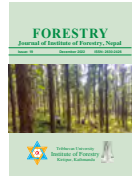




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Avian Diversity and Seasonal Abundance in Banpale Forest, Kaski District, Nepal

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KEYWORDS

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ABSTRACT

Baseline information on bird diversity is essential for biodiversity monitoring and conservation as birds are often considered a key indicator of ecosystem health and ecological balance. Studies from other countries suggest that green patches, like university campuses, play a vital role in local bird conservation in urbanized regions. In the Kaski district of Nepal, the study of bird diversity is limited to the larger lakes of the Pokhara valley. Banpale Forest, one of the few green patches in the Pokhara valley, is considered a hotspot for birdwatching; however, no proper studies have been conducted to explore the bird diversity. This study examines the species diversity and seasonal abundance of birds in the Banpale Forest of the Institute of Forestry, Pokhara. Two trails built by villagers and students for walking were used as transects for the study. A total of 2,975 bird individuals of 125 species were counted in the survey conducted from June 2018 to May 2019, with 12 field visits along a 2.17km trail. Passeriformes (54.03%) and Accipitridae (13.71%) were the dominant order and family respectively among the recorded species. Species diversity (H') was higher in the winter season ($H'=3.99$), with species richness of 13.26 and species evenness of 0.88. Insectivores ($n=54$) were the dominant foraging guilds among the recorded species. The high avifaunal diversity and conservation value index of Banpale Forest indicate the need for conservation planning in the region.

Introduction

Birds play an important role in ecosystem functioning as well as act as bio indicators (Grima et al., 2016) because they are sensitive to changes in environmental conditions (Bibi

and Ali, 2013). They also indicate the health of an ecosystem, such as the level of pollution, and, thus, play an important role in ecological balance (Bibi and Ali, 2013). Furthermore, they act as an essential tool in planning and monitoring of conservation actions (Bregman et al. 2014).

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Worldwide, 223 species of birds are on the verge of extinction (Birdlife International 2022) due to natural as well as anthropogenic threats (Sarkar et al., 2009; Birdlife International, 2022). Habitat degradation and fragmentation, urbanization, change in vegetation composition (Sarkar et al., 2009; Asefa et al. 2017; Girma et al., 2017), pollution, invasive alien species, climate change, illegal hunting and poaching (BirdLife International, 2022) are identified as the major threats to birds. More specifically, pollution, habitat destruction, disturbances due to recreational activities, removal of vegetation, logging, etc are the major threats to birds in the Kaski district (Khatri et al., 2019). Urbanization in recent decades has caused irreversible damage to many ecosystems, impacting natural habitats and reducing biodiversity (Paton et al., 2012).

Nepal has a rich bird diversity, representing 8% of global avifauna diversity (DNPWC and BCN, 2018). Despite being a global hotspot for birds, there are several key drivers for the decline of bird population in Nepal. Of the total 892 bird species found in Nepal, 43 are globally threatened and 168 are nationally threatened (DNPWC and BCN, 2022 [in press]; BirdLife International, 2022). Among nationally threatened species, 40% are critically endangered, 23% are endangered and 37% are vulnerable species (Inskipp et al., 2017). Likewise, among the 467 species of birds found in the Pokhara valley, 18 are globally threatened and 57 are nationally threatened species (Ghimire et al., 2019).

Urbanization has been rapidly increasing in Nepal since 1980 (Sharma, 2003). The Pokhara valley is no different than other regions in terms of urbanization; most of the forests and agricultural and pasturelands have been displaced by buildings. Unplanned urbanization has resulted in loss of forests, habitat fragmentation and change in land use types (Thapa and Muryama, 2010 and 2011). Bird diversity is particularly affected by urbanization, resulting in fewer species in urban areas compared to rural (Katuwal et al., 2018). With increasing urbanization, small green patches within urban areas, such

as university campuses, play an important role in the local conservation of birds (Chakdar et al., 2016; Pragasan and Madesh, 2018). The monitoring of avifaunal diversity in urban green patches is essential to conserve biodiversity in regions where vegetation and agricultural lands supporting birds are being replaced by buildings (Pragasan and Madesh, 2018). Such studies will provide baseline information on bird diversity for future monitoring, research (such as nesting characteristics, breeding biology, etc), and conservation planning. In addition to being ecologically important, key educational biodiversity spots such as university campuses have been neglected for study (Pragasan and Madesh, 2018).

Banpale Forest is a famous birdwatching destination and is one of the few green patches of bird habitat left in the Pokhara valley. The forest is utilized by researchers and green groups linked to the Institute of Forestry, Pokhara Campus, but no formal studies on the diversity and abundance of birds have been conducted. Most research on birds in the Pokhara valley focus on the larger lakes of the lakecluster of the valley (Dhakal et al., 2020), leaving other parts unexplored. Only studies on plant diversity (Miya and Gautam, 2021) and mammals (Bhattarai et al 2021., Bist et al., 2021) have been done inside the Institute of Forestry campus, leaving avifauna understudied. As reported by Grimmett et al. (2016), bushes and forests like Banpale Forest contribute 77% of Nepal's breeding bird habitat. The study was aimed at examining the seasonal diversity and abundance of avifauna present in Banpale Forest of the Institute of Forestry. In addition to this, the study provides baseline information for further research in the area, including nesting characteristics, breeding biology, habitat preferences, and so on.

Materials and Methods

Study area and design

The study was conducted in Banpale Forest, Kaski District, Gandaki Province, in Mid-

West Nepal. The forest is situated in Ward no. 15, in the south-west part of the Pokhara metropolitan city, and is under the ownership of the Institute of Forestry. It comprises very small patches of administrative buildings, open grounds, pathways, and a large forest with bush thickets. The total area of Banpale Forest is 31.85 hectares (ha), and the campus is spread over 15 ha. The forest is subtropical mixed *Schima-Castanopsis* and ranges in altitude from 750 masl (at the Seti River bed) to 915 masl. The area consists of varieties of other associated tree species such as *Diospyrus melabaricum*,

Dalbergia sissoo, *Dalbergia latifolia*, *Acacia catechu*, *Albeziappecies*, *Cinnamom camphora*, and *Delonix regia*. A total 331 plant species have been reported from Banpale Forest and Campus premises (Miya and Gautam, 2021). Banpale Forest is considered one of the bird watching hotspots in the Pokhara valley (Ghimire et al. 2019). Similarly, the university campus plays an important role in the conservation of bird diversity (Pragasan and Madesh, 2018). Formal survey of the diversity and abundance of birds in Banpale Forest has not been previously conducted.

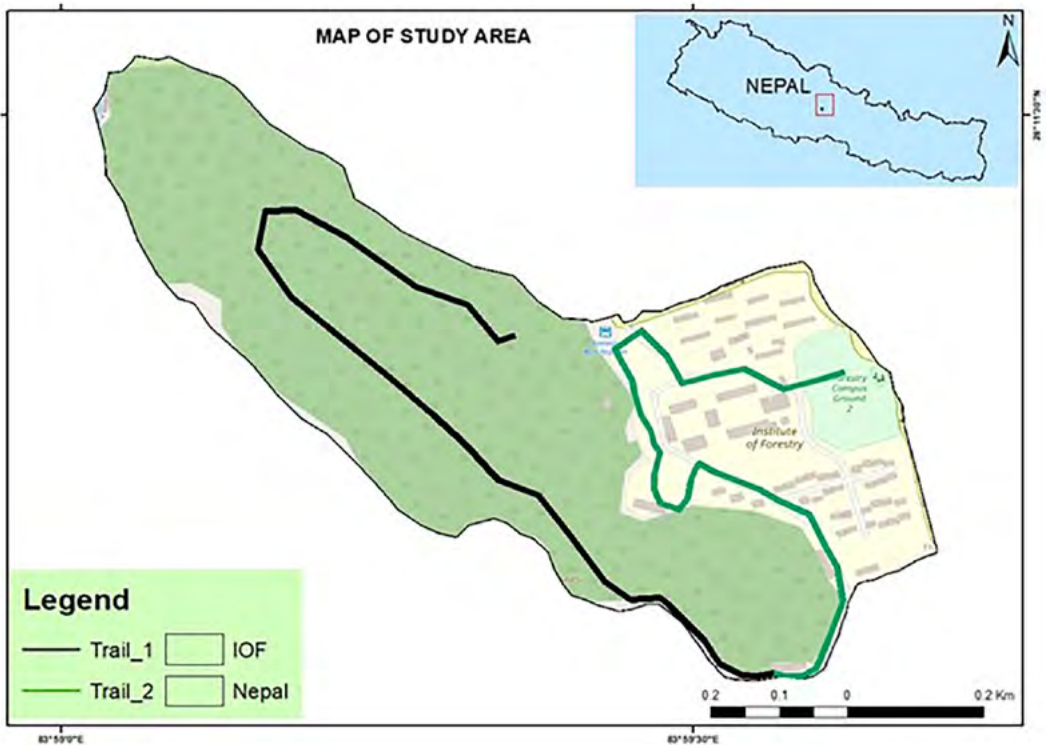


Figure 1: Map of study area showing the trail transect used for study

The selected forest has two major walking trails. The first trail passes through the middle of the forest and is used by the local people (Fig. 1). The second trail passes through a transition zone between the forest and the building areas used by the academic staffs residing in the campus (Fig. 1). The second trail runs through a mixed habitat, including open ground, bushes of the forest, building areas and small agricultural

lands. The first and second trails are contiguous and are considered as a single trail of 2.17 km extending through the whole study area (Figure 1). The line-transect (trail transect) method was used as it is flexible and effective for bird observation (Sutherland et al., 2004).

Bird survey

An absolute count of the birds seen, flushed

and/or heard was done while walking through the predetermined trails at constant speed (Gregory et al., 2004). Bird calls and flushes from behind the observers were not recorded to avoid the double count of the species/individuals. Two observers were present while collecting the data to avoid the inability of a single observer to spot the birds and record data simultaneously (Sutherland et al., 2004).

The study was carried out from June 2018 to May 2019 between 07:00 and 11:00 hours when most of the birds have their peak activity and greater detection rates (Bried et al., 2011). The transects surveys were conducted 12 times, consisting of one visit per month. The field visits covered all four seasons of the year: Summer (June–August), Autumn (September–November), Winter (December–February), and Spring (March–May). Birds feeding and resting in the area, as well as soaring and flying over the skies, were recorded. Celestron binoculars (10*42) and a Canon EOS 500D camera were used to track the birds in the field. Verification at species level were done using Helm Field Guides, *Birds of Nepal* (Grimmett et al., 2016). Field observations were carried out in favourable conditions, ie in sunny conditions with open sky and maximum visibility.

Data analysis

Comparison between the diversity of birds in different seasons was calculated using the Shannon–Weiner Diversity Index (1949) for different seasons (Katuwal et al. 2016;, Katuwal et al., 2018; Pragasnanand Madesh 2018; Joshi et al., (2021). Inskipp et al. (2016) and CITES (2017) were followed to assess the nomenclature and classification as well as conservation status of species. Ghimire et al. (2019) was followed to determine the migration status of birds in the Pokhara valley. The abundance status of the species was assessed based on their observation rates of 75–100%, 50–74%, 25–49%, and <25% and were classified as very common, common, uncommon, and rare respectively (after Khan 2005). The relative abundance index was calculated for each species, ranging from 0 to 1 for unrecorded

species through to frequently occurring species respectively (Robertson et al., 1998). The species richness index and species evenness were determined using Margalef's Richness Index (Margalef, 1958) and Pielou's Evenness Index (Pielou, 1966) respectively. Similarly, the feeding guild of birds were derived from the national red list of birds (Inskipp et al., 2016).

Shannon–Weiner diversity index:

$$H' = -\sum \frac{n_i}{N} \ln \frac{n_i}{N}$$

$$\text{Margalef's Richness Index: } R = \frac{H'}{\ln S}$$

$$\text{Pielou's Evenness Index: } E = \frac{S-1}{\ln N}$$

Where, n_i = species abundance, N = total abundance, S = total number of species, and \ln = logarithm to base e .

The conservation importance index was generated based on the threats to and rarity of the species (Gardner et al., 2015). Rarity weights were based on the commonness of the species as assessed by Ghimire et al. (2019). Threats were based on the IUCN category and CITES criteria, which were derived from Inskipp et al. (2016) as well as the official checklist of *Birds of Nepal* (DNPWC and BCN 2022[in press]). Salem (2003) was followed for the weighting of each criterion (Table 1). Thus, obtained weightings were calculated to obtain the species conservation importance index (after Gardner et al. 2015).

Species Conservation Importance Index (SCII) = Rarity x Threats (IUCN + CITES)

Conservation Value Index (CVI) of the forest was calculated from the obtained SCII's. The higher value of CVI referred to the high importance value of the site.

Results

Species composition

The study observed 2,975 bird individuals identified into 125 species. These species were

Table 1: Weighting for each criterion

Species conservation Importance Index SCII= Rarity weight X (Threats 1 wt. + Threats 2 wt.)					
Rarity status	Weight	Threats 1: IUCN/National red list	Weight	Threats 2: CITES list	Weight
Rare	10	Critically Endangered	10	Appendix I	10
Uncommon	8	Endangered	8	Appendix II	7
Frequent	6	Vulnerable	6	Appendix III	4
Fairly common	4	Near Threatened	4	Not included	1
Common	2	Least Concern	2		
		Data Deficient	1		

Weightage criterion source: Salem (2003)

classified into 71 genera, 40 families, and 15 orders (Annex I). Passeriformes was the most dominant order, with 67 (54.03%) species in 22 families, followed by Accipitriformes (14.52%), and Piciformes (6.45%) (Figure 2). Among families, Accipitridae is the dominant family (13.71%), followed by Muscicapidae (9.68%), Corvidae (4.84%), and Cuculidae (4.84%) (Figure 3).

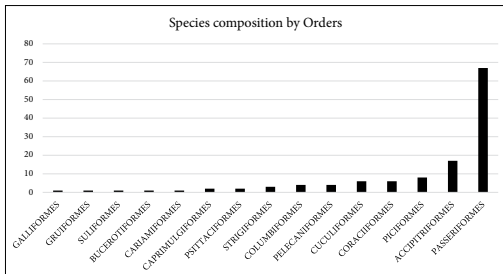


Figure 2: Species composition by orders

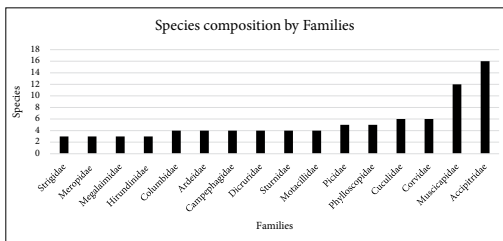


Figure 3: Species composition by families

Seasonal patterns in diversity

The highest number of species were recorded in winter, with 91 species (888 individuals), with a species diversity of 3.99, species richness of 13.25, and species evenness of 0.88. Seventy species of birds (809 individuals) were recorded in the summer season, with a species

diversity of 3.82, species richness of 10.31, and species evenness of 0.90. Likewise, 70 species were recorded in the autumn season (721 individuals), with a species diversity of 3.87, species richness of 10.49, and species evenness of 0.91. Sixty-seven species were recorded in spring (557 individuals), with a species diversity of 3.86, species richness of 10.49, and species evenness of 0.92.

Table 2: Comparison of avian diversity in different seasons

Indices	Summer	Spring	Autumn	Winter
Diversity Indices:				
Shannon–Weiner Index (H')	3.82	3.86	3.87	3.99
Richness Indices:				
Margalef's Index (S)	10.31	10.49	10.49	13.26
Evenness Indices:				
Pielou's Index (e)	0.90	0.92	0.91	0.88

Migratory status and abundance

Of the total bird species recorded, 102 species (81%) were resident, 19 species (16%) were winter visitors, and 4 species (3%) were summer visitors (Figure 4). Four species, viz Asian green bee-eater (*Meropsorientalis*), Indian roller (*Coracias benghalensis*), Rufous woodpecker (*Micropternusbrachyurus*), and Plum-headed parakeet (*Psittaculacyanocephala*) were uncommon residents. Four species, Snowy-browed flycatcher (*Ficedulahyperythra*), Tickell's leaf warbler (*Phylloscopusaffinis*), Asian house martin (*Delichondasypus*), and Little pied flycatcher (*Ficedulawestermanni*) were uncommon winter visitors. Likewise, one species, viz Chestnut-headed bee-eater

(*Meropsleschenaultia*), was an uncommon summer visitor. In addition, the abundance category showed that, of the 125 bird species recorded, 55 species were very common, 32 species common, 28 species uncommon, and 10 species were rare (Figure 5).

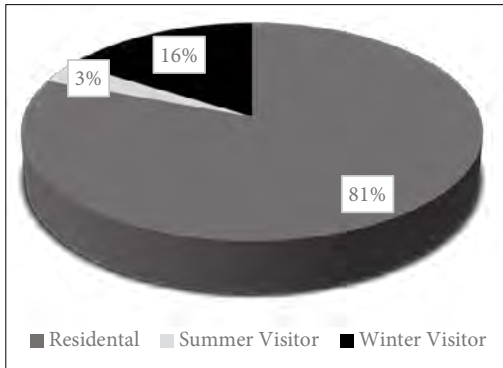


Figure 4: Migratory status of avifauna in IOF

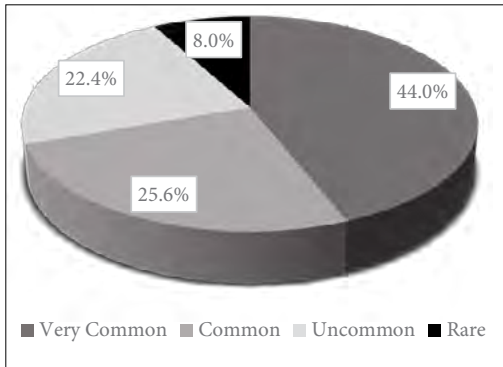


Figure 5: Abundance of avifauna in IOF

Overall Species Diversity of the study area

The overall Shannon–Weiner Diversity Index was calculated to be $H' = 4.17$. The Margalef Richness Index for avifauna was found to be $R = 15.50$. The Pielou’s Evenness Index was found to be $e = 0.86$. This record indicates that the population size of each of the species present is near to complete evenness.

Relative Abundance

The maximum relative abundance was recorded for Red-vented bulbul (*Pycnonotus cafer*) (0.0538), followed by Rock dove (*Columba livia*) (0.0528), Black drongo (*Dicrurus macrocercus*) (0.0440), Rose-ringed parakeet (*Psittacula*

krameria) (0.0434), and Black kite (*Milvus migrans*) (0.0424) (see Annex I).

Of all the families recorded, Accipitridae has the highest relative abundance (0.1485), followed by Corvidae (0.0907) and Dicruridae (0.0769) (Annex I).

Foraging guilds

The study identified insectivorous (n=54) as the dominant species-dietary guild, followed by carnivore (n=31), in the study area (Figure 6).

Conservation Status of Recorded Bird

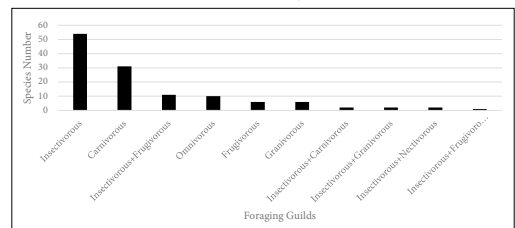


Figure 6: Foraging guild of recorded birds

Species

In total, five species were globally threatened, viz. White-rumped vulture (*Gyps bengalensis*), Slender-billed vulture (*Gyps tenuirostris*), Red-headed vulture (*Sarcogyps calvus*), Egyptian vulture (*Neophron percnopterus*), and Steppe eagle (*Aquila nipalensis*). Two species, Cinereous vulture (*Aegypius monachus*) and Himalayan vulture (*Gyps himalayensis*), were globally near threatened species.

Eighteen species were listed on CITES under Category II, viz. Asian barred owl (*Glaucidium cuculoides*), Jungle owl (*Glaucidium radiatum*), Brown fish owl (*Ketupa zeylonensis*), Shikra (*Accipiter badius*), Black kite, Plum-headed parakeet (*Psittacula cyanocephala*), White-rumped vulture, Red-headed vulture, Egyptian vulture, Slender-billed vulture, Osprey (*Pandion haliaetus*), Oriental honey-buzzard (*Pernis ptilorhynchus*), Crested serpent eagle (*Spilornis cheela*), Bonelli’s eagle (*Aquila fasciata*), Booted eagle (*Hieraaetus pennatus*), Eurasian sparrowhawk (*Accipiter nisus*), Common kestrel (*Falco tinnunculus*), and Steppe eagle.

Table 2: Species with five highest and lowest Species Conservation Importance Indices (SCII) recorded in Banpale Forest

Name	Rarity status	IUCN (national list) status	CITES status	SCII
Cinereous vulture <i>Aegypius monachus</i>	8	8	7	120
Slender-billed vulture <i>Gyps tenuirostris</i>	8	10	1	88
Brown fish owl <i>Ketupa zeylonensis</i>	6	6	7	78
Plum-headed parakeet <i>Psittacula cyanocephala</i>	8	2	7	72
White-rumped vulture <i>Gyps bengalensis</i>	4	10	7	68
Red-headed vulture <i>Sarcogyps calvus</i>	4	8	7	60
Oriental magpie robin <i>Copsychus saularis</i>	2	2	1	6
Rock dove <i>Columba livia</i>	2	2	1	6
Common myna <i>Acridotheres tristis</i>	2	2	1	6
Scaly-breasted munia <i>Lonchura punctulata</i>	2	2	1	6
Crimson sunbird <i>Aethopyga siparaja</i>	2	2	1	6

The conservation value of Banpale Forest was determined higher with conservation value index of 2182. The species with higher species conservation importance indices (SCII) were Cinereous vulture (SCII= 120), Slender-billed vulture (SCII= 88), and so on (Table 2).

Discussion

Species diversity

Our study reveals that the diversity of birds in Banpale Forest is reasonably high and indicates the area has greater potential for avian conservation sites. The higher diversity can be attributed to complexity of habitat in the study area (Pan et al., 2016; Hu et al., 2018). Institute of Forestry, Pokhara Campus, being diverse in terms of habitat, including forest, bushes, agricultural lands, open areas, and building areas, might have provided home to a diversity of birds, as observed by Neupane et al. (2020). Similarly, the study area is near a landfill site, which provides a source of food for raptors while the Seti River provides a source of water. It can also be attributed to relatively good protection of habitat types due to the presence of the university campus (Pragasen and Madesh, 2018). Similarly, the higher Margalef value indicates the suitability of habitat for community stability with the longer food chain and complex food web (Margalef, 1956). The Margalef value of the study area is similar to the observation of Poudel et al. (2021). Similarly,

the higher Pielou's Evenness Index indicates that the population size of each of the species present in the area is near complete evenness, which is similar to the observation of Poudel et al. (2021).

Passeriformes are expected to be the most diverse group of birds (Raikow et al., 2000), which might result in their dominance over other orders. Likewise, Passeriformes was the most dominant order, supporting the observations of Pawar (2011), Chakdar et al. (2016), Grima et al. (2016), Pragasen and Madesh (2018), Neupane et al. (2020), Bhusal and Paudel (2022), Poudel et al. (2022), and Upadhyaya et al. (2022). Red-vented bulbul was the most abundant species in the study area. It could be attributed to their feeding habits, preference of habitats and behaviour (Girma et al., 2016), and the same applies for birds ranked second, third and fourth in the list.

Accipitridae was found to be the dominant family, similar to the results of Grima et al. (2016). This contrasts with the observations of Pawar et al. (2011), Jha (2019), Pandey et al. (2020), Venkitachalam and Vijayan (2020), Paliwal et al. (2021), Shah & Sharma (2022), and Withaningsih et al. (2022), who found other families being more numerous than Accipitridae. The Pokhara valley is regarded as a hub for birds of prey because it harbours large numbers of resident raptor species

(Ghimire et al., 2019). The resident species are complemented with migratory species in the autumn and winter seasons. Every year, large numbers of winter migratory raptors pass through or overwinter in the Pokhara valley (Ghimire et al., 2019). For this reason, the number of species belonging to the Accipitridae family are typically higher in the Pokhara valley during winter, contributing to the significance of the Accipitridae family in the study area.

Seasonal pattern

The study found variation of species diversity in different seasons within the study area. Seasonality dynamics play an important role in shaping the regional diversity of bird communities in Nepal (Inskipp et al., 2016). The study area lies in the sub-tropical zonation and provides wintering ground to migratory birds as well as breeding areas for summer migratory birds (Ghimire et al., 2019). Altitudinal migration of birds during winter (non-breeding) and summer (breeding) seasons also influences the seasonal variation in species diversity (Grimmett et al., 2016). Altitudinal migrants descend to lower altitudes during the winter season (non-breeding season) and ascend to their breeding grounds in spring. We found a higher diversity of birds during the winter season compared to other seasons, which was in agreement with Katuwal et al. (2018), Poudel et al. (2022), and Shah and Sharma (2022). As discussed above, the Pokhara valley provides wintering areas as well as a migratory path for several winter migratory birds in contrast to summer migrants (Ghimire et al., 2019), resulting in high species number during the winter season. Similarly, the higher local movement of birds during the winter season in search of food resources, as well as defoliation of plants, results in the easy detection of bird species (Katuwal et al., 2018; Tzortzakaki et al., 2018). This can also be attributed to higher diversity of birds during the winter season.

Foraging guilds and conservation status

Insectivores are the dominant guild in the Banpale Forest, similar to the observation of

Katuwal et al. (2018), Pandey et al. (2021), Joshi et al. (2022), and Upadhyaya et al. (2022). The distribution of foraging guilds is governed by the availability of food as well as heterogeneity of landscape (Samia et al., 2015; Tryjanowski et al., 2015). Urbanization has resulted in the decrement in the richness and abundance of insects in urban areas (Clark et al., 2007), which might result in contraction of insectivores to the small green patches of urban areas like Banpale Forest. Similarly, the flowering plants of the forest attract the pollinator species, eventually increasing the insectivore birds (Bashir et al., 2019), which might have resulted in the dominance of insectivores in Banpale Forest.

The Conservation Value Index of Banpale Forest was found to be high for isolated forest patches, in agreement with Joshi et al. (2022). Despite the small size of the university campus, greenspace around it serves as a potential habitat for a higher diversity of birds as well as species with High Conservation Importance indices. As a result, small green patches in the urban landscape like Institute of Forestry play important role in the conservation of birds and their habitats.

Conclusion

This study of Banpale Forest within Institute of Forestry, Pokhara, exemplifies the role that small habitat patches within an urbanizing landscape can play in providing habitat to birds as well as their conservation. The presence of nationally and globally threatened bird species highlights the importance of such areas for biodiversity conservation. Suitable forest areas around the campus provide critical habitat for bird diversity. Further studies are required to explore the distribution pattern and habitat suitability of the species as well as nesting characteristics in the university campus to generate strong scientific support for planning conservation activities. It is concluded that the Institute of Forestry, Pokhara, has good potentiality for bird ecotourism as well biodiversity conservation. Specific conservation

actions, such as protection of large trees for nesting of raptors, management of old trees for cavity-dwelling birds, and protection of bushes for small birds are examples of conservation strategies based on bird diversity assessments and monitoring within the campus.

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Authors' contributions

Baral, M. conceptualized, investigated, collected data, analysed and developed the manuscript. Neupane, A. contributed in data collection, analysis, review and editing manuscript. Ghimire, M. and Bhusal, K.P. reviewed and edited the manuscript.

Conflict of interest

All the authors declare that there is no conflict of interest relating to this article.

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S. N	Species	Scientific Name	Migratory status	Counts	Abundance	Relative Abundance
GALLIFORMES						
Phasianidae						0.00100840
1	Kalij Pheasant	<i>Lophura leucomelanos</i>	R	3	3	0.00100840
COLUMBIFORMES						
Columbidae						0.06588235
2	Rock Dove	<i>Columba livia</i>	R	12	157	0.05277311
3	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	R	4	4	0.00134454
4	Western Spotted Dove	<i>Spilopelia suratensis</i>	R	11	34	0.01142857
5	Eurasian Collared-dove	<i>Streptopelia decaocto</i>	R	1	1	0.00033613
CAPRIMULGIFORMES						
Apodidae						0.01882353
6	House Swift	<i>Apus nipalensis</i>	R	4	20	0.00672269
7	Alpine Swift	<i>Tachymarptis melba</i>	W	6	36	0.01210084
CUCULIFORMES						
Cuculidae						0.01546218
8	Greater Coucal	<i>Centropus sinensis</i>	R	9	15	0.00504202
9	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	R	4	4	0.00134454
10	Western Koel	<i>Eudynamis scolopaceus</i>	R	3	5	0.00168067
11	Common Hawk- cuckoo	<i>Hierococcyx varius</i>	R	5	5	0.00168067
12	Indian Cuckoo	<i>Cuculus micropterus</i>	S	5	8	0.00268908
13	Common Cuckoo	<i>Cuculus canorus</i>	S	5	9	0.00302521
GRUIFORMES						
Rallidae						0.00100840
14	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R	3	3	0.00100840
PELECANIFORMES						
Ardeidae						0.01142857
15	Indian Pond-heron	<i>Ardeola grayii</i>	R	4	4	0.00134454
16	Cattle Egret	<i>Bubulcus ibis</i>	R	1	9	0.00302521
17	Intermediate Egret	<i>Ardea intermedia</i>	R	3	8	0.00268908
18	Little Egret	<i>Egretta garzetta</i>	R	5	13	0.00437122
SULIFORMES						
Phalacrocoracidae						0.01613445
19	Great Cormorant	<i>Phalacrocorax carbo</i>	W	5	48	0.01613445
STRIGIFORMES						
Strigidae						0.00268908
20	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	R	4	5	0.00168067
21	Jungle Owlet	<i>Glaucidium radiatum</i>	R	1	1	0.00033613
22	Brown Fish-owl	<i>Ketupa zeylonensis</i>	R	2	2	0.00067227
ACCIPITRIFORMES						
Accipitridae						0.14857143
23	Egyptian Vulture	<i>Neophron percnopterus</i>	R	8	74	0.02487395

24	Red-headed Vulture	<i>Sarcogyps calvus</i>	R	9	14	0.00470588
25	White-rumped Vulture	<i>Gyps bengalensis</i>	R	10	34	0.01142857
26	Steppe Eagle	<i>Aquila nipalensis</i>	W	4	22	0.00739496
27	Shikra	<i>Accipiter badius</i>	R	11	30	0.01008403
28	Black Kite	<i>Milvus migrans</i>	R	12	126	0.04235294
29	Himalayan Vulture	<i>Gyps himalayensis</i>	R	8	64	0.02151261
30	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	R	6	20	0.00672269
31	Cinereous Vulture	<i>Aegypius monachus</i>	W	4	10	0.00336134
32	Common Buzzard	<i>Buteo buteo</i>	R	6	10	0.00336134
33	Black-eared Kite	<i>Milvus migrans</i>	R	6	12	0.00403361
34	Booted Eagle	<i>Hieraaetus pennatus</i>	W	5	11	0.00369748
35	Crested Serpent-eagle	<i>Spilornis cheela</i>	R	3	3	0.00100840
36	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	R	4	5	0.00168067
37	Griffon Vulture	<i>Gyps fulvus</i>	M	2	2	0.00067227
38	Bonelli's Eagle	<i>Aquila fasciata</i>	R	2	4	0.00134454
39	Slender billed Vulture	<i>Gyps tenuirostris</i>	R	1	1	0.00033613
Pandionidae						0.00067227
40	Osprey	<i>Pandion haliaetus</i>	W	2	2	0.00067227
BUCEROTIFORMES						
Upupidae						0.00067227
41	Common Hoopoe	<i>Upupa epops</i>	W	2	2	0.00067227
CORACIIFORMES						
Meropidae						0.01579832
42	Blue-bearded Bee-eater	<i>Nyctornis athertoni</i>	R	9	34	0.01143241
43	Asian Green Bee-eater	<i>Merops orientalis</i>	R	4	5	0.00168067
44	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	S	4	8	0.00268908
Coraciidae						0.00067227
45	Indian Roller	<i>Coracias benghalensis</i>	R	2	2	0.00067227
Alcedinidae						0.00403361
46	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	R	7	10	0.00336134
47	Pied Kingfisher	<i>Ceryle rudis</i>	R	2	2	0.00067227
PICIFORMES						
Megalaimidae						0.04436975
48	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	R	4	7	0.00235294
49	Great Barbet	<i>Psilopogon virens</i>	R	12	67	0.02252101
50	Blue-throated Barbet	<i>Psilopogon asiaticus</i>	R	12	58	0.01949580
Picidae						0.02957983
51	Rufous Woodpecker	<i>Micropternus brachyurus</i>	R	2	2	0.00067227
52	Greater Yellownape	<i>Chrysophlegma flavinucha</i>	R	7	16	0.00537815
53	Lesser Yellownape	<i>Picus chlorolophus</i>	R	7	22	0.00739496
54	Black-naped Woodpecker	<i>Picus guerini</i>	R	11	21	0.00705882
55	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	R	9	27	0.00907563
PSITTACIFORMES						
Psittacidae						0.04436975
56	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	R	1	3	0.00100840
57	Rose-ringed Parakeet	<i>Psittacula kramera</i>	R	12	129	0.04336134
PASSERIFORMES						
Oriolidae						0.00268908

58	Indian Golden Oriole	<i>Oriolus kundoo</i>	S	3	6	0.00201681
59	Black-hooded Oriole	<i>Oriolus xanthornus</i>	R	2	2	0.00067227
Campephagidae						0.04235294
60	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	R	8	40	0.01344538
61	Scarlet Minivet	<i>Pericrocotus flammeus</i>	R	10	54	0.01815126
62	Indian Cuckooshrike	<i>Coracina macei</i>	R	9	30	0.01008403
63	Black-winged Cuckooshrike	<i>Lalage melaschistos</i>	R	2	2	0.00067227
Dicruridae						0.07697479
64	Black Drongo	<i>Dicrurus macrocercus</i>	R	8	131	0.04403361
65	Ashy Drongo	<i>Dicrurus leucophaeus</i>	R	1	5	0.00168067
66	Lesser Racquet-tailed Drongo	<i>Dicrurus remifer</i>	R	4	4	0.00134499
67	Hair- crested Drongo	<i>Dicrurus hottentottus</i>	R	12	89	0.02991597
Laniidae						0.02890756
68	Long-tailed Shrike	<i>Lanius schach</i>	R	11	48	0.01613445
69	Grey-backed Shrike	<i>Lanius tephronotus</i>	W	9	38	0.01277311
Corvidae						0.09075630
70	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	10	41	0.01378151
71	Grey Treepie	<i>Dendrocitta formosae</i>	R	12	65	0.02184874
72	Red-billed Blue Magpie	<i>Urocissa erythroryncha</i>	R	6	30	0.01008403
73	Common Green Magpie	<i>Cissa chinensis</i>	R	5	6	0.00201681
74	House Crow	<i>Corvus splendens</i>	R	10	70	0.02352941
75	Large-billed Crow	<i>Corvus macrorhynchos</i>	R	10	58	0.01949580
Stenostiridae						0.00571429
76	Yellow-bellied Fairy-fantail	<i>Chelidorhynch hypoxanthus</i>	R	3	6	0.00201681
77	Grey-headed Canary-flycatcher	<i>Culicicapa ceylonensis</i>	R	5	11	0.0036974
Paridae						0.04235294
78	Cinereous Tit	<i>Parus major</i>	R	12	83	0.02789916
79	Black-lored Tit	<i>Machlophus xanthogenys</i>	R	12	43	0.01445378
Cisticolidae						0.02924370
80	Striated Prinia	<i>Prinia crinigera</i>	R	1	2	0.00067249
81	Common Tailorbird	<i>Orthotomus sutorius</i>	R	12	85	0.02857143
Hirundinidae						0.02588235
82	Barn Swallow	<i>Hirundo rustica</i>	R	6	44	0.01478992
83	Red-rumped Swallow	<i>Cecropis daurica</i>	R	4	8	0.00268908
84	Asian House Martin	<i>Delichon dasypus</i>	W	4	25	0.00840336
Pycnonotidae						0.06991597
85	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	R	8	48	0.01613445
86	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	12	160	0.05378151
Phylloscopidae						0.01915966
87	Hume's Leaf Warbler	<i>Phylloscopus humei</i>	W	4	11	0.00369748
88	Greenish Warbler	<i>Phylloscopus trochiloides</i>	W	5	18	0.00605042
89	Grey-hooded Warbler	<i>Phylloscopus xanthoschistos</i>	R	4	6	0.00201681
90	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	W	5	8	0.00268908
91	Buff-barred Warbler	<i>Phylloscopus pulcher</i>	R	5	14	0.00470588
Zosteropidae						0.00336134
92	Oriental White-eye	<i>Zosterops palpebrosus</i>	R	5	10	0.00336134
Sittidae						0.01142857

93	Chestnut-bellied Nuthatch	<i>Sitta cinnamoventris</i>	R	11	25	0.00840336
94	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	R	5	9	0.00302521
Sturnidae						0.04974790
95	Brahminy Starling	<i>Sturnia pagodarum</i>	R	5	16	0.00537815
96	Chestnut-tailed Starling	<i>Sturnia malabarica</i>	R	6	46	0.01546218
97	Common Myna	<i>Acridotheres tristis</i>	R	6	31	0.01042017
98	Jungle Myna	<i>Acridotheres fuscus</i>	R	7	55	0.01849361
Turdidae						0.00067227
99	Black-throated Thrush	<i>Turdus atrogularis</i>	W	1	1	0.00033613
100	Scaly Thrush	<i>Zoothera dauma</i>	W	1	1	0.00033613
Muscicapidae						0.04705882
101	Oriental Magpie-robin	<i>Copsychus saularis</i>	R	12	54	0.01815126
102	Rufous-bellied Niltava	<i>Niltava sundara</i>	R	5	6	0.00201681
103	Small Niltava	<i>Niltava macgrigoriae</i>	R	5	5	0.00168067
104	Verditer Flycatcher	<i>Eumyias thalassinus</i>	R	2	3	0.00100840
105	Blue Whistling-thrush	<i>Myophonus caeruleus</i>	R	12	35	0.01176471
106	Snowy-browed Flycatcher	<i>Ficedula hyperythra</i>	W	3	3	0.00100840
107	Red-throated Flycatcher	<i>Ficedula albicilla</i>	W	4	7	0.00235294
108	Plumbeous Water-redstart	<i>Phoenicurus fuliginosus</i>	R	3	3	0.00100840
109	Grey Bushchat	<i>Saxicola ferreus</i>	R	3	4	0.00134454
110	Pied Bushchat	<i>Saxicola caprata</i>	R	4	8	0.00268908
111	Common Stonechat	<i>Saxicola torquatus</i>	R	5	10	0.00336134
112	Little Pied Flycatcher	<i>Ficedula westermanni</i>	W	2	2	0.00067227
Nectariniidae						0.00537815
113	Purple Sunbird	<i>Cinnyris asiaticus</i>	R	3	3	0.00100840
114	Crimson Sunbird	<i>Aethopyga siparaja</i>	R	8	13	0.00436975
Estrildidae						0.00806723
115	White-rumped Munia	<i>Lonchura striata</i>	R	3	6	0.00201681
116	Scaly-breasted Munia	<i>Lonchura punctulate</i>	R	4	18	0.00605042
Passeridae						0.00941176
117	House Sparrow	<i>Passer domesticus</i>	R	1	26	0.00873950
118	Eurasian Tree Sparrow	<i>Passer montanus</i>	R	1	2	0.00067227
Motacillidae						0.00705882
119	Paddyfield Pipit	<i>Anthus rufulus</i>	R	4	8	0.00268908
120	Grey Wagtail	<i>Motacilla cinerea</i>	R	5	8	0.00268908
121	White Wagtail	<i>Motacilla alba</i>	W	2	4	0.00134454
122	Olive-backed Pipit	<i>Anthus hodgsoni</i>	W	1	1	0.00033613
Leiotrichidae						0.00067227
123	Red-billed Leiothrix	<i>Leiothrix lutea</i>	R	2	2	0.00067227
Rhipiduridae						0.00067227
124	White-throated Fantail	<i>Rhipidura albicollis</i>	R	2	2	0.00067227
CARIAMIFORMES						
Falconidae						0.00134454
125	Common Kestrel	<i>Falco tinnunculus</i>	R	4	4	0.00134454