Avifaunal Diversity of Institute of Forestry Complex, Hetauda Metropolis, Nepal

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Abstract: Avifaunal diversity is the measure of species diversity via species richness and evenness. To this aim, avifaunal survey was conducted in the Institute of Forestry Complex, Hetauda from November 2017 to June 2018. Using line transect and point count methods, 132 species of birds were recorded, representing 15 orders and 44 families. Three species of these birds are in IUCN Red List while 90, 27 and 15 species are residential, visitor and migrant respectively. Higher Shannon diversity index (4.47) and Margalef index (18.78) indicate marked diversity and richness of bird species. A high value calculated for the Simpson index (0.98) represents higher evenness within the species individuals. Although, Pielou's evenness index (0.92) shows uniformity in the species distribution, Shannon index seems to be influenced by diversity index, species richness and evenness values. The avifaunal diversity in the study area shows the importance of the Institute of Forestry Complex as a suitable bird habitat.

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Introduction

Nepal is home to a plethora of avifauna with 886 species representing 9% of the world's avifaunal population (BCN 2020). Birds and their diversity constitute a main part of the natural ecosystem and have become a vital component of our environment (Basnet et al. 2016). Avifauna exhibit alteration in the habitat components and characteristics, thus indicating the quality of the forest landscape they inhabit (Moning and Müller 2008). Typical habitat has its own characteristics with regard to avifauna composition and any change in vegetation composition would alter the avifaunal community (Acevedo and Aide 2008). Several studies reveal that the structural characteristics of the habitat influence avifaunal diversity in general, and specific habitat preference in particular (Chakdar et al. 2016).

Forests of the Terai, Churia (Siwalik) and Bhabar range support a large number of avifauna species (Shrestha 2003). The foot hills of Nepal support half of the avifauna species found throughout the entire area of south Asia (Shrestha 2000). Under the National Park and Wildlife Conservation act, 1973, currently 9 species: Satyr Tragopan, Danphe, Cheer Pheasant, Great Hornbill, Bengal Florican, Lesser Florican, Sarus Crane, White Stork and Black Stork are protected species (Baral 2009) are under protection. Many other species which are not listed under this act, are of high importance and are not studied.

The IOF Complex is an urban forest/green space and wildlife refugium whose importance ramifies beyond the biodiversity value. Surrounded by human settlements on the north, east and south, the complex is under adverse anthropogenic pressure, thus underscoring urgent need for conservation action. In this context, the assessment of the bird community assemblage is a pre-requisite for understanding the population dynamics and their conservation significance. Although there have been several studies on urban forest bird dynamics in different parts of the country, the knowledge on bird assemblages in fast urbanizing city like Hetauda is scanty.

Despite a number of avian explorations by bird watchers, the information on species diversity, richness and assemblages at micro-landscape level in a given climatic regime is still missing from the region. The present study focuses on understanding the bird species richness, diversity and assemblages in the two different classified habitats, i.e., forested land and wetland associated with grassland habitat. This study was carried out to assess the difference in avian communities among these areas. It is initiation on making avifauna information of the IOF Complex up to date and will be helpful in preparing a baseline data on bird diversity.

Materials and Methods

Study Site

The study was carried out in IOF Complex (forest, grassland, hostel premises and staff quarter premises) and surrounding river and settlements at 433-450masl

(27°25'16"N and 85° 1'27"E) of Hetauda Sub-metropolitan city, Makwanpur district (Figure 1). The study area lies in the lower tropical bioclimatic zone with tropical forest ecosystem. Vegetation type in the IOF Complex is under Lower Tropical Sal Forest (BPP 1995). The climate here is mild, and generally warm and temperate with average annual temperature of22.7°C. Summer receives more rainfall than winter with precipitation of about 2474 mm/year (CBS 2017). The study area is spread over an area of 97 hectare (using Garmin Etrex 10 and QGIS) and is surrounded by Mahendra Highway in the east, Karra river in the south, settlement area in north and Karra river and gravel road in the west. The area supports 98 butterflies (Chhetri 2017), 4 mammal and more than 150 floral species (Singh 2016). Mammals found include Spotted Deer (*Axis axis*), Rhesus Monkey (*Macaca mulatta*), *Masked* Palm, Civet (*Pagumalarvata)* and Indian Grey Mongoose (*Herpestesedwardsi)*(Pradhan et. al 2020). Out of the total area of the IOF Complex, 75.212 hectare belongs to forested area, 10.058 hectare belongs to grassland associated with wetland and remaining land is occupied by campus premises, nurseries and playground. Being surrounded by settlements in north, east and south, the study area faces immense anthropogenic pressure which includes poaching of the animals and collection of the forest products.
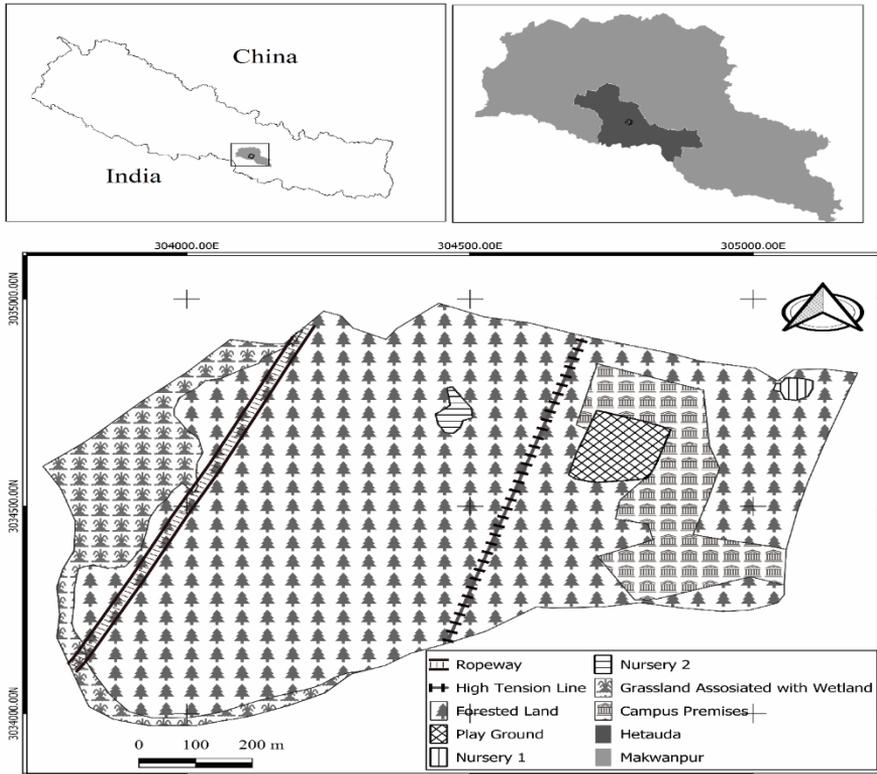

Figure 1: Geographical representation of study area

For the data collection the entire study area was stratified into two broad habitat types:

Forested Land

The forested land is a *Shorea robusta* dominated forest along with other vegetations such as *Terminalia tomentosa*, *Tectona grandis*, *Pinus roxburghii*, *Eucalyptus camaldulensis*, *Bombax ceiba,* etc. This habitat type falls under Terai Tropical Sal Forest Ecosystem type (BPP 1995). It includes staff settlement area, open lands as well as forest areas which are close to human settlements in north-east part with less than 5° slope and covers about 77.53 % of the total area

Grassland Associated with Wetland

The grassland associated with wetland habitat (10.36 % of the total area) belongs to riverine grassland ecosystem and water body ecosystem type (BPP 1995). Based on our field observation, this habitat type mainly includes natural mixed grass species such as *Dactylorhiza hatagirea*, *Imperata cylindrica*, *Saccharum munja*, *Saccharum spontaneum*, *Stylosanthes guianensis*, *Achyranthes aspera* and *Arundo donax* with, scattered tree species including *Shorearobusta*, *Acacia catechu*, *Albizzia labbek*, *Bombax ceiba*, *Cassia fistula*, *Terminalia tomentosa*, *Madhuca indica* and *Dalbergia sissoo* in the western part of study area and generally far from the human settlements. This habitat lies on south-west part of study area with evergreen vegetation and perennial water source.

Study Methods

The study was carried out between November 2017 and June 2018 for 16 days covering both the winter and summer season. A 500m transect line with truncation distance of 50m in existing trail was followed and birds in forward direction on both sides of the trail were recorded (Bibby et al. 2000). A total of 10 points count stations were systematically selected in each habitat type. A truncation distance of 50m with point count duration of 10 minutes with a spacing rule of no points closer than 400 m to each other was considered (Bibby et al. 2000). To avoid the double counting, birds flying overhead were excluded, and the birds that flew from behind the observers were not recorded. The same route was followed in both seasons by recording the birds seen or heard (song/call) from 6:30 to 10:30 hrs when birds are active. The available birds were observed by naked eye and field binoculars (8*42) and then bird species were identified and taxonomically classified using Birds of the Indian Subcontinent (Grimmett et al. 2016). Bird censuses were not carried out on rainy, windy and cloudy day to avoid biases due to change in intensity of bird activities.

Data Analysis

Bird checklists were meticulously maintained for both the habitats during the field visits. Obtained data were used to calculate various indices as explained below.

Species diversity of the documented birds was analyzed using the diversity indices. The widely used diversity indices are Shannon diversity index (H) (Shannon 1948), Simpson diversity index (D) (Simpson 1949), Whereas to understand the species richness Pielou's evenness index, Margalef Index: were used

Shannon index (H)=H'= − $\sum p_i \ln p_i$_____equation (1)

Where "pi" is the proportion of (n/N) of individuals of one particular species found (n) divided by total number of individuals found (N), "ln" natural log, E is the sum of calculation and s is the number of species.

Simpson's index is based on the probability of any two individuals drawn at random from an infinitely large community belonging to the same species:

D = $\sum p_i^2$_____equation (2)

Where again pi is the proportion of individuals found in species i. For a finite community, this is D = $\sum [n_i (n_i -1) / N (N -1)$_____equation (3)

Here D is a measure of dominance, so as D increases, diversity (in the sense of evenness) decreases. Thus, Simpson's index is usually reported as its complement 1-D (Somerfield et al. 2008)

Margalef Index: This index is used for small samples. It can be measured as:

H = S-1/InN_____equation (4)

Here,

H = Margalef's index

S = Number of species

N = Total number of individuals

Pielou's evenness index(J) = H / H max_____equation (5)

Here,

H = Shannon-Weaver index

Hmax = Maximum value of H. Hmax = ln S

The mathematical calculation was done using "vegan" package (Oksanen 2013) in R.

Results and Discussion

Results
Avian species composition and population in two different habitats

The present study documented the presence of 1202 individuals of avifauna belonging to 132 species, 15 orders and 44 families in the study area (Refer annex I). In forested habitat 697 individuals belonging to 81 species, 35 families and 12 orders were documented. Similarly, in wetland associated with grassland 505 individuals belonging to 80 species, 35 families and 13 orders were documented. A total of 29 species belonging to 15 families and 6 orders were recorded in both habitats (Table 1).

Table 1: Population and composition of avifauna in different habitat of IOF Complex

Habitat	Individuals		Species		Family		Order	
	Count	Population (%)	Count	Population (%)	Count	Population (%)	Count	Population (%)
Forested land	697	57.99	81	61.36	31	70.45	12	80.00
Wetland & Grassland	505	42.01	80	60.61	33	75.00	13	86.67
Both	549	45.67	29	21.97	15	34.09	6	40.00

The Passeriformes is the dominant order documented in both habitats. The population of 18 species belonging to it in both habitat accounts for 33% of total population followed by Psittaciformes (3 species = 6.24%), Strigiformes (4 species = 2.16%), Columbiformes (1 species = 1.83%) and Charadriiformes (1 species = 1.25%). Whereas, Camephagidae, Caraciidae, Cisticolidae, Columbidae, Corvidae, Dicruridae, Glareolidae, Hirundinidae, Meropidae, Muscipdae, Pariade, Psittacidae, Pycononotidae, Strigidae and Sturnidae were common families observed in both the habitats.

In forested habitat Jungle babbler was found to have the highest population (34=4.88%) followed by Red vented bulbul (27=3.87%), Great tit (25=3.59%), House sparrow (24=3.44%), Alexandrine parakeet (24=3.44%) and Rufous treepie (23=3.305%). The average mean population of the species was 8.65 individuals while the median value was 6 (Figure 2(a)).Likewise, in wetland associated with grassland, Common tailor bird (24=4.75%), Asian open bill (21=4.16%), Red-vented bulbul (20=3.96%), Common myna (18=3.56%) and House crow (17=3.37%) were dominant species. The average mean population of the species was 6 individuals while the median value was 5.

The species population in IOF range from 1 to 47 individuals. Red-vented bulbul was found to have highest number of individuals (47 individuals), which accounts for 3.91% of total population followed by House crow and Alexandrine parakeet with 38 individuals representing 3.16% of total population. The average species population was found to be 9 with median value of 6 (Figure 2(a)).
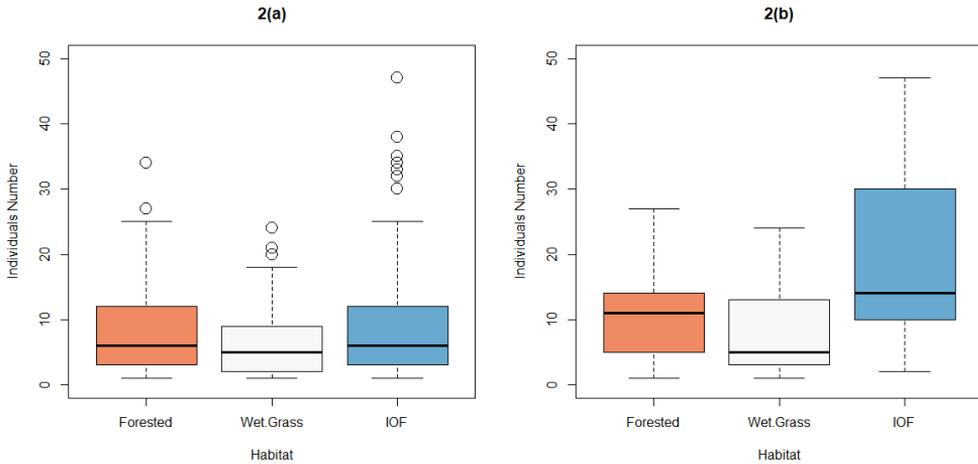
Figure 2: (a) Population of individuals in different habitats (b) Population of common individuals in different habitats

The box plot (Figure 2(b)) demonstrated the asymmetrical distribution of the common species population. The population of commonly observed species ranges from 1-27 and 1-24 in forested and wetland associated with grassland. The average mean population and median value were 10.79 and 11 in forested habitat while it was and 8.13, and 5 in wetland associated with grassland.

The maximum population of common species individuals of IOF was 47 which represent the Red vented bulbul species while minimum was 2 individuals. Among the common species, Red-vented bulbul (47) were found to have the highest population followed by Alexandrine parakeet (38) and House crow (38). Asian barred owlet has lowest population of 2 individuals.

Avian Species Diversity Indices

Table 2 gives the comparative diversity indices of avifauna in different habitats. The Shannon diversity index of IOF Complex was found to be 4.47. Species diversity of wetland associated with grassland 4.08 is slightly greater than forested land with 4.06. This means both habitats are rich in avifaunal diversity. The Simpson diversity index value is the same 0.98 for both the habitats. Similarly, Pielou's evenness index value 0.92 shows no variance along the habitats. This means lower disparity within the species individual populations. The Margalef species richness value for IOF Complex was found to be 18.78. This was slightly higher in wetland associated with grassland (13.34) than in forested land (12.62).

Table 2: Comparative Diversity indices of avifauna in different habitat of IOF

Diversity Indices	Habitat		
	Forested land	Wetland & Grassland	IOF Complex
Shannon index	4.06	4.08	4.47
Fisher alpha index	23.72880	26.76332	37.82501
Simpson diversity index	0.98	0.98	0.98
Pielou's evenness index (j)	0.92	0.92	0.92
Richness in terms of number	81	80	132
Margalef index (D)	12.62	13.34	18.78

Migratory Status of Avifauna in Study Area

A total of 90 residential species make up 77% of total population in study area. The visitors and migratory species represent 27 and 15 species, which account for the 15% and 8% of total population respectively (Figure 3(a) and 3(b)).
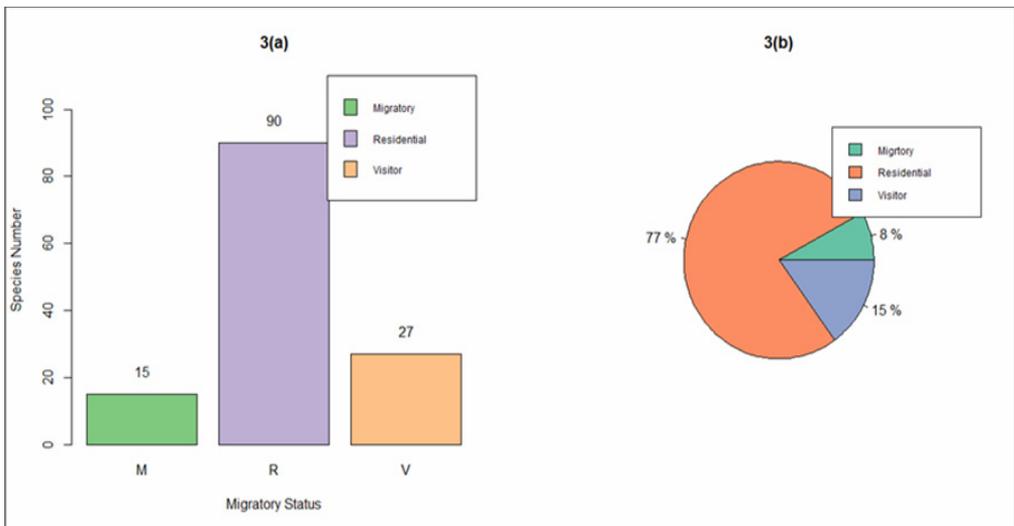

Figure 3: (a) Migration status of avifauna in IOF Complex, (b) Population proportion of avifauna with its migratory status(M=migratory=Residential, V=visitor)

In case of migratory species, Small pratincole (15) followed by Cattle egret (14), Rosy pipit (14) and visitor species like Plump headed parakeet (25) were found to have high individual population.

Table 3: Comparative migratory status of avifauna documented in IOF Complex

Migratory Status	Forested habitat		Wetland & grassland habitat	
	Count	Population proportion (%)	Count	Population proportion (%)
Migratory	14.00	1.16	83.00	6.91
Residential	555.00	46.17	370.00	30.78
Visitor	128.00	10.65	52.00	4.33

Wetland associated with grassland has comparatively higher number of migratory and residential individuals. The visitor individuals are high in wetland associated with grassland.

Table 4: Migratory status and population distribution of threatened avian species

Status	Habitat				Population in %	
	Forested Land		Wet & Grassland		Within nationally threatened individuals	% within total population
	Total	%	Total	%		
Residential	12.00	85.71	21.00	70.00	28.21	2.75
Visitor	2.00	14.29	9.00	30.00	9.40	0.92

The population of nationally threatened species population is composed of 28.21% of residential and 9.40% of visitor individuals. This also accounts for 2.75% and 0.92% of total population of residential and visitors respectively. On comparing the migratory status of these individuals in two different habitats, residential species population was found to be higher in both forested land (85.71%) and wetland associated with grass land (70.00%) followed by visitor individuals. None of the species reordered under migratory species were listed under threatened status (Table 4).

Threatened Species Population Composition and Conservation Status

Out of 132 species, only Steppe eagle is recognized as threatened species by International Union for Conservation of Nature (IUCN) Red data book. Its global status is endangered while it is listed as vulnerable under National status. It was only observed in wetland associated with grassland and accounts for 0.50% of total population. However, additional 2 species (Table 5) are recognized as threaten species under national status.

Table 5: Threatened species recorded in IOF Complex

S. N	Common Name	Scientific Name	Habitat			Threatened Status		Migratory Status
			Forested	Wet/ Grass	IOF	Global	National	
1	Asian openbill	*Anastomus oscitans*	12	21	33	LC	VU	R
2	Brown fish-owl	*Ketupa zeylonensis*	2	1	3	LC	VU	V
3	Steppe eagle	*Aquila nipalensis*	0	6	6	EN	VU	V

Note: *LC=Least Concern, EN=Endangered, NT=Near Threatened, VU=Vulnerable (DNPWC 2018; Inskipp et al., 2017)*

All 3 species shared vulnerable threatened status (Table 5). These 42 individuals of nationally threatened species population account for 3.49% of total population in the study area. Threatened species population is higher in wetland associated with grassland than in forested land.

Discussion

Knowledge on species composition of avifauna from unprotected habitats is crucial to understand the health of the environment and to develop effective and sustainable bird conservation strategies and management measures (Kiros et al. 2018). The study area is habitat to 14.90% of 886 bird species documented in Nepal (DNPWC 2018). None of the threatened species documented in this area falls under the protected species list (Baral 2009). Species under Corvidae family of Passeriformes order were dominant in both the habitats. This result also aligns with a study in Khata corridor (Chaudhari et al. 2009).

The Shannon index value (4.47) indicates that IOF complex has rich avifaunal diversity. This index value was normally noted between 1.5 and 3.5 and rarely exceeded above 4.5 (Gaines 1999). Similar Shannon index value, 4.33 was also obtained in degraded forest while studying tree species diversity in Congo (Ifo et al. 2016). This index is used to assess uncertainty of the species or to know how diverse is certain community (Ortiz-Burgos 2016). Higher uncertainty means rich in diversity. The Shannon index is influenced by species richness and evenness values (Yeom and Kim 2011; Supriatna 2018) where both indices are biased towards richness of rare and dominant species respectively (Winfree et al. 2015; Goudarzian and Erfanifard 2017). The population distribution of species unique to each habitat is symmetrical but it is asymmetrical with population of 29 common species (Table 1). This population might have influenced the result. In our study, high diversity (4.08) was documented in wetland associated with grassland habitat with 80 species while the same index value was 4.06 in forested habitat with 81 species (Table 1 and 2).

The positive association between the species richness and heterogeneous habitat supports diverse species (Basnet et al. 2016). The study area comprises of heterogeneous habitat; both forested and wetland habitats associated with grassland

are adjacent to each other. This heterogeneity in habitat could be a possible explanation of diverse species (Berg 1997). However, the higher number of the species alone is not enough to conclude high diversity (Spellerberg and Fedor 2003). We further used Simpson index which range from 0-1 where 0 represents no diversity and 1 represents high diversity (Oksanen et al. 2013). Pielou's evenness index (j) was used to understand how species population is distributed within the community. Skewedness of (J) value toward 1 suggests uniformity in species population distribution and richness in diversity (Heip et al. 1998). Margalef Index used to evaluate the species richness (Magurran 2004) also supports conclusion of Shannon index result; area is rich in avifaunal diversity.

Previous studies recorded that the species richness varies with altitude, forest edge, canopy coverage and slope (Hunter and Yonzon 1993; Ghimire 2015). Additionally, species richness is also influenced by habitat heterogeneity, volume of certain tree species (Berg 1997; Acharya et al. 2011) and seasons (Katuwal et al. 2016). According to Basnet et al. (2016) previously mentioned factors are responsible for the distribution of the species populations rather than species richness. Similarly, bird population, bird species richness was recorded higher in farmland and fresh water but evenness was not affected (Hung-Ming et al. 2020).

The threatened species richness in general is negatively correlated with elevation and positively correlated with human settlement (Paudel et al. 2018). The numbers of recorded threatened species and their population are comparatively less than what is mentioned in previous studies. Though the number per unit area is comparatively less, it is a preserved habitat and urban refugia for academic purpose. Studies have shown that the riverine and grassland moist forests were recorded to have high number of threatened species and individuals' number was higher in Khair-Sissoo forest in Khata corridor (Chaudhari et al. 2009). Our study shows high population of nationally threatened species in wetland associated with grassland (Table 4). Species with residential migratory status were higher in unique species number and in total individual population (Figure 3(a) and 3(b)).

In Nepal 95.73 % of avifaunal diversity are documented within the protected areas. According to Dahal et al. (2014), out of 124 bird species of low land, Nepal, 24% were recorded in forest outside the protected area and 45% of species were common to the protected area, community-based forest area and national forest. Even though protected area is home to global biodiversity, off-reserve area is also equally significant for conserving biodiversity (Dahal et al. 2014).

Conclusion

The IOF Complex is a remnant forest area that is home to diverse bird communities. The high value of the Shannon index (4.47) is an indication of richness of avifaunal diversity in the area. Other measured indices and observation reveal that the study area supports diversified species in heterogeneous habitat. The study area supports fairly high bird diversity with a total of 132 species distributed in 15 orders and 44

families. Identification of 90 residential species representing 77% of total birds along with three species of IUCN Red listed species warrants further research and exploration of the IOF Complex. Although, the IOF Complex is less jeopardized with threats such as habitat conversion and hunting, current infrastructures that are being built may deplete the breeding and feeding ground of the avifauna and will affect the bird diversity. Hence, developmental activities like road and building construction should be sensitive to biodiversity conservation, if unavoidable should be confined away from prime forests, wetland and grassland habitats.

Acknowledgement

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Annex: Species Inventory

S N	Common Name	Scientific Name	Forested land	Wetland/ Grassland	IUCN Status	Migratory Status
1	Alexandrine parakeet	*Psittaculaeupatria*	✓	✓	—	R
2	Ashy drongo	*Dicrurusleucophaeus*	✓	✓	—	R
3	Ashy prinia	*Priniasocialis*	—	✓	—	R
4	Asian barred owlet	*Glaucidium cuculoides*	✓	✓	—	R
5	Asian koel	*Eudyna mysscolopaceus*	✓	—	—	V
6	Asian openbill	*Anastomus oscitans*	✓	✓	LC	R
7	Asian pied starling	*Sturnus contra*	✓	✓	—	R
8	Barn swallow	*Hirundorustica*	—	✓	—	R
9	Black bulbul	*Hypsipetes leucocephalus*	✓	✓	—	R
10	Black drongo	*Dicrurus macrocercus*	✓	✓	—	R
11	Black hooded oriole	*Oriolus xanthornus*	✓	—	—	R
12	Black kite	*Milvus migrans*	✓	—	—	R
13	Black lored tit	*Parus xanthogenys*	✓	✓	—	R
14	Blue- beared bee-eater	*Nyctyornisathertoni*	—	✓	—	V
15	Blue-tailed bee-eater	*Merops philippinus*	✓	✓	—	V
16	Blue-throated barbet	*Megalaima asiatica*	✓	—	—	R
17	Brahminy starling	*Sturnus pagodarum*	✓	✓	—	V
18	Brown fish-owl	*Ketupa zeylonensis*	✓	✓	LC	V
19	Brown headed barbet	*Megalaima zeylanica*	✓	—	—	V
20	Brown-capped pigmy woodpecker	*Dendrocopos nanus*	✓	—	—	V
21	Cattle egret	*Bubulcus ibis*	—	✓	—	M
22	Chestnut-headed bee-eater	*Merops leschenaulti*	—	✓	—	V
23	Common hawk cuckoo	*Hierococcyx varius*	✓	—	—	R
24	Common hill myna	*Gracula religiosa*	✓	✓	—	V

25	Common hoppoe	*Upupa epops*	—	✓	—	V
26	Common iora	*Aegithina tiphia*	—	✓	—	R
27	Common kingfisher	*Alcedo atthis*	—	✓	—	R
28	Common myna	*Acridotheres tristis*	✓	✓	—	R
29	Common pigeon	*Columba livia*	✓	—	—	R
30	Common sandpiper	*Actitis hypoleucos*	—	✓	—	M
31	Common stonechat	*Saxicola torquatus*	—	✓	—	R
32	Common tailor bird	*Orthotomus sutorius*	✓	✓	—	R
33	Common woodshrike	*Tephrodornis pondiceranus*	—	✓	—	R
34	Coppersmith barbet	*Megalaima haemacephala*	✓	—	—	R
35	Crested serpent eagle	*Spilornis cheela*	✓	—	—	R
36	Eurasian collard dove	*Stigmatopelia decaocto*	✓	—	—	M
37	Eurasian cuckoo	*Cuculus canorus*	✓	—	—	V
38	Eurasian tree sparrow	*Passer montanus*	✓	—	—	R
39	Fulvous-breasted woodpecker	*Dendrocopos macei*	✓	—	—	R
40	Golden-fronted leafbird	*Chloropsis aurifrons*	✓	—	—	V
41	Great barbet	*Megalaima virens*	✓	—	—	V
42	Great egret	*Ardea alba*	—	✓	—	M
43	Great tit	*Parus major*	✓	✓	—	R
44	Greater coucal	*Centropus sinensis*	✓	—	—	R
45	Greater flameback	*Chrysocolaptes lucidus*	✓	—	—	R
46	Greater racket tailed drongo	*Dicrurus paradiseus*	✓	—	—	R
47	Greater yellownape	*Picus flavinucha*	✓	—	—	R
48	Green bee-eater	*Merops orientalis*	—	✓	—	R
49	Green sandpiper	*Tringaochropus*	✓	—	—	R
50	Green-billed malkoha	*Phaenicophaeus tristis*	—	✓	—	M
51	Grey backed shrike	*Lanius tephronotus*	—	✓	—	M
52	Grey bushchat	*Saxicola ferreus*	—	✓	—	R
53	Grey treepie	*Dendrocitta formosae*	—	✓	—	R
54	Grey wagtail	*Motacilla cinerea*	✓	—	—	V

55	Grey-breasted prinia	*Prinia hodgsonii*	✓	—	—	R
56	Grey-capped pigmy woodpecker	*Dendrocopos canicapillus*	✓	—	—	R
57	Grey-headed woodpecker	*Picus canus*	—	✓	—	R
58	Grey-winged blackbird	*Turdus boulboul*	✓	—	—	R
59	Himalayan flameback	*Dinopiumshorii*	✓	—	—	V
60	Himalayan bulbul	*Pycnonotus leucogenys*	✓	✓	—	R
61	House crow	*Corvus splendens*	✓	✓	—	R
62	House sparrow	*Passer domesticus*	✓	—	—	R
63	Indian cuckoo	*Cuculus micropterus*	✓	—	—	V
64	Indian golden oriole	*Oriolus kundoo*	✓	—	—	V
65	Indian Jungle crow	*Corvus culminatus*	✓	—	—	V
66	Indian pitta	*Pitta brachyuran*	—	✓	—	V
67	Indian pond heron	*Ardeola grayii*	—	✓	—	R
68	Indian roller	*Coracias benghalensis*	✓	✓	—	R
69	Intermediate egret	*Mesophoyx intermedia*	—	✓	—	M
70	Jungle babbler	*Turdodes striata*	✓	—	—	R
71	Jungle myna	*Acridootheres fuscus*	✓	✓	—	R
72	Jungle owlet	*Glaucidium radiatum*	✓	✓	—	R
73	Large cuckoo shrike	*Coracina macei*	✓	✓	—	R
74	Large-billed crow	*Corvus macrorhynchos*	✓	—	—	R
75	Lemon-rumped leaf-warbler	*Phylloscopus chloronotus*	—	✓	—	R
76	Lesser coucal	*Centropus bengalensis*	✓	—	—	R
77	Lesser kestrel	*Falco naumanni*	✓	—	—	V
78	Lesser racket tailed drongo	*Dicrurusremifer*	✓	—	—	R
79	Lesser yellownape	*Picus chlorolophus*	✓	—	—	R
80	Lineated barbet	*Megalaima lineata*	✓	—	—	R
81	Little egret	*Egretta gragetta*	—	✓	—	M
82	Little ringed plover	*Charadrius dubius*	—	✓	—	R
83	Long-tailed minivet	*Pericrocotus ethologus*	✓	—	—	R
84	Long-tailed shrike	*Lanius schach*	—	✓	—	R

85	Mountain hawk eagle	*Nisaetusnipalensis*	✓	—	—	M
86	Nepal house martin	*Delichon nipalense*	—	✓	—	R
87	Oriental honey buzzard	*Pernis ptilorhynchus*	✓	—	—	R
88	Oriental magpie robin	*Copsychus saularis*	✓	—	—	R
89	Oriental turtle dove	*Streptopelia orientalis*	✓	✓	—	R
90	Oriental white eye	*Zosterops palpebrosus*	✓	—	—	R
91	Paddyfield pipit	*Anthus rufulus*	—	✓	—	R
92	Peregrine falcon	*Falco peregrinus*	✓	—	—	V
93	Pied bushchat	*Saxicola caprata*	—	✓	—	R
94	Pied kingfisher	*Cerylerudis*	—	✓	—	R
95	Plain martin	*Riparia paludicola*	—	✓	—	R
96	Plain prinia	*Prinia inornata*	—	✓	—	R
97	Plum-headed parakeet	*Psittacula cyanocephala*	✓	✓	—	V
98	Purple sunbird	*Nectarinia asiatica*	✓	—	—	R
99	Red- billed blue magpie	*Urocissa erythroryncha*	✓	✓	—	R
100	Red-napped ibis	*Pseudibis papilllosa*	✓	—	—	V
101	Red-rumped swallow	*Cecropis daurica*	—	✓	—	R
102	Red-vented bulbul	*Pycnonotus cafer*	✓	✓	—	R
103	Red-wattled lapwing	*Vanellus indicus*	—	✓	—	R
104	Richard's pipit	*Anthus richardi*	—	✓	—	V
105	River lapwing	*Vanellus duvaucelii*	—	✓	—	R
106	Rose-ringed parakeet	*Psttacula krameri*	✓	✓	—	R
107	Rosy pipit	*Anthus roseatus*	—	✓	—	M
108	Ruddy shelduck	*Tadorna ferruginea*	—	✓	—	V
109	Rufous treepie	*Dendrocitta vagabunda*	✓	—	—	R
110	Rufous woodpecker	*Celeus brachyurus*	✓	—	—	R
111	Scaly thrush	*Zoothera dauma*	✓	—	—	M
112	Scaly-breasted munia	*Lonchura punctulata*	—	✓	—	R
113	Scarlet minivet	*Pericrocotus speciosus*	✓	—	—	R
114	Shikra	*Accipiter badius*	—	✓	—	R

115	Short-toed snake eagle	*Circaetus gallicus*	—	✓	—	M
116	Small pratincole	*Glareola lacteal*	✓	✓	—	M
117	Spangled drongo	*Dicrurus hottentottus*	✓	—	—	R
118	Spotted dove	*Stigmatopelia chinensis*	✓	—	—	R
119	Spotted owlet	*Athene brama*	✓	✓	—	R
120	Steppe eagle	*Aquila nipalensis*	—	✓	EN	V
121	Verditer flycatcher	*Eumyias thalassinus*	✓	✓	—	M
122	Western yellow wagtail	*Motacilla flava*	—	✓	—	V
123	White- breasted waterhen	*Amaurornis phoenicurus*	—	✓	—	R
124	White throated kingfisher	*Halcyon smyrnensis*	—	✓	—	R
125	White wagtail	*Motacilla alba*	—	✓	—	M
126	White-bellied drongo	*Dicrurus caerulescens*	✓	—	—	R
127	White-browed wagtail	*Motacilla maderaspatensis*	—	✓	—	R
128	White-capped water-redstart	*Chaimarrornis leucocephalus*	—	✓	—	R
129	White-rumpedshama	*Copsychus malabaricus*	—	✓	—	R
130	White-throated fantail	*Rhipidura albicollis*	—	✓	—	R
131	Yellow wattled lapwing	*Vanellus malabaricus*	—	✓	—	R
132	Zitting cisticola	*Cisticola juncidis*	—	✓	—	R