

THE DIVERSITY OF RESIDENT BIRDS IN THE CAMPUS OF THE UNIVERSITY OF PERADENIYA, SRI LANKA

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Abstract

*The Peradeniya University Campus (80° 36' E, 7° 15' N) represents one of the areas rich in bird life, both in number and species. Of the 233 species of resident birds known from Sri Lanka, 83 have been recorded from the University. In the present study conducted from April to October 1999, it was found that at least 67 species were present. Weekly roadside counts of birds along a fixed route transect passing through the main habitat types in the campus (e.g. woodland, grassland, home garden, and pine forest) indicate that the commonest birds in the campus were the Common Mynah (*Acridotheres tristis*), Black Crow (*Corvus macrorhynchos*), Common Babbler (*Turdoides affinis*), White-rumped Swift (*Apus affinis*), and the Spotted Dove (*Streptopelia chinensis*). The species richness and species evenness indices (Shannon Index and Shannon Evenness Index) indicate that the woodlands have the highest number of avian species (54 species, with a Shannon Index of 3.24), while grasslands though slightly low in avian species richness (52), were more diverse (with a Shannon Index of 3.26). The dominance indices (Berger-Parker Index and its reciprocal form) showed that grasslands have the lowest dominance (0.11) and hence the highest evenness (8.86) (and so more diverse). According to the similarity indices (Sorenson Quantitative), the woodland and grassland habitats were the most similar (0.99) in terms of avian species richness.*

keywords: diversity; indices; habitat; species

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1 Introduction

1.1 The Study Area

The campus of the University of Peradeniya (80° 36 ' E, 7° 15 ' N) is situated in the wet zone of Sri Lanka, at an altitude of about 480 m above sea level. It is also the largest university campus in Sri Lanka, with a land area of 686.24 ha. Thus the campus of the University of Peradeniya has comparatively large areas of diverse vegetation types such as grassland, woodland, and pine forest (plantation). Although all of these vegetation types have been influenced by man to a large extent, they nevertheless seem to support an astonishing diversity of bird species. Of the total number of 233 *resident* bird species of Sri Lanka, 83 species have been recorded from the University according to personal observations and available literature (*Ceylon Bird Club Notes*). Therefore approximately 36% of the resident bird species of Sri Lanka has been recorded in the University to date.

1.2 Habitat types

There are four main habitat types within the university and the characteristics of each habitat type are as follows:

1. **Grassland** - is dominated by the grasses of the genera *Panicum* and *Cymbopogon*. There are some bushes (e.g. *Lantana*), small trees (e.g. *Elaeocarpus serratus*) and tall trees (e.g. *Samanea saman* and *Artocarpus heterophyllus*) scattered among the grasses.
2. **Woodland** - consists of mixed species vegetation (e.g. *Vitex altissima*, *Mangifera indica*, *Samanea saman*, *Pterocarpus indicus*, *Spathodea campanulata*) other than *Pinus*. In some places the trees are growing close to each other, thus forming a thick canopy while in others the trees are somewhat apart so that the canopy is discontinuous. All woodlands within the campus are secondary woodlands.
3. **Home Garden** - is heavily influenced by man and is situated adjacent to buildings and houses. There are various types of plants cultivated by man, such as *Muntingia calabura*, *Elaeocarpus serratus*, *Syzygium malaccense*, and *Cassia fistula*, as well as grasses which are often cut short.
4. **Pine Forest** - consists almost exclusively of pine trees (an introduced species). The pine trees (*Pinus caribaea*) are the dominant species, but there are other small trees and bushes scattered in some places. Also, there are grasses (*Panicum* or *Cymbopogon*) on the edge of these forests in many places. Such places are habitats for birds otherwise found mostly in grassland habitat.

1.3 Objectives

In this study, an attempt was made to assess the abundance of each resident bird species of the university in the diversity of its habitats as well as in the university as a whole, to identify the habitat types richest in avifauna, to obtain the diversity indices for each type of habitat, and to compare the extent of similarity between two habitat types, in terms of avian species diversity.

2 Materials and Methods

2.1 Field Work

A pair of 7 × 35 binoculars was used to identify the birds. The data were based on roadside counts done on a fixed route transect [1] of about 6 km (Figure 1), passing through the main habitat types (grassland, woodland, garden, and pine forest) of Peradeniya University.

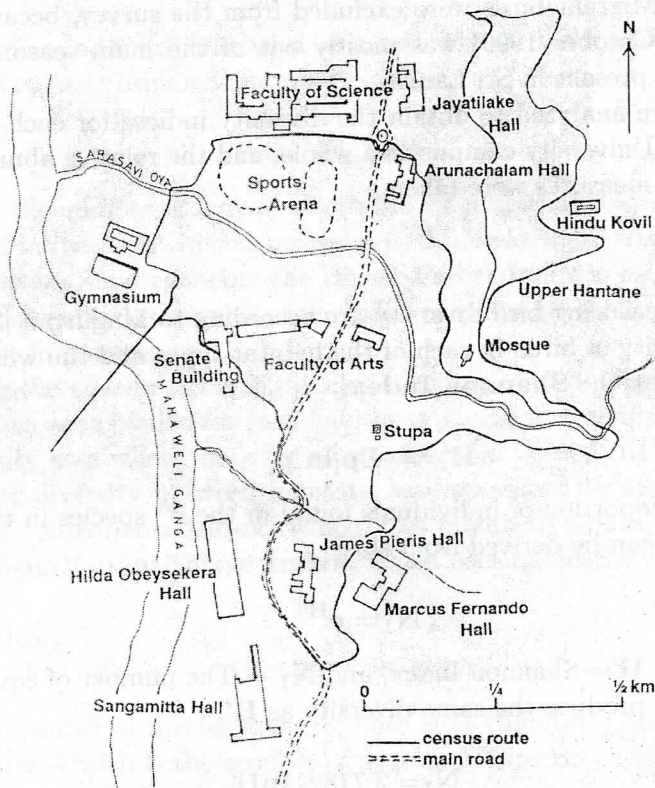


Figure 1: Map of the Peradeniya University Campus showing the bird census route

The route excluded the land of the Upper Hantana Hills, but included the land of the Lower Hantana region that belongs to the University. The route was carefully selected so that each habitat type would receive an approximately equal amount of sampling effort.

On this fixed route, birds were counted by a uniform procedure of walking on an even pace in a single direction over a period of about two and a half hours between 06 30 and 09 00 hours of the day, once a week, from the beginning of April 1999 to the end of October 1999 - a time when the migrant birds were mostly absent. A day's sampling involved recording of numbers of individuals of all *resident* species of birds sighted and/or heard within about 15 m on either side, and those flying within about 15 m height above the ground. This height was fixed considering the average height of the canopy in all the habitat types studied.

Birds were recorded as those sighted or heard on the route. A total of 24 *days* were spent in which approximately 60 *hours* of observation were made. They involved the sighting and hearing of a total of 4,794 birds belonging to 67 species. Aquatic birds and nocturnal birds were not sampled unless they occurred by chance in the sampling hours. Migrant birds were excluded from the survey, because the survey period (April to October 1999) was mostly out of the main season in which the migrant birds are present in Sri Lanka.

The raw data were analyzed to obtain the diversity indices for each of the habitat types and for the University campus as a whole, and the relative abundance of each species and other measures were taken.

2.2 Calculations

The indices for measuring bird diversity are according to Magurran [2].

The species diversity of birds in each of the habitat types and the whole University was estimated using the **Shannon Index**,

$$H' = -\sum p_i \ln p_i ,$$

where, p_i is the proportion of individuals found in the i^{th} species in the sample. Another equation can be derived from this:

$$N_1 = e^{H'}$$

where, $e = 2.7182$, H' = Shannon Index, and N_1 = The number of equally common species that would produce the same diversity as H' .

$$\therefore N_1 = 2.7182 \ln H'$$

This means, after finding *equally common* N_1 number of species, a new species can be encountered.

The **Maximum Shannon Diversity** (in a situation where all species were equally abundant) for each habitat type and for the whole University was estimated using the equation

$$H_{\max} = \ln S ,$$

where **S** is the number of species in the respective habitat.

From these data (the Shannon Index [H'] and Maximum Shannon Diversity [H_{\max}]) the **Shannon Evenness (E)** was obtained using the equation

$$E = H' / H_{\max} = H' / \ln S ,$$

because the ratio of observed diversity (H') to maximum diversity (H_{\max}) can be taken as a measure of evenness (E) [2] [3].

The Berger-Parker Index (d) was used as a measure of dominance in each habitat type. It was calculated using the formula

$$d = N_{\max} / N ,$$

where N_{\max} is the number of individuals in the most abundant species and N is the total number of individuals. In this measure, as d increases, diversity decreases (and dominance increases) and therefore the Berger-Parker Index is usually expressed as $1/d$ so that an increase in the value of the index accompanies an increase in diversity and a reduction in dominance.

For calculating the species richness, species evenness, and dominance indices, data for all the species were pooled for each habitat type and for calculating these indices for the university as a whole, data for all species were pooled (as a total count).

β **diversity**, or diversity between habitats, was measured by using the similarity coefficients, i.e. **Sorenson Index**, which uses qualitative data, and its modified version, **Sorenson Quantitative Index**, which uses quantitative data:

Sorenson Index

$$C_s = 2j / (a + b)$$

where j = the number of species found in both sites (habitats) and a = the number of species in Site A with b the number of species in Site B.

Sorenson Quantitative

$$C_N = 2jN / (aN + bN)$$

where aN = the total number of individuals in Site A, bN = the total number of individuals in Site B, and jN = the sum of the lower of the two abundances recorded for species found in both sites. (Thus if 12 individuals of a species were found in Site A and 29 individuals of the same species in Site B the value 12 would be included in the summation to give jN .)

Both these indices are designed to equal 1 in cases of complete similarity (that is where the two sets of species are identical) and 0 if the sites are dissimilar and have no species in common.

3 Results

The present survey revealed the presence of 67 resident bird species (or 29% of the total number of resident bird species of Sri Lanka), excluding the nocturnal species. (See Table 1.)

Table 1: Total number of individuals of each species of resident bird recorded during the survey in different types of habitat and the total in each habitat. [Starting from the most abundant bird.] (Gr=Grassland, Wd=Woodland, Ga=Garden, Pf=Pine Forest, # Ob.=number of individuals observed)

Species	Gr	Wd	Ga	Pf	Total
	#Ob.	#Ob.	#Ob.	#Ob.	
Common Mynah <i>Acridotheres tristis</i>	83	99	356	15	553
Black Crow <i>Corvus macrorhynchos</i>	127	159	170	35	491
Common Babbler <i>Turdoides affinis</i>	71	74	205	83	433
White-rumped Swift <i>Apus affinis</i>	147	85	177	0	409
Spotted Dove <i>Streptopelia chinensis</i>	97	72	85	62	316
Rose-ringed Parakeet <i>Psittacula krameri</i>	97	99	43	32	271
Brown-headed Barbet <i>Megalaima zeylanica</i>	25	78	57	14	174
Small Flowerpecker <i>Dicaeum erythrorhynchos</i>	22	65	45	13	145
Spotted Munia <i>Lonchura punctulata</i>	96	12	5	30	143
Franklin's Prinia <i>Prinia hodgsonii</i>	57	39	7	26	129
Ceylon Small Barbet <i>Megalaima rubricapilla</i>	26	48	35	11	120
Black-headed Oriole <i>Oriolus zanthornus</i>	22	36	54	7	119
Common Drongo <i>Dicrurus caeruleus</i>	43	31	24	16	114
Yellow-fronted Barbet <i>Megalaima flavifrons</i>	5	77	15	7	104
Tailorbird <i>Orthotomus sutorius</i>	17	35	45	5	102
Red-vented Bulbul <i>Pycnonotus cafer</i>	48	15	26	10	99
White-throated Babbler <i>Dumetia hyperythra</i>	26	10	13	28	77
Common Koel <i>Eudynamis scolopacea</i>	24	26	11	1	62
Tickell's Blue Flycatcher <i>Niltava tickelliae</i>	1	57	3	0	61
Inian Hill Mynah <i>Gracula religiosa</i>	11	27	10	10	58
Magpie Robin <i>Copsychus saularis</i>	14	8	30	3	55
Red-rumped Swallow <i>Hirundo daurica</i>	13	1	40	0	54
White-backed Munia <i>Lonchura striata</i>	29	5	3	15	52
Stork-billed Kingfisher <i>Halcyon capensis</i>	12	6	31	0	49
Red-wattled Lapwing <i>Vanellus indicus</i>	0	0	44	0	44
Alexandrine Parakeet <i>Psittacula eupatria</i>	26	15	1	1	43
Sri Lanka Lorikeet <i>Loriculus beryllinus</i>	14	7	9	10	40

Brown-capped Babbler <i>Pellorneum fuscicapillum</i>	3	32	1	1	37
Small Minivet <i>Pericrocotus cinnamoneus</i>	5	8	15	3	31
Feral Pigeon <i>Columba livia</i>	0	0	30	0	30
Yellow-naped Woodpecker <i>Picus chlorolophus</i>	14	7	2	4	27
Scarlet Minivet <i>Pericrocotus flammeus</i>	12	4	10	0	26
Loten's Sunbird <i>Nectarinia lotenia</i>	13	6	3	4	26
Edible-nest Swiftlet <i>Aerodramus unicolor</i>	11	5	6	3	25
Small White-Eye <i>Zosterops palpebrosa</i>	16	8	0	0	24
Cattle Egret <i>Bubulcus ibis</i>	0	0	19	0	19
Common Coucal <i>Centropus sinensis</i>	4	4	11	0	19
Indian Pipit <i>Anthus rufulus</i>	0	0	18	0	18
Yellow-browed Bulbul <i>Hypsipetes indicus</i>	1	14	0	2	17
Pond Heron <i>Ardeola grayii</i>	13	1	1	0	15
Indian Rollor <i>Coracias benghalensis</i>	0	0	14	0	14
Iora <i>Aegithina tiphia</i>	6	6	0	0	12
Grey Tit <i>Parus major</i>	3	2	7	0	12
Purple-rumped Sunbird <i>Nectarinia zeylonica</i>	7	1	1	2	11
Grey-necked Crow <i>Corvus splendens</i>	10	1	0	0	11
Ashy Prinia <i>Prinia socialis</i>	8	0	2	0	10
Asian Palm Swift <i>Cypsiurus balasiensis</i>	1	0	8	0	9
Crimson-breasted Barbet <i>Megalaima haemacephala</i>	6	0	3	0	9
Yellow-eyed Babbler <i>Chrysomma sinense</i>	5	0	1	2	8
White-breasted Kingfisher <i>Halcyon smyrnensis</i>	0	4	3	0	7
Scimitar Babbler <i>Pomatorhinus horsfieldii</i>	0	7	0	0	7
Shikra <i>Accipiter badius</i>	1	3	1	1	6
Large Cuckoo-Shrike <i>Coracina macei</i>	0	1	5	0	6
Crested Serpent Eagle <i>Spilornis cheela</i>	0	4	0	1	5
Crested Hawk-Eagle <i>Spizaetus cirrhatus</i>	0	4	0	1	5
White-browed Fantail <i>Rhipidura aureola</i>	2	1	2	0	5
Emerald Dove <i>Chalcophaps indica</i>	0	3	0	1	4
Little Cormorant <i>Phalacrocorax niger</i>	0	3	0	0	3
Blossom-headed Parakeet <i>Psittacula cyanocephala</i>	1	1	0	1	3
Red-backed Woodpecker <i>Dinopium benghalense</i>	1	0	0	2	3
Jerdon's Leafbird <i>Chloropsis cochinchinensis</i>	3	0	0	0	3
Little Egret <i>Egretta garzetta</i>	0	2	0	0	2
White-breasted Waterhen <i>Amaurornis phoenicurus</i>	2	0	0	0	2
Pompadour Green Pigeon <i>Trepon pompadora</i>	1	1	0	0	2
Black Bulbul <i>Hypsipetes leucocephalus</i>	0	2	0	0	2
Common Hawk-Cuckoo <i>Cuculus varius</i>	1	0	0	0	1
Common Kingfisher <i>Alcedo atthis</i>	0	1	0	0	1
Total number of individuals observed:	1303	1322	1707	462	4794

The woodland habitat had the highest number of resident bird species (54 species) whereas the pine forest (plantation) habitat had the lowest (36 species). The grassland habitat closely followed the woodland habitat with 52 species. (See Table 2.) The study reveals that the most common species of resident birds in Peradeniya University were in decreasing order of commonness, the Common Mynah (*Acridotheres tristis*), Black or Jungle Crow (*Corvus macrorhynchos*), Common Babbler or 'Seven Sisters' (*Turdoides affinis*), White-rumped or House Swift (*Apus affinis*), and Spotted Dove (*Streptopelia chinensis*). (See Table 1.) According to the quantitative measures (Sorenson Quantitative), the woodland and the grassland habitats were the most similar in terms of avian species diversity. According to the qualitative

measures (Sorenson Qualitative), the woodland, grassland, and the garden habitat types rank together. (See Table 3.)

Table 2: Diversity Indices

1. Species Richness Indices					
Index	Whole University	Grassland	Woodland	Garden	Pine Forest
Species Richness(S)	67	52	54	49	36
Shannon Index(H')	3.34	3.26	3.24	2.94	2.91
$N=e^{H'}$	3.28	3.21	3.19	2.94	2.90
Maximum Shannon Diversity (lnS)	4.21	3.95	3.99	3.89	3.58
2. Species Evenness Indices					
Index	Whole University	Grassland	Woodland	Garden	Pine Forest
Shannon Evenness (H'/H'_{max})	0.79	0.83	0.81	0.76	0.81
3. Dominance Indices					
Index	Whole University	Grassland	Woodland	Garden	Pine Forest
Berger-Parker Index(d)	0.14	0.11	0.12	0.21	0.18
1/d(reciprocal form of Berger-Parker Index)	6.99	8.86	8.31	4.80	5.57

Table 3: Similarity Indices

Index	Sorenson Qualitative	Sorenson Quantitative
Woodland-Grassland	0.83	0.99
Woodland-Garden	0.78	0.87
Woodland-Pine Forest	0.76	0.53
Grassland-Garden	0.83	0.87
Grassland-Pine Forest	0.75	0.53
Garden-Pine Forest	0.71	0.44

4 Discussion

4.1 Bird Species Diversity

Although the species richness was lower in the grassland habitat ($S=52$) than in the woodland habitat ($S=54$), the evenness (measured by Shannon Evenness) was greater (0.83 in grassland and 0.81 in woodland) and hence the bird fauna was more diverse. (High evenness is conventionally equated with high diversity [2].) The lower species diversity in woodland habitat was also indicated clearly by the Shannon Index, whose value is 3.24 whereas the value for the grassland habitat was 3.26. Although woodland habitat had the highest species richness among the four types of habitat, the evenness is slightly lower than that of grassland due to the abundance of

the Black Crow. Though this is the case, the Maximum Shannon Diversity was highest in the woodland, with an index value of 3.99. This may be because the grassland habitat is frequently disturbed by man-made fires in dry weather conditions. There was also frequent cattle grazing. As Daniels *et al.* [4] report, "frequent disturbances can prevent bird communities from establishing in any vegetation type." Daniels *et al.* [4] further state that " 'establishing' need not necessarily mean 'to breed'. A species finding sufficient food in any habitat eventually becomes dependent on it." The high species richness in woodland habitat may be due to the fact that the woodland is more heterogeneous spatially with a lot of second growth and openings. This was reported previously by Daniels *et al.* [4] in their study of birds of man-made ecosystems in the Uttara Kannada district in India. Such habitats are known to be more productive.

Pine forest habitat had the lowest species diversity with a Shannon Index of 2.91. This may be because these forests have only one species of tree, i.e. *Pinus caribaea*, and furthermore they do not support any thick undergrowth. It seems that the only plant they support in the undergrowth is a species of grass belonging to either the genus *Panicum* or *Cymbopogon*. In some places however, there were other species of small trees or bushes scattered very sparingly among the *Pinus* trees. It may also be true that a plantation of exotics such as *Pinus* may never be able to support a bird community with a level of species diversity equal to the natural forests in its neighborhood [4].

According to the Berger-Parker Index, the grassland habitat had the lowest dominance and hence the highest evenness. The highest dominance occurs in the garden habitat, due to the high proportion of the Common Mynah. Although species richness was lowest in the pine forest habitat ($S=36$), the evenness in it was higher than that of garden which has a much higher species richness ($S=49$). This was due to the high dominance in garden habitat due to the higher proportion of Common Mynah, as mentioned before.

4.2 Similarity in bird species composition between the four types of habitat

According to the quantitative measures (Sorenson Quantitative), the woodland and the grassland habitats were the most similar in terms of avian species diversity. These two types are also the habitats that share the highest number of resident bird species. They share many species such as Black Crow, Rose-ringed Parakeet, Common Mynah, Common Babbler, and Spotted Dove. They share the birds such as Koel, Indian Hill Mynah, and the parakeets, that eat fruits, seeds, berries, etc., and those that feed largely on insects such as Red-backed Woodpecker and Franklin's Prinia.

According to the qualitative measures (Sorenson Qualitative), the woodland, grassland, and the garden habitat types rank together. They share the species that are

characteristic of habitats of high human interference, such as Black Crow, Common Babbler, and Common Mynah.

4.3 Habitat preferences of resident birds

Although the grassland habitat may seem at first sight to be an unproductive and less diverse habitat, this study revealed that it is highly productive in terms of avian species richness, with a total number of 52 resident bird species recorded, second only to the woodland habitat. Moreover, the species evenness was higher in grassland habitat than in woodland habitat, making grasslands more diverse [2].

The most notable birds of the grassland habitat were the Spotted Munia, White-backed Munia, Franklin's Prinia, White-rumped Swift, Spotted Dove, Common Drongo, and the Red-vented Bulbul. However, it should be mentioned that many of the birds associated with the grassland habitat mostly inhabit the trees and bushes in the grassland, not necessarily grasses! It is interesting to note that many of the rarest birds in the University are found either in the grasslands or woodlands. The grasslands in many areas are subject to man-induced fires during the dry season (January to March) and certain other times of the year when dry weather prevails. Undoubtedly this considerably affects the rich bird life of the grassland habitat. Two species that prefer the grassland habitat require special mention: they are the White-throated Babbler and the Yellow-eyed Babbler, both of which are nationally rare species according to Kotagama and Fernando [5] and Grimmett *et al.* [6]. According to the results, the White-throated Babbler was represented in the pine forest as equally as in the grassland, but it should be mentioned that all of these individuals were encountered in the grasses that border the pine forests in many areas, and such was also the case with the White-backed Munia, which was also fairly well represented in the pine forest habitat, although not as equally as in the grassland.

The Common Mynah, Feral Pigeon, Indian Pipit, Red-wattled Lapwing, Cattle Egret, Indian Roller, and the Red-rumped Swallow were mostly associated with the garden habitat.

Although the Common Mynah has its greatest abundance in the garden habitat, it is also well represented in the grassland and woodland habitats, though to a much lesser extent. The preference of Common Mynah to fields and gardens has been reported previously [7]. The Common Mynah is the commonest bird in the University and it is also the most common bird in the home gardens and other areas associated with human habitations (e.g. buildings).

The Black Crow was the second most common bird in the University and, though it is one of the commonest birds in villages and the outskirts of towns, it is not so well represented in the garden habitat as the Common Mynah. As is apparent from the results, and as Henry [7] reports, the Black Crow is much less dependent

on man for its subsistence than the Grey-necked Crow, for it is almost equally well represented in the grassland and woodland habitats. Even though this is the case, the Grey-necked Crow, also called the House Crow, though very common in Kandy and frequently seen in Peradeniya town, has not yet invaded the habitats of the University to a considerable extent. It was recorded several times during the survey period. One reason behind the fact that it has not yet invaded many places in the University to any extent may be the competition from the Black Crow.

There were several pairs of Red-wattled Lapwings in the University, and some of these were seen with chicks. They frequent the open, flat areas in the garden habitat. As is evident from works by Henry [7], Ripley [8], Kotagama and Fernando [5], Grimmett *at al.* [6], and Harrison and Worfolk [9], the Red-wattled Lapwing, which, in Henry's time, was a common resident in the low country dry zone and only a casual straggler in the hills, has gradually increased its range to the hills and now, according to Harrison and Worfolk [9], is a resident in the lower hills. According to personal observations, it is now a breeding resident in the University.

The Cattle Egret may be found scattered in places where cattle are grazing. However, it is not always found at such places, and it seemed to be a visitor¹ to such places from adjacent areas. It is seldom seen away from cattle. Likewise, the Little Egret also seemed to be a visitor from adjacent areas, for it was not frequently seen in the University. It may be observed in the Sarasavi Oya, a small montane stream that flows through the University. The Little Cormorant too is a bird observed in the small streams and the Mahaweli Ganga. The Stork-billed Kingfisher is normally found in wooded banks of streams and rivers, and is not so common as the White-breasted Kingfisher, which largely found in the garden habitat. While other kingfishers were usually found in association with water bodies, the White-breasted Kingfisher was mostly seen in the gardens [6] [7] [9] [10]. It is not much given to fishing like other kingfishers. Its main food consists of invertebrates and small vertebrates found on the ground [11] [12] [13].

The Indian Roller, although a bird of the low country dry zone in G. M. Henry's time, now seems to occur occasionally in the lower hills and wet zone [9]. Several birds can be seen regularly in the University in garden habitats where both trees and open areas occur together.

The Indian Pipit is a bird that lives mostly on the ground, in garden habitat with short grass. The Red-rumped Swallow, the Edible-nest Swiftlet, and the White-rumped Swift are common in areas with open airspace. The grassland and garden habitats were the habitat types they prefer most.

The Feral Pigeon was never seen far from human habitations but the Spotted Dove, which is the fifth commonest bird in the University, was well represented in all four

¹The term 'visitor' should not be confused with Winter Visitor. It is applied here to the resident birds that seem to have their roosting places outside the University and come to the University during the day to feed.

types of habitat. Other birds which are well represented in all these habitats are the Common Babbler, Common Drongo, Small Barbet, Indian Hill Mynah, Sri Lanka Lorikeet, Red-backed Woodpecker, Purple-rumped Sunbird, and Shikra.

Birds that prefer the woodland habitat over the others are the Small Barbet, Yellow-fronted Barbet, Tickell's Blue Flycatcher, Indian Hill Mynah, Brown-capped Babbler, Scimitar Babbler, Yellow-browed Bulbul, Stork-billed Kingfisher, Shikra, Crested Serpent Eagle, Crested Hawk-Eagle, and Emerald Dove.

Of the four species of barbets, the Yellow-fronted Barbet preferred the woodland habitat to a great extent, but it was not limited to that, for it is also found in well-wooded gardens. This has been reported previously [6] [7] [9] [14]. On the other hand, the Brown-headed Barbet is not so fond of heavy forest as the Yellow-fronted species [7], for it is equally found in the gardens. The Small Barbet also preferred the woodland, but it is not rare in gardens or grasslands with tall trees. As barbets are mainly fruit eating birds, their preference to the woodland habitat is not strange. But, interestingly enough, the Crimson-breasted Barbet was not recorded in the woodland habitat in the present survey. It is clearly less common than the Small Barbet. It may be because it is mostly a dry zone species and because of the competition from the Small Barbet, which is the well established wet zone species of the same size.

The present survey revealed that no bird prefers the pine forest habitat to such an extent as the Common Babbler. It is the commonest bird in the pine forest, but on the whole, it preferred the garden habitat to other types of habitat. The fact that the Common Babbler was the commonest bird in the pine forest needs further investigation. One reason may be that the Common Babbler finds it easy to adapt to the habitats altered by humans as it is normally associated with human habitations. Another reason may be that the forest floor of many pine plantations is bare thus making it easier for the babblers to find food.

4.4 Conclusion

It can be stated from this study that the most common species of resident birds in Peradeniya University are the Common Mynah, Black or Jungle Crow, Common Babbler or 'Seven Sisters', White-rumped or House Swift, and Spotted Dove. The woodland habitat had the highest number of resident bird species (54 species) whereas the pine forest (plantation) habitat had the lowest (36 species). According to the similarity measures, the woodland and the grassland habitats were similar. Furthermore, it can be concluded from this study that the natural forests, or the forests with indigenous plant species, are the habitats with highest species richness, whereas plantations with exotic plants, such as *Pinus*, are very poor in species diversity in comparison with natural vegetation. Also it is evident that many species are unable to adapt to the plantations with exotic plants (this is well reflected in the

comparatively low species richness in pine forest habitat), so that their only refuges would be the natural forests. Therefore it is obvious that, to conserve the birds as well as other fauna, the preservation of natural vegetation is very important.

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References

- [1] W.J. Sutherland, (1996), *Ecological Census Techniques*. Cambridge University Press, Cambridge.
- [2] A.E. Magurran, (1988), *Ecological Diversity and Its Measurement*. Croom Helm, London and Sydney.
- [3] ² E.C. Pielou, (1969), *An Introduction to Mathematical Ecology*. Wiley, New York.
- [4] R.J.R. Daniels, M. Hedge and M. Gadgil, (1990), Birds of the man-made ecosystems: the plantations. *Proc. Indian Acad. Sci. (Anim. Sci.)* **99-1** 79-89.
- [5] S. Kotagama and P. Fernando, (1994), *A Field Guide to the Birds of Sri Lanka*. The Wildlife Heritage Trust of Sri Lanka, Colombo.
- [6] R. Grimmett, C. Inskipp, and T. Inskipp, (1998), *Birds of the Indian Subcontinent*. Oxford University Press, Delhi.
- [7] G.M. Henry, (1971), *A Guide to the Birds of Ceylon* (2nd Edn.), Oxford University Press, London.
- [8] S.D. Ripley, (1982), *A Synopsis of the Birds of India and Pakistan* (2nd Edn.), Bombay Natural History Society/Oxford University Press, Bombay.
- [9] J. Harrison and T. Worfolk, (1999), *A Field Guide to the Birds of Sri Lanka*. Oxford University Press, Oxford.
- [10] B.F. King, E.C. Dickinson, and M.W. Woodcock, (1975), *A Field Guide to the Birds of South-East Asia*. Collins, London.

²Original not consulted

- [11] L.J. Knowles and J.W. Nitchen, (1995), *Kingfishers of the World*. Times Books International, Singapore and Kuala Lumpur.
- [12] W.V. Legge, (1983), *A History of the Birds of Ceylon* (2nd Edn.), Tisara Prakasakayo Ltd., Dehiwala.
- [13] S. Ali, (1996), *The Book of Indian Birds* (12th End.), Bombay Natural History Society/Oxford University Press, Mumbai.
- [14] G.M. Henry, (1928), *Coloured Plates of the Birds of Ceylon* (Part I), Ceylon Government Press, Colombo.