preferences in Rangia College Campus, Assam, India. *Journal of Animal Diversity*, 7 (3): 1–9. https://dx.doi.org/10.22034/JAD.2025.7.3.1

Received: 3 August 2025
Revised: 21 August 2025
Accepted: 15 September 2025
Published online: 30 September 2025

Abstract

Avian assemblages serve as sensitive bioindicators of habitat quality and ecological resilience, particularly within anthropogenic landscapes such as institutional campuses. The present study conducted a comprehensive diversity assessment of avifauna in Rangia College Campus, Assam, India, from August, 2024 to July, 2025 to evaluate species composition, trophic guild structure, habitat preferences, and conservation status. Standardized line transects and point count methods were employed across four habitat types, and community parameters were quantified using Shannon–Wiener, Simpson, Margalef, Berger–Parker, and Pielou's indices. A total of 54 species across 43 genera, 32 families and 12 orders were recorded, of which *Leptoptilos javanicus* (Vulnerable) was of global conservation concern. Insectivores dominated the trophic structure (31.48%), and habitat analysis revealed maximum richness and diversity within tree-dominated patches (HT-1). Diversity indices indicated marked variation across habitats, with HT-1 exhibiting the highest Shannon diversity (H′= 2.685) and HT-3 (Open areas like rooftops, playgrounds, fields and roadsides) the lowest (H′= 2.001). These findings demonstrate that structurally heterogeneous, vegetation-rich habitats act as micro-refugia sustaining both common and threatened taxa within an urban–educational matrix. The study provides a robust baseline inventory, elucidates the role of microhabitat heterogeneity in shaping avian communities, and highlights the need for biodiversity-sensitive campus management in rapidly urbanizing regions of Assam.

Key words: Conservation status, diversity assessment, feeding guild structure, habitat heterogeneity, institutional campus biodiversity

Introduction

Bird communities are often considered sentinel taxa, whose presence, richness, and community structure reflect underlying ecosystem integrity, habitat heterogeneity, and anthropogenic pressures (Sekercioglu et al., 2012; Aronson et al., 2014). Their relatively high detectability varied ecological roles (e.g. insect control, seed dispersal, pollination), and mobility make them prime indicators for monitoring biodiversity responses to land-use change (Bibby et al., 2000; Gregory and van Strien, 2010).

In landscapes increasingly dominated by urbanization, remnant green spaces—such as institutional campuses—frequently act as biodiversity refugia and stepping stones, supporting surprisingly rich avian assemblages (Lepczyk et al., 2017; Sanllorente et al., 2023).

India is among the world's most avian-diverse countries, with recent checklists documenting over 1,350 bird species across ecosystems ranging from alpine regions to tropical wetlands. This diversity spans multiple taxonomic orders and families and includes several endemic and regionally restricted taxa, reflecting the country's unique biogeographic history (Maheswaran and Alam, 2024). Recent assessments, such as the *State of India's Birds 2023*, further highlight the conservation importance of this richness by revealing population trends and emphasizing the need for continued monitoring and habitat protection (SoIB, 2023).

Institutional campuses, especially in developing regions, often incorporate diverse microhabitats (woodlots, gardens, ponds, managed lawns, buildings), resulting in a mosaic of niches that may harbor heterogeneous bird assemblages (Sanllorente et al., 2023; Yadav et al., 2024). Empirical surveys across global and Indian contexts have shown that well-vegetated campuses can exceed adjacent urban zones in bird richness and functional diversity (Guthula et al., 2022; Sanllorente et al., 2023). For instance, a study of 335 academic campuses across India recorded a cumulative 779 bird species (mean ~88 species per campus), including several threatened taxa (Guthula et al., 2022). Similarly, Sanllorente et al. (2023) demonstrated that university campuses can maintain elevated biodiversity relative to surrounding urban matrices, especially when structural vegetation complexity is preserved.

Despite these advances, integrated studies that concurrently examine feeding guild structure, fine-scale habitat preference, and conservation status of campus bird communities remain relatively scarce, particularly in the biodiversity-rich northeastern region of India. Assam, a beautiful state in India, is situated at the confluence of Indo-Malayan, Himalayan, and Indo-Burma biodiversity hotspots regions, and offers a uniquely rich avifaunal pool yet is gradually subject to urban expansion and habitat transformation (Rahmani et al., 2016; Bhaduri and Rathod, 2022; Ali et al., 2025). A systematic inventory in such a region thus holds promise not only for local conservation but also for refining our general ecological knowledge of the interplay between trophic resources, microhabitat structure, and species persistence in anthropogenic settings (Bhaduri and Rathod, 2022).

In recent campus bird surveys, insectivores and omnivores often dominate the species composition, reflecting available prey bases in gardens and tree strata (Sanllorente et al., 2023; Yadav et al., 2024). In the context of campus habitats, factors such as canopy cover, vertical stratification, presence of water bodies, and plant species composition strongly influence species occupancy and richness (Yang et al., 2020; Zhao et al., 2023). Furthermore, the prevalence of native versus invasive species, community evenness, dominance patterns, and the presence of species of conservation concern (per IUCN) are vital indicators of ecological stability under urbanizing influence (Aronson et al., 2014; Lepczyk et al., 2017).

This study delivers a comprehensive assessment of avifauna in Rangia College Campus, Assam, encompassing trophic guild analysis to interpret resource partitioning, habitat-specific diversity evaluation across four habitat types using standard community indices, and conservation appraisal highlighting threatened species such as *Leptoptilos javanicus* (Horsfield, 1821) and *Anhinga melanogaster* Pennant, 1769. The objectives are to establish a robust baseline for long-term monitoring, clarify how microhabitat heterogeneity and trophic gradients shape diversity, and propose evidence-based measures for habitat restoration and bird-friendly campus planning.

Material and Methods

Study area

The survey was conducted within the Rangia College campus (26°26′ N, 91°37′ E), located in the Kamrup district of Assam, India (Ali, 2025), at an average elevation of 39 meters, encompassing tree-dominated patches, shrublands, water bodies, open lawns, and built-up zones. The region falls under a monsoonal climate, providing diverse ecological conditions suitable for avifauna (Fig. 1).

Sampling and observation

Bird surveys were carried out between August, 2024 and July, 2025 using standard line transect (500 m) and fixed-radius point count (50 m, 10 min) methods across four habitat types (HT-1 = Tall and Scattered trees, woody-plantation areas; HT-2 = Gardens, bushes, corpses, scrublands, grasslands and paddies; HT-3 = Open areas like rooftops, playgrounds, fields and roadsides; and HT-4 = Aquatic bodies and Wetland areas) (Bibby et al., 2000; Sanllorente et al., 2023). Surveys were conducted twice daily during peak activity (05:30–08:30 h and 15:30–17:30 h). Observations were made with binoculars (Nikon 8 × 40), supported by DSLR (Nikon D5600) photography for confirmation. Opportunistic sightings of rare or threatened species were also recorded.

Species identification followed Choudhury (2000) and Grimmett et al. (2016), with nomenclature standardized using the IOC World Bird List (v.13.2, 2023). Conservation status was assigned per the IUCN Red List of Threatened Species (2025). Species were categorized into trophic guilds (insectivorous, carnivorous, omnivorous, granivorous, frugivorous, piscivorous, nectarivorous) based on published dietary data (Kissling et al., 2007; Yadav et al., 2024).

Data analysis

Avian diversity was quantified using Shannon–Wiener index (H′), Simpson's index (D), Margalef richness index (M), Pielou's evenness (J), and Berger–Parker dominance (d) (Magurran, 2021). Indices were computed using PAST v.4.13 (Hammer et al., 2001). Comparative diversity among habitat types was analyzed to infer habitat preferences and guild distribution. Differences in Shannon–Wiener diversity (H′) among habitats were assessed using Hutcheson's *t*-test (Hutcheson, 1970), based on species abundances, with analyses performed in Python (SciPy, v3.11) at a significance level of $p < 0.05$.

Results

During the survey period, a total of 54 avian species belonging to 43 genera representing 32 families across 12 taxonomic orders were documented (Table 1). Of these, 52 species are classified under the Least Concern (LC) category, whereas *Leptoptilos javanicus* is designated as Vulnerable (VU) according to the IUCN Red List of Threatened Species (2025). The families Cuculidae and Ardeidae exhibited the greatest taxonomic representation, each comprising four species, followed by Laniidae, Columbidae, Nectariniidae, and Sturnidae with three species apiece. Families including Accipitridae, Ciconiidae, Coraciidae, Meropidae, Alcedinidae, Paridae, Estrildidae, and Megalaimidae were represented by two species each, while the remaining 18 families were represented by a single species. At the ordinal level, Passeriformes contributed the maximum richness (25 species), trailed by Coraciiformes (6 species); Cuculiformes and Pelecaniformes (4 species each); Piciformes and Columbiformes (3 species each); Accipitriformes, Ciconiiformes, and Suliformes (2 species each); and Gruiformes, Psittaciformes, and Upupiformes (1 species each) (Table 1).

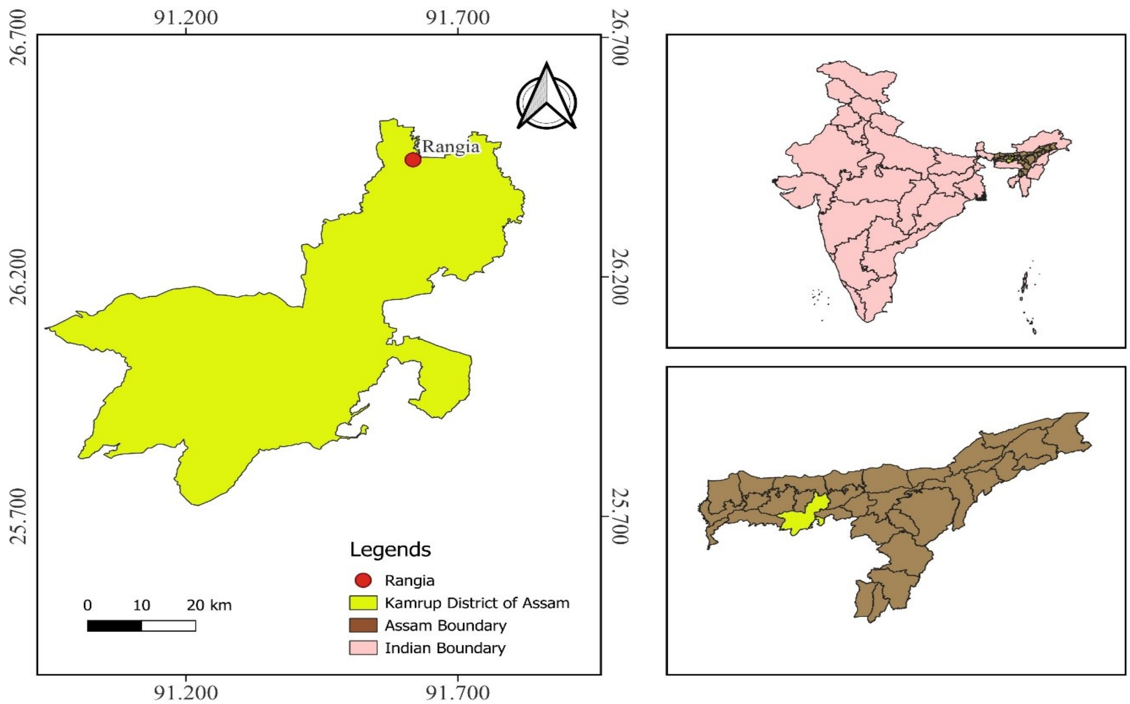

Figure 1: Maps showing the study site (Source: QGIS Version 3.34.10). The red dot on the map of Kamrup district (depicted in green) identifies the precise position of Rangia, where Rangia College is located.

Table 1: Order-wise list of birds observed in and around Rangia College Campus, Assam of India during the study period, along with their feeding habits, habitat preferences, relative abundance, and conservation status.

Sl. No.	Order	Family	Species	Common name	Relative abundance (%)	Conservation status	Main feeding habit	Preferred habitat type
1	Accipitriformes	Accipitridae	*Milvus migrans* (Boddaert, 1783)	Black kite	2.86	LC	Carnivorous	HT-1
			Spilornis cheela (Latham, 1790)	Crested serpent eagle	2.14	LC	Carnivorous	HT-1
2	Ciconiiformes	Ciconiidae	*Leptoptilos javanicus* (Horsfield, 1821)	Lesser adjutant	3.36	VU	Carnivorous	HT-4
			Anastomus oscitans (Boddaert, 1783)	Asian open bill	3.36	LC	Carnivorous	HT-4
3	Columbiformes	Columbidae	*Columba livia* Gmelin, 1789	Rock pigeon	14.73	LC	Granivorous	HT-3
			Streptopelia decaocto (Frivaldszky, 1838)	Eurasian collared-dove	9.82	LC	Granivorous	HT-3
			Streptopelia decaocto (Frivaldszky, 1838)	Spotted dove	17.18	LC	Granivorous	HT-3

Table 1: (Continued).

Sl. No.	Order	Family	Species	Common name	Relative abundance (%)	Conservation status	Main feeding habit	Preferred habitat type
4	Coraciiformes	Coraciidae	*Coracias affinis* Horsfield, 1821	Indochinese roller	1.43	LC	Insectivorous	HT-1
			Coracias benghalensis (Linnaeus, 1758)	Indian roller	2.14	LC	Insectivorous	HT-1
		Meropidae	*Merops orientalis* Latham, 1802	Asian green bee-eater	5.11	LC	Insectivorous	HT-2
			Merops philippinus Linnaeus, 1766	Blue-tailed bee-eater	8.40	LC	Insectivorous	HT-4
		Alcedinidae	*Halcyon smyrnensis* (Linnaeus, 1758)	White-breasted kingfisher	10.92	LC	Carnivorous	HT-4
			Alcedo atthis Linnaeus, 1758	Common kingfisher	3.36	LC	Piscivorous	HT-4
5	Cuculiformes	Cuculidae	*Cacomantis merulinus* (Scopoli, 1768)	Plaintive cuckoo	5.71	LC	Insectivorous	HT-1
			Centropus sinensis (Stephens, 1815)	Greater coucal	2.92	LC	Carnivorous	HT-2
			Eudynamys scolopaceus (Linnaeus, 1758)	Asian koel	3.57	LC	Frugivorous	HT-1
			Hierococcyx varius (Vahl, 1797)	Common hawk-cuckoo	2.14	LC	Insectivorous	HT-1
6	Gruiformes	Rallidae	*Amaurornis phoenicurus* (Pennant, 1769)	White-breasted waterhen	23.53	LC	Omnivorous	HT-4
7	Passeriformes	Passeridae	*Passer domesticus* (Linnaeus, 1758)	House sparrow	15.34	LC	Granivorous	HT-3
		Nectariniidae	*Aethopyga siparaja* (Raffles, 1822)	Crimson sunbird	5.84	LC	Nectarivores	HT-2
			Leptocoma zeylonica (Linnaeus, 1766)	Purple rumped sunbird	1.46	LC	Nectarivores	HT-2
			Cinnyris asiaticus (Latham, 1790)	Purple sunbird	4.28	LC	Nectarivores	HT-2
		Muscicapidae	*Copsychus saularis* (Linnaeus, 1758)	Oriental magpie-robin	11.68	LC	Insectivorous	HT-2
		Sturnidae	*Acridotheres tristis* (Linnaeus, 1766)	Common myna	19.63	LC	Omnivorous	HT-3
			Acridotheres fuscus (Wagler, 1827)	Jungle myna	11.66	LC	Omnivorous	HT-3
			Gracupica contra (Linnaeus, 1758)	Indian pied starling	5.52	LC	Omnivorous	HT-3
		Pycnonotidae	*Pycnonotus cafer* (Linnaeus, 1766)	Red-vented bulbul	18.25	LC	Omnivorous	HT-2
		Cisticolidae	*Orthotomus sutorius* (Pennant, 1769)	Common tailorbird	3.65	LC	Insectivorous	HT-2
		Ploceidae	*Ploceus philippinus* (Linnaeus, 1766)	Baya weaver	8.76	LC	Omnivorous	HT-2
		Laniidae	*Lanius cristatus* Linnaeus, 1758	Brown shrike	5.11	LC	Carnivorous	HT-2
			Lanius Schach Linnaeus, 1758	Long tailed shrike	2.92	LC	Carnivorous	HT-2
			Lanius tephronotus Vigors, 1831	Grey-backed shrike	3.65	LC	Carnivorous	HT-2
		Dicruridae	*Dicrurus macrocercus* Vieillot, 1817	Black drongo	7.14	LC	Insectivorous	HT-1
		Paridae	*Parus cinereus* Vieillot, 1818	Cinereous tit	7.14	LC	Insectivorous	HT-1
			Parus major Linnaeus, 1758	Great tit	6.43	LC	Insectivorous	HT-1
		Corvidae	*Corvus splendens* Vieillot, 1817	House crow	19.29	LC	Omnivorous	HT-1
		Zosteropidae	*Zosterops palpebrosus* Temminck, 1824	Indian white-eye	5.00	LC	Omnivorous	HT-1
		Aegithinidae	*Aegithina tiphia* (Linnaeus, 1758)	Common iora	3.57	LC	Insectivorous	HT-1
		Estrildidae	*Lonchura punctulata* (Linnaeus, 1758)	Scaly-breasted munia	8.03	LC	Granivorous	HT-2
			Lonchura atricapilla (Vieillot, 1807)	Chestnut munia	5.84	LC	Granivorous	HT-2
		Dicruridae	*Dicrurus hottentottus* (Linnaeus, 1766)	Hair-crested drongo	2.14	LC	Insectivorous	HT-1
		Oriolidae	*Oriolus xanthornus* (Linnaeus, 1758)	Black-hooded oriole	2.14	LC	Insectivorous	HT-1
		Leiothrichidae	*Turdoides striata* (Dumont, 1823)	Jungle babbler	12.41	LC	Omnivorous	HT-2

Table 1: (Continued).

Sl. No.	Order	Family	Species	Common name	Relative abundance (%)	Conservation status	Main feeding habit	Preferred habitat type
8	Pelecaniformes	Ardeidae	*Ardea intermedia* Wagler, 1829	Intermediate egret	16.81	LC	Carnivorous	HT-4
			Bubulcus ibis (Linnaeus, 1758)	Cattle egret	10.92	LC	Insectivorous	HT-4
			Ardea alba Linnaeus, 1758	Great egret	5.88	LC	Carnivorous	HT-4
			Ardeola grayii (Sykes, 1832)	Indian pond-heron	6.72	LC	Piscivorous	HT-4
9	Piciformes	Megalaimidae	*Psilopogon lineatus* (Vieillot, 1816)	Lineated barbet	4.29	LC	Omnivorous	HT-1
			Psilopogon haemacephalus (Müller, 1776)	Copper smith barbet	2.86	LC	Frugivorous	HT-1
		Picidae	*Dinopium benghalense* (Linnaeus, 1758)	Black-rumped flameback	7.14	LC	Insectivorous	HT-1
10	Psittaciformes	Psittaculidae	*Psittacula krameria* (Scopoli, 1769)	Indian rose-ringed parakeet	12.86	LC	Frugivorous	HT-1
11	Suliformes	Anhingidae	*Anhinga melanogaster* Pennant, 1769	Oriental darter	2.52	LC	Piscivorous	HT-4
		Phalacrocoracidae	*Microcarbo niger* (Vieillot, 1817)	Little cormorant	4.20	LC	Piscivorous	HT-4
12	Upupiformes	Upupidae	*Upupa epops* Linnaeus, 1758	Eurassian hoopoe	6.13	LC	Insectivorous	HT-3

(LC = Least Concern, VU = Vulnerable).

From a trophic perspective, the avifauna in this study were segregated into seven major guilds: insectivorous, carnivorous, omnivorous, granivorous, frugivorous, piscivorous, and nectarivorous. The insectivorous guild dominated the assemblage (31.48%, 17 species), succeeded by carnivores (20.37%, 11 species), omnivores (18.52%, 10 species), granivores (11.11%, 6 species), and piscivores (7.40%, 4 species). The least represented foraging categories were frugivores and nectarivores, each comprising three species (5.56%) (Fig. 3, and Table 2).

Among the surveyed habitats, HT-1 exhibited the greatest species richness (35.19%, 19 species), whereas HT-3 represented the most impoverished habitat (14.81%, 8 species). The hierarchical gradient of avian richness across habitats followed the sequence: HT-1 (35.19%, 19 species) > HT-2 (27.78%, 15 species) > HT-4 (22.22%, 12 species) > HT-3 (14.81%, 8 species) (Fig. 2, Table 2). The Shannon–Wiener diversity index (H') attained its maximum in HT-1 (H'= 2.685) and its minimum in HT-3 (H'= 2.001) (Table 3). Taxonomically, Passeriformes constituted the predominant order (25 species), distributed across habitats as 13 species in HT-2, 8 species in HT-1, and 4 species in HT-3. These results substantiate that arboreal/vegetation-rich habitats were disproportionately favored over other habitat types (Table 2).

The analysis of community evenness revealed that Pielou's Evenness index (J) varied from 0.905 (HT-4) to 0.962 (HT-3). Similarly, the Berger–Parker dominance index (d) ranged between 0.182 (HT-2) and 0.235 (HT-4). In terms of species richness, the Margalef index (M) recorded its peak value in HT-1 (3.640) and the lowest in HT-3 (1.374), further corroborating the ecological primacy of HT-1 (Table 3).

Pairwise comparisons using Hutcheson's *t*-test revealed significant differences in avian diversity among the habitats. The Shannon index for HT-1 was significantly higher than that for HT-2 (t= 2.08, p= 0.038), HT-3 (t= 10.07, $p < 0.001$), and HT-4 (t= 5.04, $p < 0.001$). Similarly, HT-2 differed significantly from both HT-3 (t= 8.79, $p < 0.001$) and HT-4 (t= 3.38, $p < 0.001$). Even between HT-3 and HT-4, the difference was significant (t= –3.65, $p < 0.001$). These results confirm that habitat heterogeneity strongly influences avifaunal diversity, with more structurally complex or vegetated areas (HT-1, HT-2) supporting higher diversity compared to open or water-dominated habitats (HT-3, HT-4).

Discussion

The avian assemblage documented in the campus landscape of this study reveals several patterns of ecological and conservation significance. The marked heterogeneity in species richness, diversity indices, and habitat preferences underscores the influence of microhabitat structure, resource heterogeneity, and anthropogenic filtering in shaping urban avifauna (Upadhyaya et al., 2022; Ali et al., 2025).

Table 2: Distribution of bird species across major feeding guilds and habitat types (HT-1 to HT-4) within Rangia College Campus. The table summarizes the number of species belonging to each feeding habit recorded in four distinct habitat categories, along with their overall totals, highlighting variations in dietary specialization and habitat use patterns.

Feeding habits	Habitat types				No. of species
	HT-1	HT-2	HT-3	HT-4	
Carnivorous	2	4	0	5	11
Granivorous	0	2	4	0	6
Insectivorous	11	3	1	2	17
Piscivorous	0	0	0	4	4
Frugivorous	3	0	0	0	3
Omnivorous	3	3	3	1	10
Nectarivores	0	3	0	0	3
Total	19	15	8	12	54

Table 3: Diversity indices of avifaunal communities in different habitats of Rangia College Campus, Assam, India.

Habitat types	Shannon index (H’)	Pielou’s evenness (J’)	Berger-parker index (d)	Margalef index (D)
HT-1	2.685	0.917	0.193	3.640
HT-2	2.518	0.930	0.182	2.850
HT-3	2.001	0.962	0.196	1.374
HT-4	2.248	0.905	0.235	2.302

The pronounced dominance of HT-1 in both species richness and Shannon diversity suggests that this habitat type provides a richer complement of niches, structural complexity, and resources compared to other habitat types in the campus. The fact that HT-3 emerged as species-poor accords with the idea that simpler or disturbed habitat types support fewer species (e.g. fewer nesting or perching opportunities, lower food diversity) (Ali et al., 2025). The rank ordering of habitats (HT-1 > HT-2 > HT-4 > HT-3) is consistent with ecological expectations that more structurally diverse and resource-rich habitats support greater richness and diversity (Bhaduri and Rathor, 2022).

In studies of university campuses elsewhere, similar trends have been observed. For example, Sanllorente et al. (2023) demonstrated that more vegetated, less managed patches within university campuses harbored significantly higher bird diversity compared to intensively managed or open lawns (i.e. where structural complexity is low) (Sanllorente et al., 2023). Zhang et al. (2021) also found that within Chinese campuses, both green space area and patch connectivity strongly influenced campus bird richness (Zhang et al., 2021). Thus, our results align with and reinforce broader patterns: habitat complexity and vegetation heterogeneity are key determinants of avian diversity in campus landscapes.

The predominance of insectivorous species in our dataset (31.48%) corroborates the common finding that insectivores often dominate bird communities in semi-natural and urban green patches, especially where insect prey remains abundant. In campus settings, trees, shrubs, and managed vegetation support arthropod communities, thereby favoring insectivorous taxa (Yadav et al., 2024). The relatively high proportions of carnivorous, omnivorous, and granivorous guilds suggest that the campus ecosystem provides a mosaic of trophic resources, from small vertebrate prey to seeds and fruits.

The lower representation of frugivorous and nectarivorous birds might reflect a paucity of native fruiting trees or nectar-producing flora in the campus, or seasonal mismatches in fruit/flower availability. In some campus studies, the lack of fruiting shrubs or flowering plantings limits the abundance of frugivores and nectarivores (Sanllorente et al., 2023). This trend suggests a potential management opportunity: planting native fruiting and nectarivorous species could help bolster functional diversity by attracting underrepresented dietary guilds.

Interestingly, the dominance of Passeriformes (25 species) across habitat types underscores both their inherent species richness and their ability to adapt to heterogeneous or anthropogenic landscapes. As the most speciose avian order, passerines are expected to dominate bird communities in most ecosystems due to their ecological versatility, diverse feeding guilds, and flexible nesting and foraging behaviors (Zhao et al., 2023).

The Shannon index (H′) showed that HT-1 achieved the highest diversity (2.685), whereas HT-3 was the lowest (2.001). These values reinforce the strong gradient in habitat suitability. The high evenness (J ranging from 0.905 to 0.962) suggests that species relative abundances were not excessively skewed by dominance of a few taxa; in fact, even in less favourable habitats, rare species were not entirely suppressed. Such high evenness is a favourable sign of balanced communities rather than ones dominated by a few generalists (Upadhyaya et al., 2022).

The Berger–Parker dominance index (d) indicated the greatest dominance (i.e. highest d) in HT-4 (0.235) and the lowest in HT-2 (0.182). This suggests that in HT-4, one or a few species may exert a disproportionate presence, possibly exploiting a particular micro-niche or resource. Thus, the juxtaposition of multiple diversity/dominance metrics underscores that richness alone does not capture community structure fully—some habitats may support many species but also harbor dominant, abundant taxa (Upadhyaya et al., 2022).

The Margalef richness index (M) reaffirmed the primacy of HT-1 (3.640) and the impoverishment of HT-3 (1.374), further underlining the critical distinctiveness of HT-1 in maintaining avian richness.

The pattern that tree-dominated or structurally complex habitats (HT-1 and HT-2) were favored over simpler or open habitats suggests that canopy cover, vertical stratification, and woody vegetation are decisive in habitat selection by birds. Such preferences are well documented in urban ecology: birds use vertical structure for nesting, perching, predator avoidance, and microclimatic buffering (Marzluff, 2001). In the context of campuses, preserving or enhancing mature trees and shrub understorey can greatly enhance avian habitat quality.

Given that Passeriformes were widely distributed across HT-1, HT-2, and even some presence in HT-3, it is likely that birds penetrate less favorable habitats too, but their richness is constrained by resource availability. The data thus suggest that while habitat connectivity permits movement, the quality and resource contents of habitats determine occupancy and persistence (Şekercioğlu et al., 2004).

The fact that the campus supports the highest number of insectivorous species implies that the site functions as both a refuge and a foraging ground for these taxa. That the campus supports diverse avifauna beyond insectivores highlights its role as a micro-reservoir of biodiversity in an urban matrix (Abin and Samson, 2024). This resonates with broader findings: university campuses often outperform surrounding urban areas in avian richness and functional diversity if well managed (Sanllorente et al., 2023; Zhao et al., 2023).

From a conservation and urban planning standpoint, this study offers practical insights. First, HT-1 clearly emerges as a priority habitat for protection and enhancement within the campus. Efforts to maintain its structural integrity, avoid tree removal, and impede undue human disturbance would preserve its key role in supporting avifaunal richness.

Second, to augment representation of frugivorous and nectarivorous guilds, planting native fruiting shrubs, trees, and flowering species—especially in peripheral or degraded habitats—could increase resource heterogeneity and functional diversity. In campus bird studies, such plantings have been shown to enhance frugivore visitation or residency (Sanllorente et al., 2023).

Third, minimizing habitat fragmentation—by ensuring connectivity, reducing edge effects, and maintaining stepping-stone patches—is crucial for sustaining avian diversity. As noted by Fahrig (2003), habitat fragmentation typically leads to biodiversity loss through isolation and reduced habitat area, while Franklin et al. (2002) and Lindenmayer and Fischer (2007) emphasize that maintaining continuous or aggregated patches mitigates such effects. In campus landscapes, patch aggregation and lower splitting indices positively influence bird richness and diversity (Zhang et al., 2021).

Operationally, this can be achieved by linking tree groves through vegetated corridors, retaining understorey cover between buildings, converting unused open spaces into small green stepping stones, and establishing buffer vegetation zones along roads and water bodies to reduce edge pressure and promote species movement between patches.

Fourth, regular monitoring of avian communities over time is essential to detect temporal trends, species turnover, or shifts in dominance. Some species (e.g. *Leptoptilos javanicus*) with non-Least Concern statuses require particular attention; changes in their local abundance or occupancy may signal landscape degradation or emerging threats.

Finally, while our study provides a robust snapshot, there are some limitations to acknowledge. The survey period, sampling intensity, seasonal coverage, detectability biases, and spatial scale restrictions may influence species detection probabilities. Future work should incorporate standardized point counts or acoustic monitoring, multi-season sampling, and comparisons with non-campus control sites to strengthen inferences.

Conclusion

In sum, the results demonstrate that structural habitat richness, vegetation heterogeneity, and trophic resource availability are key determinants of avian diversity in campus ecosystems. The dominance of insectivores, clear habitat-preference gradients, and the diversity metrics collectively indicate that even in anthropogenic landscapes, well-designed and managed green space can support robust bird communities. From a conservation and campus planning perspective, prioritizing structurally complex habitats, minimising fragmentation, and promoting plant species with diverse fruit/nectar traits can help maintain and enhance avian biodiversity within institutional landscapes.

Acknowledgments

We would like to acknowledge Dr. Brajendra Saikia, Principal of Rangia College for allowing us to conduct the study in the college campus. Moreover, we would like to acknowledge the reviewers for reviewing our manuscript and giving valuable suggestions to improve the quality and readability of the manuscript. Last but not least, we would like to acknowledge the efforts of the editorial team of the Journal of Animal Diversity during the communication process.

Author contributions

NA has conceptualized the study and designed the methodology. NA was also involved in data collection and analysis, ensuring the accuracy and reliability of the results. All authors (NA and PKS) participated in writing, reviewing, and editing the manuscript. All authors have read and approved the final version of the manuscript.

Conflict of interest

The authors declare that there are no conflicting issues related to this research article.

References

Abin, J. and Samson, P. D. (2024). Urban habitat diversity and bird species associations in Kochi City, Kerala, India. *Journal of Animal Diversity*, 6 (1): 23–50. https://doi.org/10.22034/JAD.2024.6.1.4

Ali, N. (2025). The sighting record of Hoary-bellied Squirrel in Rangia College, Assam, India. *Zoo's Print*, 40 (2): 8–9.

Ali, N., Chetry, V., Singha, P. K. and Boro, M. (2025). Preliminary checklist of avifauna from All India Institute of Medical Sciences, Guwahati, Assam, India. *Journal of Threatened Taxa*, 17 (3): 26697–26703. https://doi.org/10.11609/jott.9390.17.3.26697-26703

Aronson, M. F. J., La Sorte, F. A., Nilon, C. H., Katti, M., Goddard, M. A., Lepczyk, C. A., Warren, P. S., Williams, N. S. G., Cilliers, S., Clarkson, B., Dobbs, C., Dolan, R., Hedblom, M., Klotz, S., Kooijmans, J. L., Kühn, I., MacGregor-Fors, I., McDonnell, M., Mörtberg, U., Pyšek, P., Siebert, S., Sushinsky, J., Werner, P. and Winter, M. (2014). A global analysis of the impacts of urbanization on bird and plant diversity reveals key anthropogenic drivers. *Proceedings of the Royal Society B: Biological Sciences*, 281 (1780): 20133330. https://doi.org/10.1098/rspb.2013.3330

Bhaduri, R. and Rathod, U. (2022). Avifaunal diversity in Indian Institute of Technology Guwahati Campus, Assam, India. *Journal of Threatened Taxa*, 14 (12): 22293–22308. https://doi.org/10.11609/jott.8010.14.12.22293-22308

Bibby, C. J., Burgess, N. D., Hill, D. A. and Mustoe, S. (2000). *Bird Census Techniques*. Second Edition. Academic Press, London, United Kingdom. 302 pp.

Choudhury, A. U. (2000). *The Birds of Assam*. Gibbon Books and World-Wide Fund for Nature–India, North-East Regional Office, Guwahati. 240 pp.

Fahrig, L. (2003). Effects of habitat fragmentation on biodiversity. *Annual Review of Ecology, Evolution, and Systematics*, 34 (1): 487–515. https://doi.org/10.1146/annurev.ecolsys.34.011802.132419

Franklin, A. B., Noon, B. R. and George, T. L. (2002). What is habitat fragmentation? *Studies in Avian Biology*, 25 (1): 20–29.

Gregory, R. D. and Van Strien, A. (2010). Wild bird indicators: Using composite population trends of birds as measures of environmental health. *Ornithological Science*, 9 (1): 3–22. https://doi.org/10.2326/osj.9.3

Grimmett, R., Inskipp, C., Inskipp, T. and Allen, R. (2016). *Birds of the Indian Subcontinent.* Christopher Helm, London. 528 pp.

Guthula, V. B., Shrotriya, S., Nigam, P., Goyal, S. P., Mohan, D. and Habib, B. (2022). Biodiversity significance of small habitat patches: More than half of Indian bird species are in academic campuses. *Landscape and Urban Planning*, 228: 104552. https://doi.org/10.1016/j.landurbplan.2022.104552

Hammer, Ø. (2001). PAST: Paleontological statistics software package for education and data analysis. *Palaeontologia Electronica*, 4 (1): 1–9.

Hutcheson, K. (1970). A test for comparing diversities based on the Shannon formula. *Journal of Theoretical Biology*, 29: 151–154. https://doi.org/10.1016/0022-5193(70)90124-4

Kissling, W. D., Rahbek, C. and Böhning-Gaese, K. (2007). Food plant diversity as a broad-scale determinant of avian frugivore richness. *Proceedings of the Royal Society B: Biological Sciences*, 274 (1611): 799–808. https://doi.org/10.1098/rspb.2006.0311

Lepczyk, C. A., La Sorte, F. A., Aronson, M. F., Goddard, M. A., MacGregor-Fors, I., Nilon, C. H. and Warren, P. S. (2017). Global patterns and drivers of urban bird diversity, *In:* Murgui, E. and Hedblom, M. (Eds.), *Ecology and conservation of birds in urban environments.* Springer International Publishing, Cham, Switzerland. pp. 13–33. https://doi.org/10.1007/978-3-319-43314-1_2

Lindenmayer, D. B. and Fischer, J. (2007). Tackling the habitat fragmentation panchreston. *Trends in Ecology and Evolution*, 22 (3): 127–132. https://doi.org/10.1016/j.tree.2006.11.006

Magurran, A. E. (2021). Measuring biological diversity. *Current Biology*, 31 (19): R1174–R1177. https://doi.org/10.1016/j.cub.2021.07.049

Maheswaran, G. and Alam, I. (2024). Fauna of India Checklist: Aves. Version 1.0, Zoological Survey India, 2024. https://doi.org/10.26515/Fauna/1/2023/Chordata:Aves

Rahmani, A. R., Islam, M. Z. and Kasambe, R. M. (2016). *Important Bird and Biodiversity Areas in India: Priority Sites for Conservation.* Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International, United Kingdom. 1992 pp.

Sanllorente, O., Rios-Guisado, R., Izquierdo, L., Molina, J. L., Mourocq, E. and Ibáñez-Álamo, J. D. (2023). The importance of university campuses for the avian diversity of cities. *Urban Forestry and Urban Greening*, 86: 128038. https://doi.org/10.1016/j.ufug.2023.128038

Şekercioğlu, Ç. H., Daily, G. C. and Ehrlich, P. R. (2004). Ecosystem consequences of bird declines. *Proceedings of the National Academy of Sciences*, 101 (52): 18042–18047. https://doi.org/10.1073/pnas.0408049101

SoIB (2023). *State of India's Birds, 2023: Range, trends, and conservation status*. The SoIB Partnership. 119 pp. https://doi.org/10.5281/zenodo.11124590

Upadhyaya, L. P., Pandey, N. and Khanal, L. (2022). Tribhuvan University area serves as a greenspace for birds in the Kathmandu Valley, Central Nepal. *Journal of Animal Diversity*, 4 (1): 27–40. http://dx.doi.org/10.52547/JAD.2022.4.1.4

Yadav, H., Pansari, S. and Phartyal, S. S. (2024). Bird diversity on an under-constructed educational campus: A case study of Nalanda University, Rajgir, India. *International Journal of Ecology and Environmental Sciences*, 50 (6): 909–920. https://doi.org/10.55863/ijees.2024.0334

Yang, X., Tan, X., Chen, C. and Wang, Y. (2020). The influence of urban park characteristics on bird diversity in Nanjing, China. *Avian Research*, 11 (1): 45. https://doi.org/10.1186/s40657-020-00234-5

Zhang, Y., Jiang, C., Chen, S., Zhang, Y., Shi, H., Chen, B. and Mao, L. (2021). Effects of landscape attributes on campus bird species richness and diversity: Implications for eco-friendly urban planning. *Sustainability*, 13 (10): 5558. https://doi.org/10.3390/su13105558

Zhao, Z., Borzée, A., Li, J., Chen, S., Shi, H. and Zhang, Y. (2023). Urban bird community assembly mechanisms and driving factors in university campuses in Nanjing, China. *Animals*, 13 (4): 673. https://doi.org/10.3390/ani13040673