

Avian assemblages pattern along forest-tea plantation gradients in the north bank landscape of Eastern Himalaya, Assam, India

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Abstract The study explores the patterns of avian communities along forest-tea plantation gradients in the north bank landscape of Eastern Himalayas, India, focusing on the Udalguri district of Assam. The present study aims to identify the impact of transitioning from undisturbed forest to tea plantations on bird diversity and composition. Bird surveys were conducted from August 2022 to June 2023 using point count methods at 16 sampling stations. The results revealed that forests exhibited higher species diversity and functional richness than tea plantations, which showed higher functional evenness and divergence. Additionally, forest edges supported greater species richness and abundance, emphasising their conservation significance. The study also observed significant differences in species composition at varying distances from the forest edge. Key species influencing these differences included the Yellow-footed Green Pigeon (*Treron phoenicopterus*) and various bulbul species (*Pycnonotus* spp.), indicating habitat sensitivity and edge effects. These findings suggest that while tea plantations can accommodate certain adaptable species, forests play a crucial role in providing habitats for a wider range of avian species. In addition, the study highlights the importance of conserving forest edges and comprehending avian responses to habitat mosaics for effective biodiversity conservation.

Keywords: Assam, Bornadi-Khalingduar forest complex, diversity, forest edge, species composition

Összefoglalás A tanulmány a madárközösségek mintázatát vizsgálja a Keleti-Himalája északi vidékének erdő-teaültvények gradiense mentén, Indiában, Assam Udalguri kerületére összpontosítva. A jelen tanulmány célja, hogy meghatározza az erdőből a teaültvényekbe való átmenet hatását a madárvilág diverzitására és összetételére. A madárfelméréseket 2022 augusztusától 2023 júniusáig végeztük pontszámilási módszerekkel, 16 mintavételi állomáson. Az eredmények alapján az erdők nagyobb faji diverzitást és funkcionális gazdagságot mutattak, mint a teaültvények, amelyek magasabb funkcionális egyenletességet és divergenciát mutattak. Emellett az erdőszegek nagyobb fajgazdagságot és egyedszámot támogattak, hangsúlyozva természetvédelmi jelentőségüket. Jelentős különbségeket figyelhetünk meg a fajösszetételben az erdőszegetől való különböző távolságokban. A különbségeket meghatározó fajok közé tartozott a sárgalábú zöldgalamb (*Treron phoenicopterus*) és a különböző bülbül fajok (*Pycnonotus* spp.), ami az élőhelyérzékenység és a szegek hatását jelzi. Ezek az eredmények azt sugallják, hogy míg a teaültvények bizonyos jól alkalmazkodó fajoknak biztosítanak élőhelyet, az erdők döntő szerepet játszanak a madárfajok szélesebb körének élőhelyeként. A tanulmány továbbá kiemeli az erdőszelek megőrzésének, és az élőhely-mozaikokra adott madárreakciók megértésének fontosságát a biodiverzitás hatékony megőrzése érdekében.

Kulcsszavak: Assam, Bornadi-Khalingduar erdő, diverzitás, erdőszegegy, fajösszetétel

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Introduction

The forest edge, where forested areas meet other ecosystems, is vital for maintaining biodiversity and ecological functions. However, these edges are highly susceptible to changes in land use, mainly due to agricultural expansion and plantation development (Chaplin-Kramer *et al.* 2015). With about half of the Earth's land surface modified by human activity, landscapes now consist of a dynamic mix of native and non-native land covers varying in size, degree of separation, and land use intensity (Hansen *et al.* 2020). This includes urban developments, agricultural fields, reforested regions, and natural habitats impacted by human influence (Theobald *et al.* 2020, Ellis 2021). One prevalent form of such land-use change is the conversion of forests into tea plantations, which significantly alters habitat structure, resource availability, and microclimatic conditions (Hasan *et al.* 2020). These changes often lead to substantial shifts in the composition and diversity of bird communities (Moura *et al.* 2013, Nogueira *et al.* 2021).

Agroecosystems, including tea-forest landscapes, are human-modified areas in natural habitats formed by clearing existing forests and ecosystems (Chowdhury *et al.* 2021). Tea plantations once considered ecological wastelands, have emerged as critical habitats that can sustain significant bird diversity in the South Asian region (Kottawa-Arachchi *et al.* 2012, Sreekar *et al.* 2013, Imboma *et al.* 2020). However, the extent to which tea plantations can effectively substitute for natural forest habitats remains debatable (Chowdhury *et al.* 2021). Understanding these shifts is essential and urgent for conserving avian biodiversity and birds' ecological services, such as pollination, seed dispersal, and pest control. While tea plantations may support a significant number of bird species, the abundance and community structure of these avian assemblages can differ considerably from those found in primary forest ecosystems (Subasinghe & Sumanapala 2014, Chettri *et al.* 2018, Mola *et al.* 2021).

The Eastern Himalayan region, including the north bank landscape in Assam, India, is known for its remarkable avian diversity (Renner & Rappole 2011). While most studies primarily focus on the species diversity of forested areas, studies to understand the pattern of bird species distribution along the gradients of forest and human-modified habitats like tea plantations are lacking (Sodhi 2002, Ahmed & Dey 2014). Tea cultivation is a dominant land-use type in the Eastern Himalayan piedmont in Assam, and its expansion has significantly altered the region's once-extensive natural ecosystems (Prokop 2018). Tea plantations may serve as secondary habitat for various bird species, offering opportunities and challenges for avian conservation (Bhagwat *et al.* 2008). In the present study, we aim to investigate the patterns of bird diversity and composition along the gradient of forest and tea plantations, two prominent land cover types in the Assam region.

Material and Methods

Study area

The present study was conducted in the Udalguri district of Assam, India, a region of significant importance in the north bank landscape of the Eastern Himalayan region. The study area mainly covered two habitats: forest and tea plantation (*Figure 1*). The forest region,

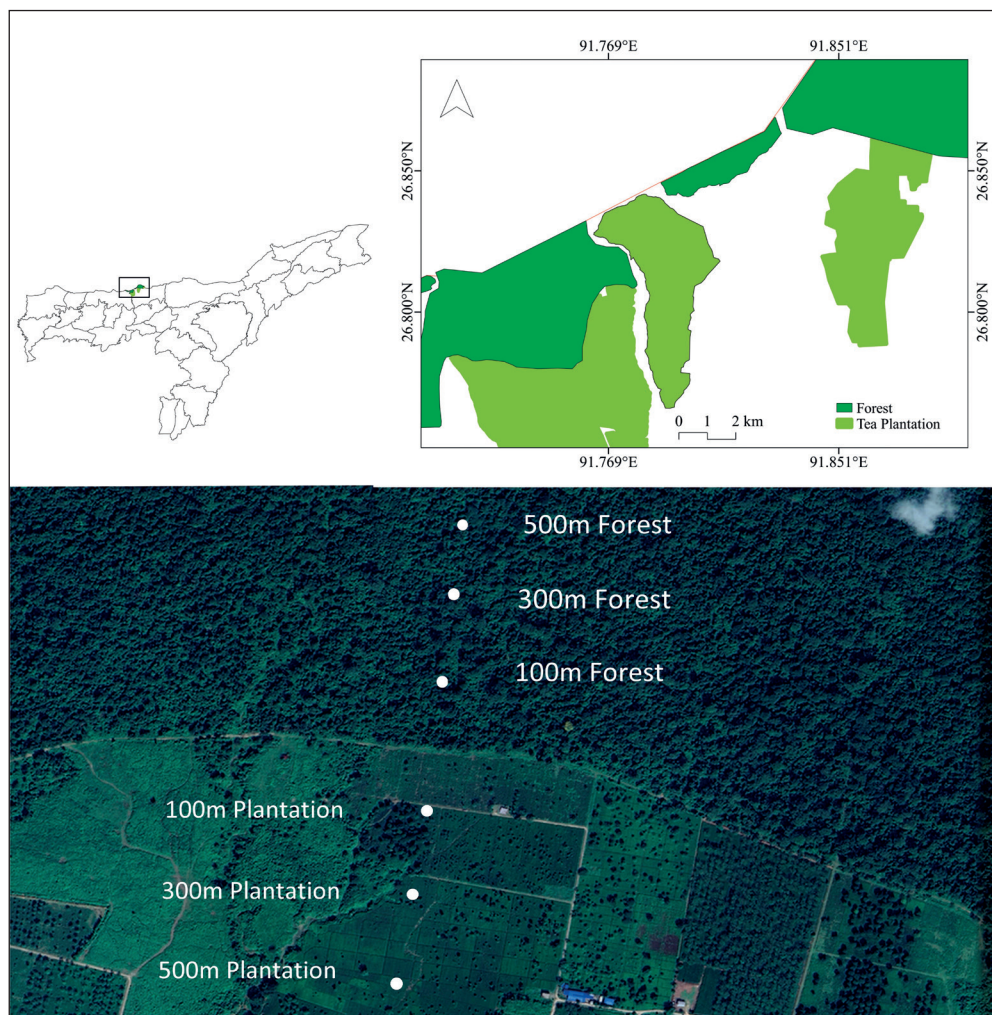


Figure 1. Map of the study area with an illustrative representation of the sampling points of the study design

1. ábra A vizsgálati terület térképe a mintavételi pontjok szemléltető ábrázolásával

known as the Bornadi-Khalingduar forest complex, mostly features Eastern Himalayan moist deciduous forest and lies at the foothill region of the Eastern Himalayas (Chakraborty *et al.* 2015). The forest complex spans an area of 108.03 km² (26.7649°N–26.9176°N, 91.7053°E–91.9635°E, 158–681 m a.s.l) and includes three forest regions: Bornadi Wildlife Sanctuary, Newlee proposed reserve forest, and Khalingduar reserve forest. The southern side of the forest complex is adjacent to human-modified habitats, mostly tea plantations. The region has a mild to moderate climate, with significantly higher rainfall in summer. The average annual temperature is 22.5 °C, and the annual rainfall is 2,621 mm (Climate-Data.org 2024).

Bird survey

Bird surveys were conducted from August 2022 to June 2023, covering all months. The study design comprised 16 sampling stations at the edge of the forest-plantation areas. Six point counts were taken at each sampling station: three inside the forest and three towards the plantation, perpendicular to the edge, each separated by a 200-metre distance. To minimise counting the same individuals from the nearest sampling station, each sampling station was separated by a distance of 1 km. Birds were observed and counted at each point for 15 minutes using the point count method considering a radius of 30 metres (Bibby *et al.* 2000). Each count was conducted between 06:00 and 08:30 hrs in fair weather conditions. Bird surveys excluded unfavourable weather conditions such as fog, wind, and human presence in tea plantations. Only birds seen and calls that could be distinctly heard and identified were considered for analysis. Species were categorised into five foraging guilds based on diet habit: FruiNect (feeding on fruits and nectar), Omnivore, Invertebrate (feeding on invertebrates), VertFishScav (birds feeding on vertebrates, fish, or scavengers) or PlantSeed (feeding on plants and seeds) (Wilman *et al.* 2014).

Data analysis

A sample coverage and species accumulation curve were plotted to evaluate whether the sampling effort was high enough for further analysis. Both analyses used iNEXT (iNterpolation and EXTrapolation) Online, an R-based interactive online version of iNEXT (Chao *et al.* 2016). Species diversity was analysed using the Shannon-Wiener Index in PAST version 4 software (Hammer *et al.* 2001), and functional diversity was obtained using the mFD package for R software (Magneville *et al.* 2022). We obtained each sampling point's Shannon-Wiener Index and functional diversity indices and considered the mean value. In the current study, three functional diversity indices, namely functional richness (FRic), functional evenness (FEve), and functional divergence (FDiv), were evaluated.

The one-way permutational analysis of variance (PERMANOVA) test (Anderson 2001) was used to determine significant differences in species composition and abundance among the various distance categories of forest and plantation from the edge. The significance level was tested at a P-value of 0.05. To further analyse the data, a pairwise comparison was conducted to observe any differences between the various distance categories in cases where the test yielded significant results.

The difference in the species assemblage composition across the distance gradient of the two habitats was observed by the analysis of similarity (ANOSIM) test, which utilises a dissimilarity matrix rather than raw data using Bray-Curtis distance (Clarke 1993). The ANOSIM statistic compares dissimilarities between and within groups. An R-value close to 1 suggests group dissimilarity, while a value close to 0 suggests even distribution within and between groups (Clarke & Warwick 2001). R values below 0 indicate greater dissimilarities within groups than between groups. Similarity percentage analysis (SIMPER) was employed to determine which species contribute to any dissimilarity between forest and tea plantation bird compositions. PERMANOVA, ANOSIM, and SIMPER analyses were performed using PAST software version 4.

Results

Species diversity

132 species of birds belonging to 13 orders and 49 families were observed during the study period. 30 species were observed exclusively from tea plantation, 35 exclusively from forest, and 67 were common in both habitats. The Shannon-Weiner Index was higher in forest ($H'=2.62$) than tea plantation ($H'=2.45$). Functional richness was higher in forest habitat ($FRic=0.11\pm0.02$) than tea plantation ($FRic=0.06\pm0.01$). However, tea plantation had higher Functional evenness ($FEve=0.59\pm0.02$) and divergence ($FDiv=0.78\pm0.02$) compared to forest habitat (Table 1).

Both forest and tea plantation reach a high sample coverage of 0.95 with a high number of individuals sampled (Figure 2). The species accumulation curve almost reached its plateau, signifying a reasonable sampling effort (Figure 2).

Table 1. Summary of species richness, abundance and diversity metrics of bird assemblages in forest and tea plantation habitats of the study area

1. táblázat A vizsgált terület erdei és teaültetvények élőhelyein élő madárállományok fajgazdagság, abundancia és diverzitás mérőszámainak összefoglalása

	Forest	Tea plantation
Species richness	102	97
Abundance	616	630
Shannon-Weiner Index (mean±SE)	2.62±0.09	2.45±0.10
Functional Richness (mean±SE)	0.11±0.02	0.06±0.01
Functional Evenness (mean±SE)	0.54±0.02	0.59±0.02
Functional Divergence (mean±SE)	0.74±0.02	0.78±0.02

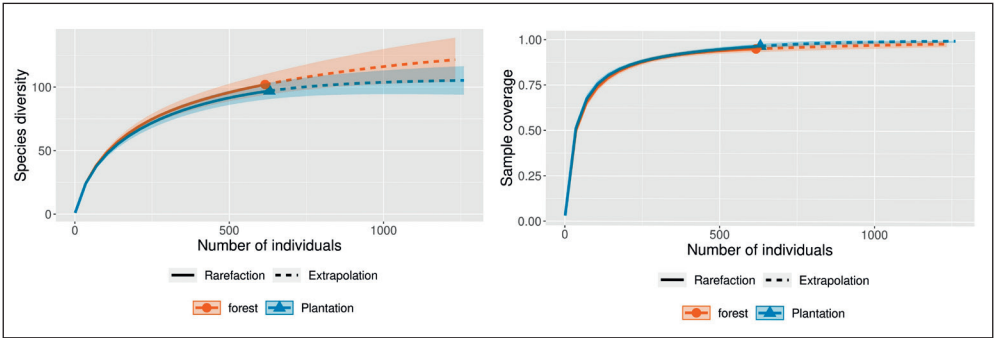


Figure 2. Species accumulation and sample coverage curve for forest and plantation sites using rarefaction and extrapolation methods, with a 95% confidence interval denoted by a shaded region

2. ábra Az erdei és ültetvényes területek fajtelítődései és mintavételi lefedettségü görbéje a rarefaction és az extrapolációs módszerekkel, a 95%-os konfidencia intervallumot árnyékolt terület jelöli

Richness and abundance

Species composition ($F = 3.02$, $P < 0.05$) significantly differed among the distance categories from the edge to forest and tea plantation (Table 2). No significant difference was observed for species abundance ($F = 1.58$, $P > 0.05$) across the distances from the edge.

Of the recorded species, 102 were observed in the forest and 97 in the tea plantation habitat. In forest habitat, Species richness ($n=79$) and abundance ($n=384$) were highest at 100 m distance from the edge. In contrast, species richness ($n=36$) and abundance ($n=97$) were lowest at 300 m forest distance from edge. In tea plantation habitat, species richness and abundance decreased as the distance from the forest edge increased. The highest species richness ($n=66$) and abundance ($n=340$) were observed at a distance of 100 m from the edge, while the lowest species richness ($n=43$) and abundance ($n=97$) were observed at a distance of 500 m (Figure 3).

Table 2. Pairwise p -values of the PERMANOVA test for species composition at various distances from the edge into forest and tea plantation. Bold numbers indicate significant values

2. táblázat A PERMANOVA-teszt páros p -értékei a fajgazdagságra vonatkozóan az erdő és a teaültetvény határától való különböző távolságokban. A félkövéren szedett számok szignifikáns értékeket jelölnek

Distance from edge	Tea plantation 100 m	Tea plantation 300 m	Tea plantation 500 m	Forest 100 m	Forest 300 m
Tea plantation 300 m	0.0293				
Tea plantation 500 m	0.0073	0.5880			
Forest 100 m	0.5795	0.0232	0.0075		
Forest 500 m	0.0148	0.8479	0.2499	0.0278	
Forest 300 m	0.0245	0.4520	0.1424	0.0136	0.1855

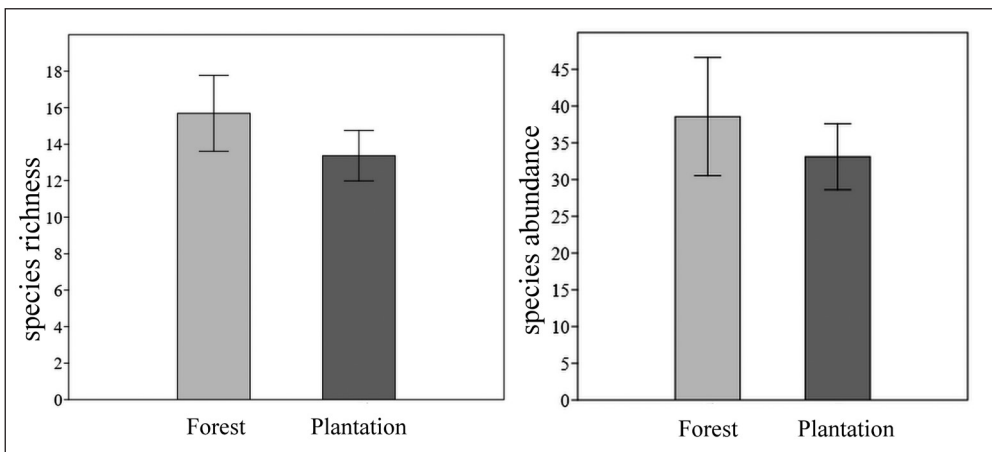


Figure 3. Species richness and abundance (mean $\pm$ SE) in two different habitat types
3. ábra Fajgazdagság és abundancia (átlag $\pm$ SE) két különböző élőhelytípusban

Species composition across the habitat gradients

A significant difference was observed in bird species assemblages across the forest-tea plantation distance gradient ($R=0.12$, $P<0.05$) (Figure 4). However, the moderate effect size ($R=0.12$) suggests that while the habitat gradients harbour distinct bird assemblages, there is also considerable species overlap. The pairwise comparison also showed a significant dissimilarity in the species composition at different distance categories except for the 100 m forest distance from the edge (Table 3).

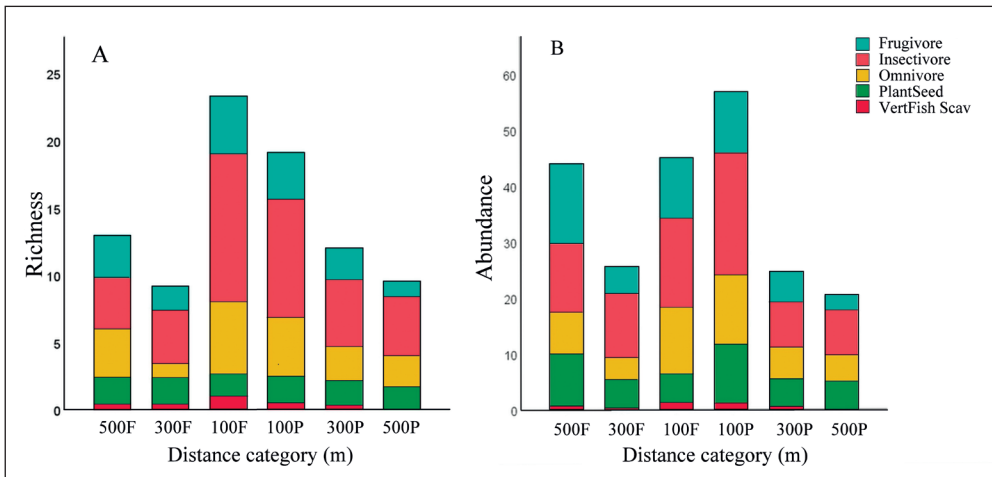


Figure 4. Mean species richness (A) and abundance (B) across distances (metres) from the edge of the forest (F) and tea plantation (P)

4. ábra Az átlagos fajgazdagság (A) és egyedszám (B) az erdő szélétől (F) és a teaültetvénytől (P) mért távolságok (méter) függvényében

Table 3. R-values and corresponding P-values of ANOSIM for comparing species composition between tea plantation (TP) and forest (F) at various distances from the edge (in metres). Bold numbers indicate significant values

3. táblázat Az ANOSIM R-értékei és a hozzátartozó P-értékek a teaültetvény (TP) és az erdő (F) fajösszetételének összehasonlítására a szegélytől való különböző távolságokban (méterben). A félkövéren szedett számok szignifikáns értékeket jelölnek

Distance from edge	500TP	300TP	100TP	100F	300F
300TP	-0.10 (0.79)				
100TP	0.26 (0.02)	0.11 (0.14)			
100F	0.21(0.04)	0.21 (0.01)	0.14 (0.10)		
300F	0.08 (0.24)	0.09 (0.23)	0.34 (0.01)	0.16 (0.06)	
500F	0.06 (0.29)	0.16 (0.11)	0.21 (0.05)	0.03 (0.33)	-0.16 (0.87)

SIMPER analysis reveals that among the various foraging guilds, FruitNect ($n=2$) and Omnivore-feeding birds ($n=3$) were the top five contributors to the dissimilarity of bird assemblages, with higher occurrence in forest habitats. The Yellow-footed Green Pigeon

Table 4. SIMPER test results for the top five contributing species to the dissimilarity between tea plantation and forest habitat [Co: contributing, Cu: cumulative, TP: tea plantation, F: forest]

4. táblázat A SIMPER teszt eredményei a teaültetvény és az erdei élőhely közötti különbségekhez leginkább hozzájáruló öt fajra vonatkozóan [Co: hozzájáruló, Cu: kumulatív, TP: teaültetvény, F: erdő]

Common Name	Foraging Guild	Average dissimilarity	Co %	Cu %	Mean abundance (TP)	Mean abundance (F)
Yellow-footed Green Pigeon	FruiNect	6.79	7.94	7.94	3.79	4.63
Black-crested Bulbul	FruiNect	4.17	4.88	12.83	1.47	2.44
Red-whiskered Bulbul	Omnivore	3.20	3.75	16.58	1.26	1.81
Blue-throated Barbet	Omnivore	2.93	3.43	20.01	1.95	0.43
Red-vented Bulbul	Omnivore	2.55	2.98	23.00	1.11	1.38

(*Treron phoenicopterus*) contributed the highest dissimilarity, accounting for 7.94%. Three species of bulbul, namely, Black-crested Bulbul (*Rubigula flaviventris*), Red-whiskered Bulbul (*Pycnonotus jocosus*), and Red-vented Bulbul (*Pycnonotus cafer*), were among the top five contributors to the dissimilarity of bird assemblages (Table 4).

Discussion

High species diversity was observed in forests compared to tea plantations, suggesting that forests provide a more heterogeneous and complex environment supporting a wider variety of bird species. Forests typically offer diverse food resources, nesting sites, and microhabitats, contributing to higher biodiversity (Cavard *et al.* 2011, Tinya *et al.* 2021). Additionally, the simplified vegetation structure of tea plantations, with limited undergrowth and complex canopy layers, may not offer the same nesting and foraging opportunities to birds that prefer more diverse forest habitats. This contrast in habitat complexity and resource availability between tea plantations and nearby forests could make the tea plantations less attractive to these bird species, reducing their presence.

The bird species found in the forest have a wide range of functional traits, indicating a broader diversity of roles within the ecosystem compared to bird species found in tea plantations. Forests provide a variety of ecological roles for birds, including insectivores, frugivores, canopy specialists, and ground foragers due to their structural complexity and abundant resources. This results in a highly diverse community of bird species in the forest (Pigot *et al.* 2016). In contrast, tea plantations are highly managed habitats where resources are more evenly distributed, leading to higher functional evenness. This means that bird communities in tea plantations have a more uniform species distribution across different ecological roles. The higher functional divergence in tea plantations suggests that species adapt and exploit resources more variedly. As a result, plantations support species that

can thrive in novel or disturbed environments, leading to a more functionally divergent community. The higher functional evenness and divergence suggest that plantations might serve as important habitats for certain adaptable or generalist species, contributing to landscape-level biodiversity.

The significant difference in bird species richness in the varying distance categories of forest and tea plantations signifies that landscape-scale metrics influence species richness. At the same time, abundance is affected by habitat quality (Wu *et al.* 2023). Both species richness and abundance were higher at distances closer to the edge. Such findings sharply contrast with previous studies in tropical regions, challenging our current understanding (Watson *et al.* 2004, Lindell *et al.* 2007, Zakaria *et al.* 2014). Although edge habitats in the tropical zone tend to have less avian diversity compared to the temperate zone (Báldi 1996), the possibility of such analogous findings might be due to the high abundance of frugivores and insectivores in the forest edge habitat of the tropical zone (Menke *et al.* 2012). Also, the composition of the feeding guild might be a determining factor for high species richness at the forest edge. High-contrast edges, such as those between forest and tea plantation habitats, are known to exhibit higher species richness across various latitudinal regions (Willmer *et al.* 2022). This is attributed to historical disturbances that favour generalist and resilient bird species, facilitate cross-habitat spillover, and are influenced by local factors such as the adjacent habitat matrix (Boesing *et al.* 2018, Willmer *et al.* 2022). In forests and tea plantation habitats, insectivores were the most prominent among the different foraging guilds, a finding consistent with other researches (Githiru *et al.* 2009, Ahmed & Dey 2014). Studies suggest that edge habitats ensure high prey availability and nesting choices due to abundant tree cavities, undergrowth, and shrubs (McCollin 1998, Keyel *et al.* 2013).

The ANOSIM results demonstrate the variation in bird species composition between forest edge and interior habitats across different distance categories. While the overall difference in species composition between the two habitats is evident, it is not substantial, suggesting some degree of species overlap. This suggests that spatial variation in habitat characteristics influences bird assemblages but not in a major way. It is, however, noticeable across habitats that a few bird species, like the Yellow-footed Green-Pigeon, Black-crested Bulbul, Red-whiskered Bulbul, Blue-throated Barbet, and Red-vented Bulbul, contributed the most to the observed differences. These species are apparently sensitive to habitat changes and thus may indicate the habitat edge effect on bird communities. Of these five species, birds from the FuitNect foraging guild, Yellow-footed Green Pigeon, and Black-crested Bulbul had higher mean abundances in the forest than in tea plantation. It is evident from previous studies that these birds are found less frequently in tea plantations adjacent to forests (Li *et al.* 2020). One possible explanation for the lower abundance of fruit and nectar-feeding birds in tea plantations near forests is the difference in the availability of their preferred food sources. Forest habitat offers a wide variety of fruits ranging from small berries to large fruits and nectar from flowering plants providing various food resources, whereas shaded tea plantations typically feature a monoculture of tea plants, with very few trees, which may not provide the same level of resources for these specialised bird species (Singh & Bhagwat 2013). A higher abundance of FruitNect birds also indicates a resilient forest, as they contribute to the dispersal of seeds and the pollination of plants (Blendinger 1999).

The present study provides evidence that forest – tea plantation edges are essential habitats that can hold high species assemblages. It highlights the intricate relationships between distance to edge and bird community assemblages. Conservation efforts should also focus on forest edges while understanding the role of plantation habitats in supporting avian biodiversity. Further study is needed to understand how birds respond to mosaic habitats of forests with tea plantations at a landscape level and whether such habitats can limit the distribution of some birds.

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Appendix 1. List of bird species recorded during the study period [TP: Tea Plantation, F: Forest, IUCN: International Union for Conservation of Nature, '+' : species present, '-' : species absent]

1. melléklet A vizsgálati időszak alatt észlelt madárfajok listája [TP: teaültetvény, F: erdő, IUCN: Természetvédelmi Világszövetség, "+" : jelenlévő faj, "-" : hiányzó faj]

Sl. No.	Family	Common Name	Scientific Name	TP	F	IUCN Status
Order – Galliformes						
1	Phasianidae	Indian Peafowl	<i>Pavo cristatus</i>	+	+	LC
2	Phasianidae	Kalij Pheasant	<i>Lophura leucomelanos</i>	-	+	LC
3	Phasianidae	Red Junglefowl	<i>Gallus gallus</i>	+	+	LC
Order – Pelecaniformes						
4	Ardeidae	Cattle Egret	<i>Bubulcus ibis</i>	+	-	LC
5	Ardeidae	Indian Pond Heron	<i>Ardeola grayii</i>	+	-	LC
Order – Accipitriformes						
6	Accipitridae	Besra	<i>Accipiter virgatus</i>	-	+	LC
7	Accipitridae	Crested Goshawk	<i>Accipiter trivirgatus</i>	-	+	LC
8	Accipitridae	Shikra	<i>Accipiter badius</i>	-	+	LC

Sl. No.	Family	Common Name	Scientific Name	TP	F	IUCN Status
9	Accipitridae	Crested Serpent Eagle	<i>Spilornis cheela</i>		+	LC
10	Accipitridae	Oriental Honey Buzzard	<i>Pernis ptilorhynchus</i>	+	-	LC
Order – Strigiiiformes						
11	Strigidae	Oriental Scops Owl	<i>Otus sunia</i>	+	-	LC
Order – Columbiformes						
12	Columbidae	Asian Emerald Dove	<i>Chalcophaps indica</i>	-	+	LC
13	Columbidae	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	+	-	LC
14	Columbidae	Green Imperial Pigeon	<i>Ducula aenea</i>	+	-	NT
15	Columbidae	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	-	+	LC
16	Columbidae	Red Collared Dove	<i>Streptopelia tranquebarica</i>	+	+	LC
17	Columbidae	Rock Pigeon	<i>Columba livia</i>	+	+	LC
18	Columbidae	Spotted Dove	<i>Streptopelia chinensis</i>	+	+	LC
19	Columbidae	Wedge-tailed Green Pigeon	<i>Treron apicauda</i>	-	+	LC
20	Columbidae	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	-	+	LC
Order – Psittaciformes						
21	Psittacidae	Red-breasted Parakeet	<i>Psittacula alexandri</i>	+	-	NT
Order – Cuculiformes						
22	Cuculidae	Asian Koel	<i>Eudynamys scolopaceus</i>	-	+	LC
23	Cuculidae	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	+	+	LC
24	Cuculidae	Greater Coucal	<i>Centropus sinensis</i>	+	-	LC
25	Cuculidae	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	+	-	LC
26	Cuculidae	Indian Cuckoo	<i>Cuculus micropterus</i>	+	-	LC
27	Cuculidae	Square-tailed Drongo Cuckoo	<i>Surniculus lugubris</i>	-	+	LC
Order – Coraciiformes						
28	Coraciidae	Indochinese Roller	<i>Coracias affinis</i>	-	+	LC
29	Meropidae	Blue-bearded Bee-eater	<i>Nyctornis athertoni</i>	+	+	LC
30	Meropidae	Blue-tailed Bee-eater	<i>Merops philippinus</i>	-	+	LC
31	Meropidae	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	+	+	LC
32	Meropidae	Green Bee-eater	<i>Merops orientalis</i>	+	+	LC
33	Upupidae	Eurasian Hoopoe	<i>Upupa epops</i>	+	+	LC
Order – Bucerotiformes						
34	Bucerotidae	Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>	+	-	LC
35	Bucerotidae	Wreathed Hornbill	<i>Rhyticeros undulatus</i>	+	+	VU
Order – Piciformes						
36	Picidae	Black-rumped Flameback	<i>Dinopium benghalense</i>	+	+	LC
37	Picidae	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	+	+	LC

Sl. No.	Family	Common Name	Scientific Name	TP	F	IUCN Status
38	Picidae	Greater Flameback	<i>Chrysocolaptes guttacristatus</i>	+	+	LC
39	Picidae	Greater Yellownape	<i>Chrysophlegma flavinucha</i>	+	-	LC
40	Picidae	Grey-headed Woodpecker	<i>Picus canus</i>	+	-	LC
41	Picidae	Lesser Yellownape	<i>Picus chlorolophus</i>	-	+	LC
42	Picidae	Rufous Woodpecker	<i>Micropternus brachyurus</i>	+	-	LC
43	Picidae	Speckled Piculet	<i>Picumnus innominatus</i>	+	+	LC
44	Megalaimidae	Blue-eared Barbet	<i>Psilopogon duvaucelii</i>	+	+	LC
45	Megalaimidae	Blue-throated Barbet	<i>Psilopogon asiaticus</i>	+	+	LC
46	Megalaimidae	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	+	+	LC
47	Megalaimidae	Great Barbet	<i>Psilopogon virens</i>	-	+	LC
48	Megalaimidae	Lineated Barbet	<i>Psilopogon lineata</i>	+	-	LC
Order – Caprimulgiformes						
49	Caprimulgidae	Large-tailed Nightjar	<i>Caprimulgus climacurus</i>	-	+	LC
50	Caprimulgidae	Savanna Nightjar	<i>Caprimulgus affinis</i>	-	+	LC
Order – Apodiformes						
51	Apodidae	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	-	+	LC
52	Apodidae	House Swift	<i>Apus nipalensis</i>	-	+	LC
Order – Passeriformes						
53	Acrocephalidae	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	+	+	LC
54	Aegithinidae	Common Iora	<i>Aegithina tiphia</i>	+	-	LC
55	Alaudinae	Oriental Skylark	<i>Alauda gulgula</i>	-	+	LC
56	Alcippeidae	Brown-cheeked Fulvetta	<i>Alcippe poioicephala</i>	+	+	LC
57	Artamidae	Ashy Woodswallow	<i>Artamus fuscus</i>	+	+	LC
58	Campephagidae	Black-winged Cuckooshrike	<i>Lalage melaschistos</i>	+	+	LC
59	Campephagidae	Large Cuckooshrike	<i>Coracina macei</i>	-	+	LC
60	Campephagidae	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	+	+	LC
61	Campephagidae	Scarlet Minivet	<i>Pericrocotus speciosus</i>	+	+	LC
62	Campephagidae	Small Minivet	<i>Pericrocotus cinnamomeus</i>	+	+	LC
63	Chloropseidae	Blue-winged Leafbird	<i>Chloropsis moluccensis</i>	+	+	LC
64	Chloropseidae	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	+	+	LC
65	Chloropseidae	Orange-bellied Leafbird	<i>Chloropsis hardwickii</i>	+	+	LC
66	Cisticolidae	Common Tailorbird	<i>Orthotomus sutorius</i>	+	-	LC
67	Cisticolidae	Zitting Cisticola	<i>Cisticola juncidis</i>	+		LC
68	Corvidae	Grey Treepie	<i>Dendrocitta formosae</i>	-	+	LC
69	Corvidae	House Crow	<i>Corvus splendens</i>	+	-	LC
70	Corvidae	Large-billed Crow	<i>Corvus macrorhynchos</i>	+	-	LC

Sl. No.	Family	Common Name	Scientific Name	TP	F	IUCN Status
71	Corvidae	Rufous Treepie	<i>Dendrocitta vagabunda</i>	+	+	LC
72	Dicaeidae	Plain Flowerpecker	<i>Dicaeum minullum</i>	+	+	LC
73	Dicaeidae	Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>	+	+	LC
74	Dicruridae	Ashy Drongo	<i>Dicrurus leucophaeus</i>	+	+	LC
75	Dicruridae	Black Drongo	<i>Dicrurus macrocerus</i>	+	+	LC
76	Dicruridae	Bronzed Drongo	<i>Dicrurus aeneus</i>	+	+	LC
77	Dicruridae	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	+	+	LC
78	Dicruridae	Hair-crested Drongo	<i>Dicrurus hottentottus</i>	+	+	LC
79	Dicruridae	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	-	+	LC
80	Estrildidae	Chesnut Munia	<i>Lonchura atricapilla</i>	+		LC
81	Irenidae	Asian Fairy Bluebird	<i>Irena puella</i>	+	+	LC
82	Laniidae	Brown Shrike	<i>Lanius cristatus</i>	+	-	LC
83	Laniidae	Grey-backed Shrike	<i>Lanius tephronotus</i>	+	+	LC
84	Laniidae	Long-tailed Shrike	<i>Lanius schach</i>	+	+	LC
85	Leiothrichidae	Greater Necklaced Laughingthrush	<i>Pterorhinus pectoralis</i>	-	+	LC
86	Leiothrichidae	Rufous-necked Laughingthrush	<i>Pterorhinus ruficollis</i>	+	+	LC
87	Locustellidae	Striated Grassbird	<i>Megalurus palustris</i>	+	+	LC
88	Monarchidae	Black-naped Monarch	<i>Hypothymis azurea</i>		+	LC
89	Muscicapidae	Blue Rock Thrush	<i>Monticola solitarius</i>	+		LC
90	Muscicapidae	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	+	+	LC
91	Muscicapidae	Oriental Magpie Robin	<i>Copsychus saularis</i>	+		LC
92	Muscicapidae	Pale Blue Flycatcher	<i>Cyornis unicolor</i>		+	LC
93	Muscicapidae	Rufous-gorgeted Flycatcher	<i>Ficedula strophilata</i>	+	+	LC
94	Muscicapidae	Siberian Stonechat	<i>Saxicola maurus</i>	+	-	LC
95	Muscicapidae	Small Niltava	<i>Niltava macgrigoriae</i>	+	+	LC
96	Muscicapidae	Taiga Flycatcher	<i>Ficedula albicilla</i>	+	+	LC
97	Muscicapidae	Verditer Flycatcher	<i>Eumyias thalassinus</i>	-	+	LC
98	Muscicapidae	White-rumped Shama	<i>Copsychus malabaricus</i>	-	+	LC
99	Nectariniidae	Crimson Sunbird	<i>Aethopyga siparaja</i>	+	-	LC
100	Nectariniidae	Purple Sunbird	<i>Cinnyris asiaticus</i>	+	+	LC
101	Nectariniidae	Ruby-cheeked Sunbird	<i>Chalcoparia singalensis</i>	+	+	LC
102	Oriolidae	Black-hooded Oriole	<i>Oriolus xanthornus</i>	+	+	LC
103	Oriolidae	Maroon Oriole	<i>Oriolus traillii</i>		+	LC
104	Passeridae	Eurasian Tree Sparrow	<i>Passer montanus</i>	+	+	LC
105	Pellorneidae	Abbott's Babbler	<i>Malacocincla abbotti</i>	-	+	LC
106	Phylloscopidae	Blyth's Leaf Warbler	<i>Phylloscopus reguloides</i>	+	+	LC

Sl. No.	Family	Common Name	Scientific Name	TP	F	IUCN Status
107	Phylloscopidae	Green-crowned Warbler	<i>Phylloscopus burkii</i>	+	+	LC
108	Phylloscopidae	Greenish Warbler	<i>Phylloscopus trochiloides</i>	+	+	LC
109	Phylloscopidae	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	+	+	LC
110	Ploceidae	Baya Weaver	<i>Ploceus philippinus</i>	+		LC
111	Pycnonotidae	Black Bulbul	<i>Hypsipetes leucocephalus</i>	-	+	LC
112	Pycnonotidae	Black-crested Bulbul	<i>Pycnonotus flaviventris</i>	+	+	LC
113	Pycnonotidae	Red-vented Bulbul	<i>Pycnonotus cafer</i>	+	+	LC
114	Pycnonotidae	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	+	+	LC
115	Pycnonotidae	White-throated Bulbul	<i>Alophoixus flaveolus</i>	+	+	LC
116	Rhipiduridae	White-throated Fantail	<i>Rhipidura albicollis</i>	+	+	LC
117	Sturnidae	Asian Pied Starling	<i>Gracupica contra</i>	+	+	LC
118	Sturnidae	Chestnut-tailed Starling	<i>Sturnia malabarica</i>	+	+	LC
119	Sturnidae	Common Hill Myna	<i>Gracula religiosa</i>	+	-	LC
120	Sturnidae	Common Myna	<i>Acridotheres tristis</i>	+	+	LC
121	Sturnidae	Great Myna	<i>Acridotheres grandis</i>	+	-	LC
122	Sturnidae	Jungle Myna	<i>Acridotheres fuscus</i>	+	+	LC
123	Sturnidae	Spot-winged Starling	<i>Saroglossa spilopterus</i>	-	+	LC
124	Timaliidae	Jungle Babbler	<i>Turdoides striata</i>	+	+	LC
125	Timaliidae	Pin-striped Tit Babbler	<i>Mixornis gularis</i>	-	+	LC
126	Turdinae	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	+	+	LC
127	Turdinae	Orange-headed Thrush	<i>Geokichla citrina</i>	+	+	LC
128	Vangidae	Large Woodshrike	<i>Tephrodornis virgatus</i>	-	+	LC
129	Zosteropidae	Indian White-eye	<i>Zosterops palpebrosus</i>	+	-	LC
130	Phylloscopidae	Dusky Warbler	<i>Phylloscopus fuscatus</i>	+	+	LC
131	Pittidae	Hooded Pitta	<i>Pitta sordida</i>	+	+	LC
132	Scotocercidae	Mountain Tailorbird	<i>Phyllergates cucullatus</i>	-	+	LC

