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SHORT COMMUNICATION

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Kiran Choudaj & Varsha Wankhade

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Changed avian assemblage of Savitribai Phule Pune University campus in last four decades

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Abstract: Savitribai Phule Pune University is known for its biodiversity in Pune. In the present study, we have analyzed changes which have occurred on the campus and surrounding area over the last 40 years. Of the 90 bird species reported in the campus and Khadki pond in 1976, we failed to notice 34 species in 2018. A major reason for the decline in bird diversity could be changes in the campus habitat from low scrub jungle, fallow lands and grassland to buildings, roads, and exotic plantations. Increase in human settlement surrounding the campus may also be a contributing factor. Replacing exotic plants by indigenous plant species and control of land use can prevent further loss of biodiversity.

Keywords: Educational campus, exotic plants, urbanization, loss of native flora.

Cities are under the pressure of anthropogenic activities such as the construction of roads, buildings, industries, increased human settlement, and pollution. Most of the cities in the world are established in biodiversity rich regions. As anthropogenic pressure increases in the cities, people start intruding into naturally balanced ecosystems surrounding them. Increase in the human population and anthropogenic activities affect the diversity and structure of biological communities

(Vitousek 1994; Maurer 1996). Urbanization causes long term loss of native habitats (Simberloff 1986) and creates human-specific environments (McKinney 2002). Though anthropogenic disturbance is great within in cities, some places such as campuses of educational institutes are comparatively less disturbed and more rich in biodiversity. The biodiversity of many educational institutes is well documented, making them good places to study changes in biodiversity over time. We noticed an increase in anthropogenic activities in the campus of Savitribai Phule Pune University (SPPU) when consultation of previous floral literature for Ganeshkhind (the surrounding region; Varadpande 1973) indicated drastic changes in vegetation. Grassland-scrub vegetation and fallow land in the campus was diminished, replaced with buildings, roads and exotic plantations. Birds are good indicators of biodiversity change due to their sensitivity to environmental changes (Gregory 2006). In this study, we analyzed the impact of vegetation change and anthropogenic activities on avian diversity of Savitribai Phule Pune University campus and Khadki pond.

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MATERIAL AND METHODS

Study area

The study was carried out in Savitribai Phule Pune University campus (18.553° & 73.824°) and Khadki pond (18.555°N & 73.831°E) which is adjacent to the university campus. The campus is spread over 411 acres of land and contains buildings, gardens, exotic plantations, agricultural land and a university pond (Image 1). The major area of the campus is under the cover of exotic plantations; *Dalbergia melanoxylon* (African Blackwood) and *Gliricidia sepium* (Gliricidia) are two dominant exotic plant species in the campus. Alice garden is the oldest garden in the campus, containing native and non-native tree species such as *Ficus benghalensis*, *Albizia saman*, *Syzygium cumini*, *Mangifera indica*, *Polyalthia longifolia*, *Eucalyptus citriodora*, *Kigelia pinnata*, *Putranjiva roxburghii*, *Delonix regia*, and *Peltophorum pterocarpum*. Agricultural land in the campus is mostly fallow in recent days, with some utilized for horticulture. The university pond is small and seasonal, containing plant species such as *Hydrilla* sp., *Ceratophyllum* sp., *Typha* sp., *Ipomoea aquatica*, *Spirogyra* sp., *Chara* sp., *Hydrodictyon* sp. (Kulkarni et al. 2015). Khadki pond is a seasonal waterbody spread over 7.42 acres.

Data collection

We surveyed the complete area previously sampled by Goel (1976). Bird survey was carried for one and a

half years, from November 2014 to April 2015 and July 2017 to June 2018. Bird survey was carried out in all three seasons (Monsoon, winter, and summer) and the complete study area was surveyed at least once per season. Other than regular surveys, opportunistic birds seen were also considered for preparing a checklist. Bird surveys were carried out by a single observer in the between 07.00h and 11.00h. Birds were observed using binoculars (Olympus 10 × 50X magnification). Audiovisual cues were used for bird identification. For identification of birds, feeding guild and residential status we used field guides of Grimmett et al. (1999), Ali (2002), and Kazmierczak & Perlo (2000). For bird taxonomy and nomenclature, we followed Praveen et al. (2016).

RESULTS

In 1976, Goel listed 91 bird species for the university campus and nearby area of Khadki pond. From this checklist we observed only 56 species in the current survey. *Gallus gallus domesticus* (Linnaeus, 1758), a domestic fowl, is not listed in the checklist of birds of India prepared by Praveen et al. (2016), thus we considered only 90 bird species from the previous checklist when preparing a new one. In addition to the previous checklist, we found 16 new bird species in the campus, making a total of 106 bird species listed from Savitribai Phule Pune University campus and Khadki



Image 1. Savitribai Phule Pune University campus and Khadki pond, Pune.

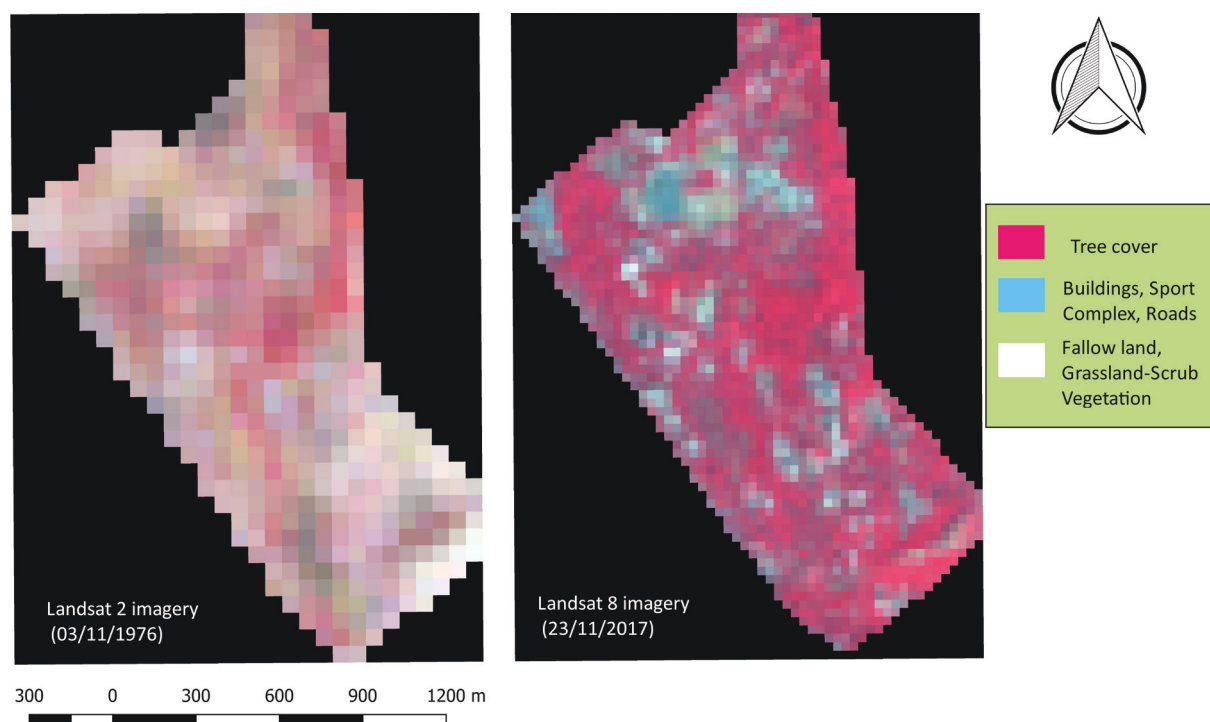


Image 2. False colour satellite imagery of Savitribai Phule Pune University campus of two time periods 1976 and 2017.

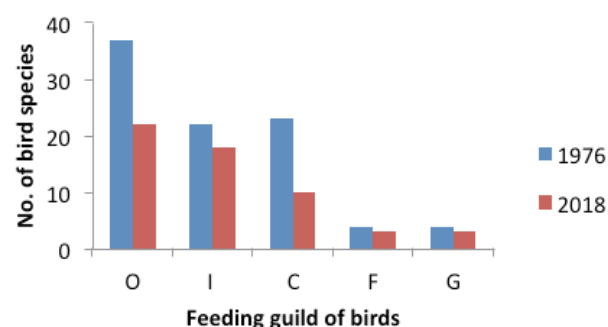


Figure 1. Feeding guild-wise decline in number of bird species of Savitribai Phule Pune University campus and Khadki pond. O—Omnivore | I—Insectivore | C—Carnivore | F—Frugivore | G—Granivore.

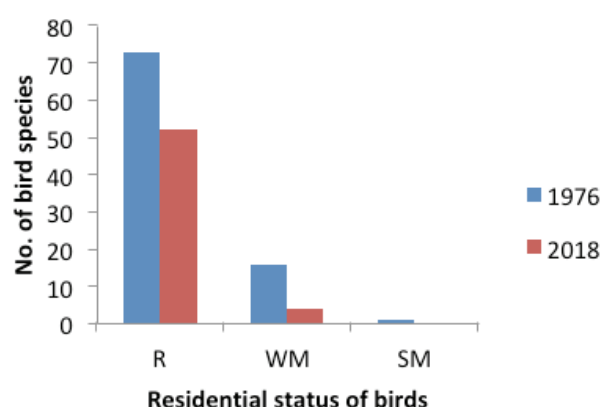


Figure 2. Residential status wise decline in number of bird species of Savitribai Phule Pune University campus and Khadki pond. R—Resident | WM—Winter migratory | SM—Summer migratory.

pond. All the birds observed are classified into 17 orders and 53 families, of which 56% birds belonged to order Passeriformes (Table 1 & 2). The richness of insectivore, carnivore and omnivore birds has declined more compared to frugivore and granivore birds (Figure 1, Table 1). The richness of both resident and migratory birds has decreased compared to 1976 (Figure 2, Table 1).

DISCUSSION

In 1976, 17% of the entire area of university campus was occupied by buildings, roads, and gardens, the

major part of rest of the area was thinly wooded low scrub jungle interspersed with various trees (Goel 1976). There were also fallow lands, three patches of trees, flower nursery and citrus garden. But thinly wooded low scrub jungle, fallow lands, flower nursery, citrus garden are no longer found on the campus, where a majority of the total area is covered with buildings, sports complexes, roads and exotic plantations (Image 2). Currently it is noted that there has been increase in buildings, sports complexes, concrete fence and

Table 1. List of avifauna recorded in the campus of Savitribai Phule Pune University and Khadki pond in 1976 and its present status in 2018.

	Order/Family/Scientific name	Common name	Food habit/ Guild	Residential status	Present status
	Phoenicopteriformes: Podicipedidae				
1	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	Little Grebe	C	R	×
	Columbiformes: Columbidae				
2	<i>Columba livia</i> (J.F. Gmelin, 1789)	Rock Pigeon	G	R	—
3	<i>Streptopelia chinensis</i> (Scopoli, 1786)	Spotted Dove	G	R	×
4	<i>Streptopelia senegalensis</i> (Linnaeus, 1766)	Laughing Dove	G	R	—
5	<i>Treron phoenicopterus</i> (Latham, 1790)	Yellow-legged Green Pigeon	F	R	×
	Caprimulgiformes: Apodidae				
6	<i>Cypsiurus balasensis</i> (J.E. Gray, 1829)	Asian Palm Swift	I	R	—
7	<i>Apus affinis</i> (J.E. Gray, 1830)	Indian House Swift	I	R	—
	Cuculiformes: Cuculidae				
8	<i>Centropus sinensis</i> (Stephens, 1815)	Greater Coucal	C	R	—
9	<i>Clamator jacobinus</i> (Boddaert, 1783)	Pied Cuckoo	C	SM	×
10	<i>Eudynamis scolopacea</i> (Linnaeus, 1758)	Asian Koel	O	R	—
11	<i>Cacomantis merulinus</i> (Scopoli, 1786)	Plaintive Cuckoo	C	WM	×
12	<i>Hierococcyx varius</i> (Vahl, 1797)	Common Hawk Cuckoo	O	R	×
	Gruiformes: Rallidae				
13	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	White-breasted Waterhen	O	R	—
	Pelecaniformes :Ardeidae				
14	<i>Ardeola grayii</i> (Sykes, 1832)	Indian Pond Heron	C	R	—
15	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	C	R	—
	Charadriiformes : Charadriidae				
16	<i>Charadrius dubius</i> (Scopoli, 1786)	Little Ringed Plover	C	R	×
17	<i>Vanellus indicus</i> (Boddaert, 1783)	Red-wattled Lapwing	C	R	—
18	<i>Vanellus malabaricus</i> (Boddaert, 1783)	Yellow-wattled Lapwing	C	R	×
	Rostratulidae				
19	<i>Rostratula benghalensis</i> (Linnaeus, 1758)	Greater Painted-snipe	O	R	×
	Jacaniidae				
20	<i>Hydrophasianus chirurgus</i> (Scopoli, 1786)	Pheasant-tailed Jacana	O	R	×
	Scolopacidae				
21	<i>Tringa glareola</i> (Linnaeus, 1758)	Wood Sandpiper	C	WM	×
22	<i>Actitis hypoleucos</i> (Linnaeus, 1758)	Common Sandpiper	C	WM	×
23	<i>Tringa nebularia</i> (Gunnerus, 1767)	Common Greenshank	C	WM	×
24	<i>Gallinago gallinago</i> (Linnaeus, 1758)	Common Snipe	C	WM	×
	Turnicidae				
25	<i>Turnix suscitator</i> (J.F. Gmelin, 1789)	Barred Buttonquail	O	R	×
	Accipitriformes: Accipitridae				
26	<i>Accipiter badius</i> (J.F. Gmelin, 1788)	Shikra	C	R	—
27	<i>Milvus migrans</i> (Boddaert, 1783)	Black Kite	C	R	—
	Strigiformes: Strigidae				
28	<i>Athene brama</i> (Temminck, 1821)	Spotted Owlet	C	R	—
	Bucerotiformes: Bucerotidae				
29	<i>Ocyrceros birostris</i> (Scopoli, 1786)	Indian Grey Hornbill	O	R	—

	Order/Family/Scientific name	Common name	Food habit/ Guild	Residential status	Present status
	Upupidae				
30	<i>Upupa epops</i> (Linnaeus, 1758)	Common Hoopoe	I	R	—
	Piciformes: Picidae				
31	<i>Dendrocopos mahrattensis</i> (Latham, 1801)	Yellow-fronted Pied Woodpecker	I	R	—
	Ramphastidae				
32	<i>Psilopogon haemacephalus</i> (Statius Muller, 1776)	Coppersmith Barbet	F	R	—
	Coraciiformes: Meropidae				
33	<i>Merops orientalis</i> (Latham, 1801)	Green Bee-eater	I	R	—
	Coraciidae				
34	<i>Coracias benghalensis</i> (Linnaeus, 1758)	Indian Roller	C	R	×
	Alcedinidae				
35	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	White-throated Kingfisher	C	R	—
	Falconiformes: Falconidae				
36	<i>Falco tinnunculus</i> (Linnaeus, 1758)	Common Kestrel	C	R	×
	Psittaciformes: Psittaculidae				
37	<i>Psittacula cyanocephala</i> (Linnaeus, 1766)	Plum-headed Parakeet	G, F	R	—
38	<i>Psittacula krameri</i> (Scopoli, 1769)	Rose-ringed Parakeet	G, F	R	—
	Passeriformes: Campephagidae				
39	<i>Pericrocotus cinnamomeus</i> (Linnaeus, 1766)	Small Minivet	I	R	—
40	<i>Coracina javensis</i> (Horsfield, 1821)	Large Cuckooshrike	O	R	×
	Vangidae				
41	<i>Tephrodornis pondicerianus</i> (J.F. Gmelin, 1789)	Common Woodshrike	I	R	×
	Oriolidae				
42	<i>Oriolus oriolus</i> (Linnaeus, 1758)	Eurasian Golden Oriole	O	R	—
	Aegithinidae				
43	<i>Aegithina tiphia</i> (Linnaeus, 1758)	Common Iora	I	R	—
	Dicruridae				
44	<i>Dicrurus macrocercus</i> (Vieillot, 1817)	Black Drongo	O	R	—
	Laniidae				
45	<i>Lanius vittatus</i> (Valenciennes 1826)	Bay-backed Shrike	C	R	×
46	<i>Lanius schach</i> (Linnaeus, 1758)	Long-tailed Shrike	C	R	—
	Corvidae				
47	<i>Dendrocitta vagabunda</i> (Latham, 1790)	Rufous Treepie	O	R	—
48	<i>Corvus splendens</i> (Vieillot, 1817)	House Crow	O	R	—
49	<i>Corvus macrorhynchos</i> (Wagler, 1827)	Large-billed Crow	O	R	—
	Nectariniidae				
50	<i>Leptocoma zeylonica</i> (Linnaeus, 1766)	Purple-rumped Sunbird	O	R	—
51	<i>Cinnyris asiaticus</i> (Latham, 1790)	Purple Sunbird	O	R	—
	Ploceidae				
52	<i>Ploceus philippinus</i> (Linnaeus, 1766)	Baya Weaver	O	R	—
	Estrildidae				
53	<i>Euodice malabarica</i> (Linnaeus, 1758)	Indian Silverbill	G	R	—
54	<i>Lonchura punctulata</i> (Linnaeus, 1758)	Scaly-breasted Munia	O	R	—

	Order/Family/Scientific name	Common name	Food habit/ Guild	Residential status	Present status
	Passeridae				
55	<i>Passer domesticus</i> (Linnaeus, 1758)	House Sparrow	O	R	—
	Motacillidae				
56	<i>Anthus rufulus</i> (Vieillot, 1818)	Paddyfield Pipit	I	R	×
57	<i>Motacilla cinerea</i> (Tunstall, 1771)	Grey Wagtail	I	WM	—
58	<i>Motacilla citreola</i> (Pallas, 1776)	Citrine Wagtail	I	WM	×
59	<i>Motacilla alba</i> (Linnaeus, 1758)	White Wagtail	I	WM	—
60	<i>Motacilla maderaspatensis</i> (J.F. Gmelin, 1789)	White-browed Wagtail	I	R	—
61	<i>Motacilla flava</i> (Linnaeus, 1758)	Western Yellow Wagtail	I	WM	—
	Fringillidae				
62	<i>Erythrura erythrura</i> (Pallas, 1770)	Common Rosefinch	O	WM	×
	Paridae				
63	<i>Parus cinereus</i> (Vieillot, 1818)	Cinereous Tit	O	R	—
64	<i>Macholophus xanthogenys</i> (Vigors, 1831)	Black-lored Tit	O	R	×
	Sylviidae				
65	<i>Sylvia hortensis</i> (Gmelin, 1789)	Western Orphean Warbler	O	WM	×
66	<i>Curruca curruca</i> (Linnaeus, 1758)	Lesser Whitethroat	O	WM	×
	Alaudidae				
67	<i>Ammomanes phoenicura</i> (Franklin, 1831)	Rufous-tailed Lark	O	R	×
68	<i>Eremopterix griseus</i> (Scopoli, 1786)	Ashy-crowned Sparrow Lark	O	R	×
69	<i>Mirafra erythroptera</i> (Blyth, 1845)	Indian Bushlark	O	R	×
	Cisticolidae				
70	<i>Prinia socialis</i> (Sykes, 1832)	Ashy Prinia	I	R	—
71	<i>Prinia inornata</i> (Sykes, 1832)	Plain Prinia	O	R	—
72	<i>Orthotomus sutorius</i> (Pennant, 1769)	Common Tailorbird	O	R	—
	Hirundinidae				
73	<i>Cecropis daurica</i> (Laxmann, 1769)	Red-rumped Swallow	I	R	—
74	<i>Hirundo smithii</i> (Leach, 1818)	Wire-tailed Swallow	I	R	—
75	<i>Ptyonoprogne rupestris</i> (Scopoli, 1769)	Eurasian Crag Martin	I	WM	—
76	<i>Ptyonoprogne concolor</i> (Sykes, 1832)	Dusky Crag Martin	I	R	—
	Pycnonotidae				
77	<i>Pycnonotus jocosus</i> (Linnaeus, 1758)	Red-whiskered Bulbul	O	R	—
78	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	Red-vented Bulbul	O	R	—
79	<i>Pycnonotus luteolus</i> (Lesson, 1841)	White-browed Bulbul	O	R	×
	Sylviidae				
80	<i>Chrysomma sinense</i> (J.F. Gmelin, 1789)	Yellow-eyed Babbler	O	R	×
	Zosteropidae				
81	<i>Zosterops palpebrosus</i> (Temminck, 1824)	Oriental White-eye	O	R	—
	Leiothrichidae				
82	<i>Argya malcolmi</i> (Sykes, 1832)	Large Grey Babbler	O	R	—
	Sturnidae				
83	<i>Pastor roseus</i> (Linnaeus, 1758)	Rosy Starling	O	WM	×
84	<i>Sturnia pagodarum</i> (J.F. Gmelin, 1789)	Brahminy Starling	O	R	—
85	<i>Acridotheres tristis</i> (Linnaeus, 1766)	Common Myna	O	R	—

	Order/Family/Scientific name	Common name	Food habit/ Guild	Residential status	Present status
	Muscicapidae				
86	<i>Saxicoloides fulicatus</i> (Linnaeus, 1766)	Indian Robin	C	R	—
87	<i>Copsychus saularis</i> (Linnaeus, 1758)	Oriental Magpie Robin	I	R	—
88	<i>Cyornis tickelliae</i> (Blyth, 1843)	Tickell's Blue Flycatcher	I	R	—
89	<i>Phoenicurus ochrurus</i> (S.G. Gmelin, 1774)	Black Redstart	C	WM	×
90	<i>Monticola solitarius</i> (Linnaeus, 1758)	Blue Rock Thrush	I	WM	×

I—Insectivore | G—Granivore | F—Frugivore | C—Carnivore | O—Omnivore | R—Resident | WM—Winter migratory | SM—Summer migratory | —Recorded at the study site in 2018 | ×—Not recorded at the study site in 2018.

Note: Birds those feed exclusively on insects are classified into insectivore; birds those feed on insects, invertebrates and vertebrates are classified as carnivore.

Table 2. List of bird species newly recorded in the campus of Savitribai Phule Pune University and Khadki pond in 2018.

	Order/Family/Scientific name	Common name	Food habit/ Guild	Residential status	Present status
	Anseriformes: Anatidae				
1	<i>Anas poecilorhyncha</i> (J.R.Forster, 1781)	Indian Spot-billed Duck	H	R	—
	Galliformes: Phasianidae				
2	<i>Pavo cristatus</i> (Linnaeus, 1758)	Indian Peafowl	O	R	—
3	<i>Francolinus pondicerianus</i> (J.F. Gmelin, 1789)	Grey Francolin	O	R	—
	Pelecaniformes :Ardeidae				
4	<i>Ardea intermedia</i> (Wagler, 1829)	Intermediate Egret	C	R	—
5	<i>Egretta garzetta</i> (Linnaeus, 1766)	Little Egret	C	R	—
	Phalacrocoracidae				
6	<i>Microcarbo niger</i> (Vieillot, 1817)	Little Cormorant	P	R	—
	Charadriiformes: Scolopacidae				
7	<i>Tringa ochropus</i> (Linnaeus, 1758)	Green Sandpiper	C	WM	—
	Coraciiformes: Alcedinidae				
8	<i>Alcedo atthis</i> (Linnaeus, 1758)	Common Kingfisher	C	R	—
	Psittaciformes: Psittaculidae				
9	<i>Psittacula eupatria</i> (Linnaeus, 1766)	Alexandrine Parakeet	G, F	R	—
	Passeriformes: Rhipiduridae				
10	<i>Rhipidura aureola</i> (Lesson, 1831)	White-browed Fantail	I	R	—
	Monarchidae				
11	<i>Terpsiphone paradisi</i> (Linnaeus, 1758)	Indian Paradise-flycatcher	I	R	—
	Dicaeidae				
12	<i>Dicaeum erythrorhynchos</i> (Latham, 1790)	Pale-billed Flowerpecker	O	R	—
	Acrocephalidae				
13	<i>Acrocephalus dumetorum</i> (Blyth, 1849)	Blyth's Reed Warbler	O	WM	—
	Sturnidae				
14	<i>Acridotheres fuscus</i> (Wagler, 1827)	Jungle Myna	O	R	—
	Muscicapidae				
15	<i>Ficedula parva</i> (Bechstein, 1792)	Red-breasted Flycatcher	I	WM	—
16	<i>Saxicola caprata</i> (Linnaeus, 1766)	Pied Bushchat	I	R	—

I—Insectivore | G—Granivore | F—Frugivore | C—Carnivore | P—Piscivore | H—Herbivore | O—Omnivore | R—Resident | WM—Winter migratory.

Note: Birds that feed exclusively on insects are classified as insectivore; birds those feed on insects, invertebrates and vertebrates are classified as carnivore.



Image 3. Khadki Pond in December 2018.

gardens containing exotic grass and ornamental plant species. Major construction work took place over open spaces and grassy patches, and many old trees of *Ficus benghalensis* were cut down for constructing sports complexes. Concrete fencing and gardening along the roads have cleared native vegetation. These activities have contributed to a decrease in the richness of avifauna which depend on low scrub jungle, grasslands, and fallow lands.

World biodiversity is facing the threat of exotic plants due to increased trade and transport. Exotic plantations in natural habitats gradually displace birds typical to that habitat (Daniels et al. 1990) and support generalist bird species (Zurita et al. 2006). Significantly less arthropod mass is supported by exotic plants compared to a native plantation, and fewer birds prefer exotic plants (Herrera & Dudley 2003; Flanders et al. 2006; Hickman et al. 2006; Ortega et al. 2006). Natural vegetation in the campus is replaced by exotic plants; *Dalbergia melanoxylon* and *Gliricidia sepium* are dominant exotic plants in the campus. *Gliricidia sepium* is known herbicidal plant; it has nematicidal and insecticidal activity (Nazali et al. 2008). *Gliricidia sepium* could have reduced herb, shrub and grass cover, reduced invertebrate and vertebrate fauna depending on it, and ultimately it might have affected the bird species diversity. Khadki pond was a perennial pond (Goel 1976), now transformed into seasonal pond (Image 3) that has been overtaken by natural vegetation due to blockage of water channels. The pond is surrounded by a plantation of exotic plant species *Acacia mearnsii* (Australian acacia) and *Euclyptus globulus*, and because of these changes the

number of aquatic bird species has declined in Khadki pond. In addition to the above mentioned disturbances, there has also been a tremendous increase in human settlements in the area surrounding the campus, which might act as a barrier between campus and surrounding hilly regions. Pune is the eighth largest and fastest growing metropolis in India. From 1967 to 1998, area under human settlements in Pune city increased by 2.4 times, while area under agriculture and grassland-scrub decreased by 31% and 39% respectively (Nalavade 2000–2001). In 2000, 40% (60% in 1950) of total Pune urban area was under agriculture, 40% (15% in 1950) under human habitation, 6% (7% in 1950) under forest, 3% (0% in 1950) under plantations (Dixit et al. 2000–2001). We also noticed that richness of both resident and migratory birds declined and it is because of the unsuitability of the habitat. Urbanization was the main cause for encroachment of all the natural habitats in Pune urban area and thus bird diversity has declined in all habitat types (Ingalthalikar et al. 2000–2001).

It is, thus, concluded that increased anthropogenic activities in the university campus and surroundings has led to a decrease in bird diversity. Replacing exotic plantation with indigenous plants and restricting anthropogenic activities could prevent further biodiversity loss in the campus. Further studies are needed to check the impact of *Gliricidia sepium* the most planted exotic plant species on the plateaus in the Pune urban area through urban joint forest management programme, on the native biodiversity on a larger scale.

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