IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

VERTICAL DISTRIBUTION OF TERRESTRIAL BIRDS IN CERTAIN URBAN GREEN SPACES OF AJMER CITY, RAJASTHAN

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Abstract: Given the fact that resources are scarce for all species in any habitat, avian species have adapted to resource partitioning. Because they harbour numerous bird species that are well adapted to human activities, urban greenspaces like parks, gardens, and woodlots are essential. From July 2021 to July 2022, this study was carried out on the Mayo College campus in Ajmer, Rajasthan, India. 47% of all observed birds fell into the ground bird category, 12% into the shrub-dwelling bird category, 18% into the lower canopy category, and 23% into the higher canopy category, according to their mean vertical height. The three species with the highest RMHI Value were found to be Black Kite, Common Kestral, and Dusky craig martins. Only three species—the Grey Francolin, Paddyfield Pippet, and Western Yellow Wagtail—were found at Ground Startum and no other startum. In terms of the dietary guilds of the bird species in the research area, the proportion of frugivores and nectarivores is fairly low. This suggests that bird species with specialised colonies may not be able to fit in relatively small greenspaces because of their reliance on forest structure.

Index Terms **– Avifauna, Vertical Distribution, RMHI Value, Niche, Ajmer**

I. INTRODUCTION

Avian species have adapted to resource partitioning because resources in any habitat are limited for all species. This reduces interspecific competition (Koplin and Hoffman 1968). To occupy a different niche in a vertical stratum is one of these adaptations. Vegetation layering and profiles are directly correlated with bird variety and density (MacArthur and MacArthur 1961, Tramer 1969). The morphological adaptations (Dilger 1956), nest site selection (Turcek 1951), social patterns (Moynihan 1962), and widely accessible food resources, all play a role in the vertical spread of avian species (Slud 1960). As anthropogenic pressure on biodiversity rises, urban greenspaces like parks, gardens, and woodlots are crucial because they support a variety of bird species that are well adapted to anthropogenic activity (Adams 1994). This study's primary goal was to examine bird communities and their vertical distribution in urban green spaces of Ajmer, Rajasthan, India.

II. STUDY AREA

The study area comprises of scattered green patches in an urban landscape. The dominant trees are *Azadirachta indica, Ficus religiosa, Dalbergia sissoo, Delonix regia, Saraca asoca, Mangifera indica, Punica granatum, Phyllanthus emblica, Magnolia champaca, Psidium guajava,* and scrubs including *Prosopis juliflora* and *Bougainvillea glabra* with an average hight of highest canopies ranging upto 12 mt.

Figure 1: Map of Study area located in Ajmer city, Rajasthan, India.

III. RESEARCH METHODOLOGY

For the objective of sampling, the day's daylight hours were divided into the mornings (06:00 AM to 10:00 AM) and the evenings (04:00 PM to 7:00 PM). Birds were observed for one year. It was recorded the species, abundance, and vertical height of presence was recorded. The study was conducted from July 2021 to July 2022 on the Mayo College campus in Ajmer, Rajasthan, India, which is close to a lot of anthropogenic activity. 5500 observations of 57 different bird species with data on vertical height were collected using a 8x42 Rangefinder. Vertical strata categories were classified as follows:

Table 1: Classification of vertical strata

Vertical Strata	Height
Ground	0-1m
Shrub	1-3 m
Lower Canopy	3-8 m
Middle Canopy	8-12 m
Higher Canopy	12+ m

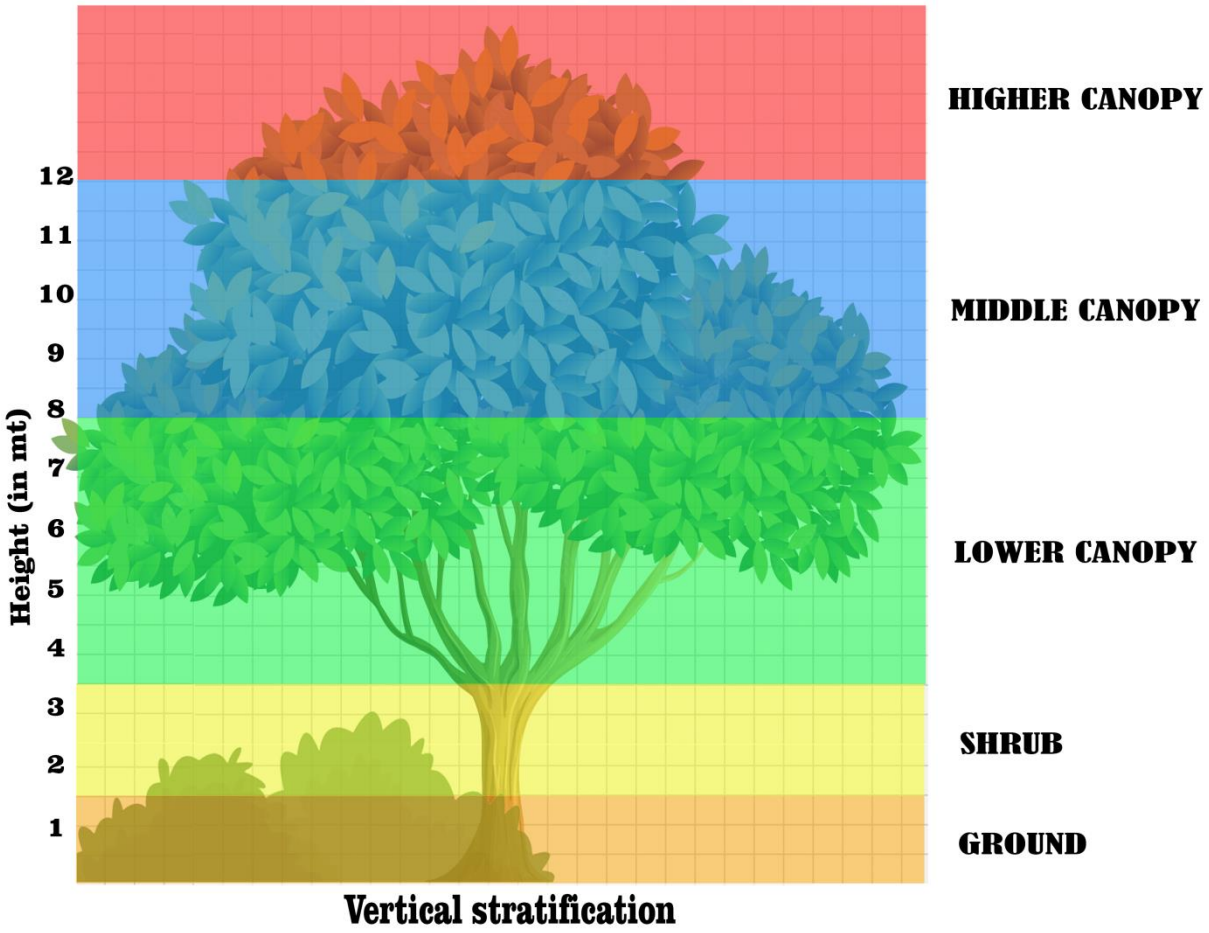

Figure 2: Classification of vertical stratification in study area.

Calculation of Relative Mean Height Index Value (RMHI Value):

The vertical classification of birds was categorized in 5 categories, Ground height was considered to be 0-1 m from ground, Shrub height 1-3 m from ground, Lower Canopy 3-8 m from ground, Middle Canopy 8-12 m from ground and Higher Canopy was considered to be 12+ m from ground. Relative Mean Height Index Value (RMHI Value) was calculated by multiplying number of sightings in each stratum by: 1 from stratum 1 (ground), 2 for stratum 2 (Shrub), 3 for stratum 3 (Lower Canopy), 4 for stratum 4 (Middle Canopy) and 5 for stratum 5 (Higher Canopy) and the sum of these products for each species was then divided by total sightings, giving relative mean height.

With reference to their RMHI Value, Species were categorized into four classes as in following table:

Table 2: Range of RMHI Value for different vertical guild.

Vertical Guild Category	Relative Mean Height Index Value (RMHI Value)
Ground Dwellers	1 to 1.9 m
Shrub Dwellers	2 to 2.9 m
Lower Canopy Dwellers	3 to 3.9 m
Higher Canopy Dwellers	4 to 5 m

The birds were documented according to their sighting at various vegetative heights, and observations were not limited to any specific behavioral category.

IV. RESULTS AND DISCUSSION

Table 3: Observation Table

S.No	Common Name	Ground	Shrub	Lower canopy	Middle canopy	Higher canopy	Total Individuals	Relative Mean Height index Value (RMHI Value)
		0-1m	1-3 m	3-8 m	8-12 m	12+ m		
1	Black-winged Kite	0	0	1	1	7	9	4.6
2	Shikra	2	1	0	13	7	23	3.9
3	Black Kite	0	0	0	0	11	11	5
4	Indian Grey Hornbill	0	0	1	1	27	29	4.8
5	Common Hoopoe	70	10	0	0	0	80	1.1
6	Rock Pigeon	230	170	30	22	50	502	1.9
7	Eurasian Collared Dove	140	72	28	14	19	273	1.9
8	Laughing Dove	70	50	11	7	23	161	2.1
9	Yellow-legged green pigeon	5	0	0	70	117	192	4.5
10	Green Bee eater	0	0	0	57	30	87	4.3
11	Indian Roller	0	0	0	43	20	63	4.3
12	White-throated kingfisher	0	0	13	17	3	33	3.6
13	Greater Coucal	27	11	0	0	3	41	1.5
14	Asian Koel	0	0	56	43	11	110	3.5
15	Common Kestral	0	0	0	0	11	11	5
16	Indian Peafowl	133	0	0	13	2	148	1.3
17	Grey francolin	54	0	0	0	0	54	1
18	Small Minivet	0	0	0	25	33	58	4.5
19	Indian Golden Oriole	0	0	0	11	7	18	4.3
20	Common Woodshrike	5	11	11	3	2	32	2.5
21	Blank Drongo	70	67	33	5	3	178	1.8

22	Long Tailed Shrike	11	27	5	0	1	44	1.9
23	Rufous Treepie	27	9	5	56	5	102	3
24	House Crow	150	30	11	20	26	237	1.9
25	Purple Sunbird	0	178	34	0	0	212	2.1
26	Baya Weaver	0	11	43	7	2	63	3
27	Indian Silverbill	43	94	0	0	0	137	1.6
28	House Sparrow	203	478	63	0	0	744	1.8
29	Paddyfield pipet	13	0	0	0	0	13	1
30	Western Yellow Wagtail	78	5	0	0	0	83	1
31	White wagtail	137	23	0	0	0	160	1.1
32	Grey-headed canary flycatcher	5	21	11	0	0	37	2.1
33	Ashy prinia	11	43	3	0	0	57	1.8
34	Plain prinia	3	35	0	0	0	38	1.9
35	Common tailorbird	48	76	9	0	0	133	1.7
36	Dusky crag martin	0	0	0	0	79	79	5
37	Red-vented bulbul	37	98	17	11	2	165	2
38	White-eared bulbul	1	3	0	0	0	4	1.7
39	Common Chiffchaff	0	0	5	5	11	21	4.2
40	Oriental White Eye	0	5	21	29	5	60	3.2
41	Large Grey Babbler	73	11	2	0	0	86	1.1
42	Asian Pied Starling	7	29	2	1	5	44	2.2
43	Brahminy Myna	22	21	1	1	1	46	1.6
44	Common Myna	83	34	11	9	5	142	1.7
45	Bank Myna	148	79	0	0	0	227	1.3
46	Indian Robin	34	29	0	0	0	63	1.4
47	Oriental Magpie Robin	11	32	5	0	0	48	1.8
48	Red-breasted Flycatcher	0	11	3	2	0	16	2.1
49	Black Redstart	9	3	1	0	0	13	1.3
50	Siberian Stonechat	5	17	0	0	0	22	1.7
51	Brown Rock Chat	43	28	0	0	0	71	1.3

52	Coppersmith barbet	0	0	1	5	17	23	4.9
53	Black-rumpedflame back	0	5	5	7	3	20	3.4
54	Plum Headed Parakeet	0	11	17	40	5	73	3.5
55	Alexandrine Parakeet	0	0	0	3	7	10	4.7
56	Rose Ringed Parakeet	5	11	28	34	9	87	3.3
57	Spotted Owlet	0	0	5	2	0	7	3.2
	TOTAL	2013	1849	492	577	569	5500	

From the study area, 5500 sightings of 57 different bird species were documented along vertical height data. A total of 13 species—the Blue rock dove, Eurasian Collard dove, Laughing dove, common wood shrike, Black drongo, Rufous treepie, House crow, Red vented bulbul, Asian pide starling, Brahmany starling, Common Myna, and Rose-ringed Parakeet—were observed on all categorized vertical heights. The only species found at Ground startum and no other startum were Grey francolin, Paddyfield pippet, and Western yellow wagtail (Figure 4). Black Kite, Common Kestral, and Dusky craig martins were shown to have the greatest RMHI Value. Thus according their mean vertical height, 47% of all observed birds were categorized as ground birds, 12% as shrub-dwelling birds, 18% as lower canopy birds, and 23% as higher canopy birds. (Table 3)

With RMHI values ranging from 3.9 to 5, the Family Accipitridae of the Order Accipitriformes were found to be higher canopy birds, as shown in Table 3. In the research region, two species of the order Bucerotiformes were found, and their RMHI values ranged from one another, with members of the Family Upupidae being found at an RMHI Value of 1.1 and those of the Family Bucerotidae being found at an RMHI Value 4.8. With the exception of the Yellow-Footed Green Pegion at RMHI Value 4.5, all Columbiformes species were found to have RMHI values of 2 or below. With the exception of the order Alcedinidae, which had an RMHI Value of 3.6 and indicated that the species was a low canopy guild bird, the families Meropidae and Coracidae of the order Coraciiformes were all seen in the study area, two species of the Cuculidae Family of the Cuculiformes Order were found, each with a different vertical guild. The Greater Coucal had an RMHI Value of 1.5, making it mostly a ground dweller, while the Asian Koel had an RMHI Value of 3.5, making it a lower canopy dweller. The Family Falconidae and Order Falconiformes' Common Kestral was identified as a High Canopy Dwelling Species with an RMHI Value of 5. With RMHI values ranging from 1 to 1.3, two species of the order Galliformes were found to be predominately ground dwellers. The vertical distribution of species of the Order Passeriformes ranged from ground dwellers to high canopy dwellers (RMHI Value from 1 to 5). With RMHI values ranging from 3.3 to 4.9, species of the orders Piciformes and Psittaciformes were seen to occupy Lower and Higher Canopy guilds. With an RMHI value of 3.2, only species belonging to the order Strigiformes were found to be lower canopy dwellers (Figure 3).

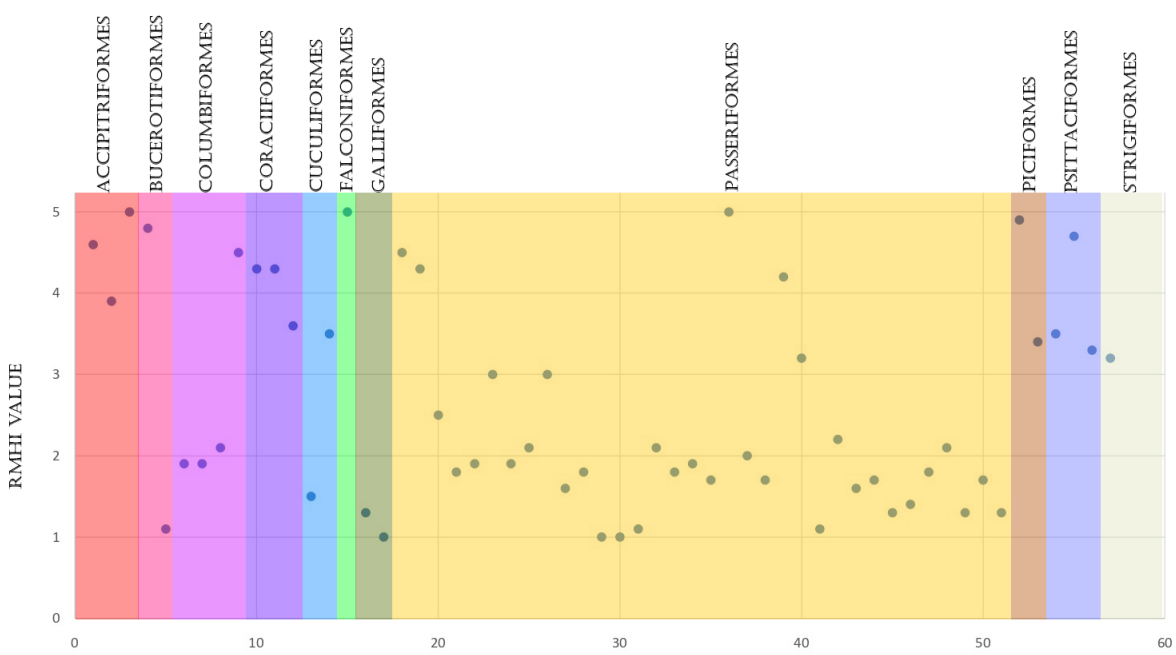

Figure 3: Family wise grouping and RMHI Value of Observed Species.

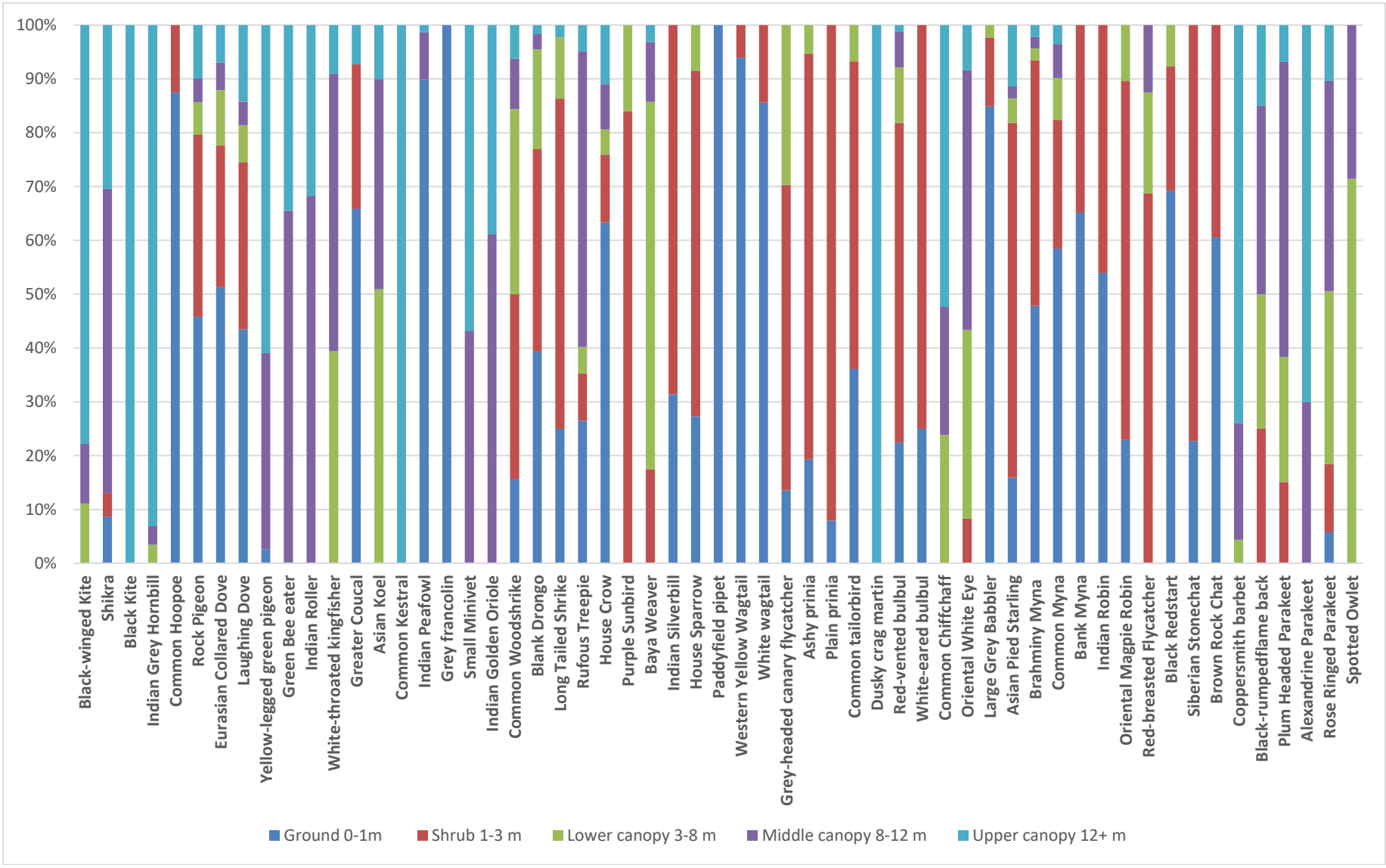

Figure 4: Occurrence of individuals in different vertical strata.

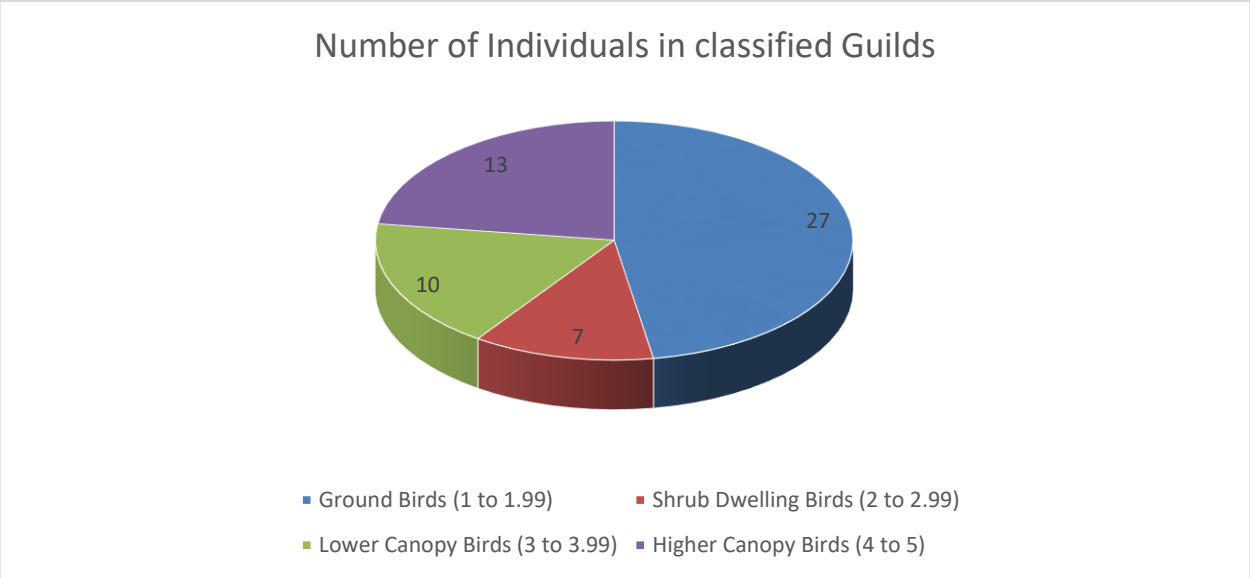

Figure 5: Number of Individuals in classified vertical stratification guilds.

V. CONCLUSION

Data of 5500 sightings of 57 species was used to investigate height segregations and resource consumption, vertical height data is analysed. A wider variety of food sources and a more varied habitat for shelter and nesting needs are provided by a more diverse vegetation structure, which leads to a higher diversity of birds. The relevance of structural biodiversity like presence of vegetative layers, such as trees, shrubs, and herbs spread over space and time), plays a crucial role in maintaining the bird diversity despite the growing pressure from anthropogenic activities. According to the current study, the proportion of frugivores and nectarivores is rather low in the study area when it comes to the bird species' eating guilds. Due to the reduced area of the greenspaces and the great abundance of omnivorous birds, these species may benefit from increased edge and proximity to the human population. These birds can consume fruits, insects, as well as anthropogenic food (waste from homes). When talking about urban greenspaces, size is a crucial factor. In accordance with the shrinking extent of the greenspaces, our study found a decreased abundance of uncommon and forest-preferring species. This implies that colonies of bird species that are specialised on forest structures might not be able to fit in very limited greenspaces. As per their feeding guilds, Due to the fact that most fruiting takes place in the primary canopy, which the obligatory frugivores rarely depart, seasonal variations in fruiting would often not result in alterations in vertical distribution. Changes in the microclimate may also have an impact on the insects that some birds eat. According to research by Chauvin (1967) and Wigglesworth (1965), insects have temperature tolerances below which they cannot move and above which they must stop moving in order to prevent moisture loss. These findings are supported by the relationship between temperature and the activity of insectivorous birds. Because their food is limited to one level, the primary canopy, obligatory frugivores exhibit no change in vertical distribution.

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