*ISBN: 978-81-968830-8-9*

# 9. Sustainable Use of Indigenous Tree Species for Conservation of Avian Fauna in Urban Ecosystem

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## 9.1 Introduction:

Birds have a very close association with trees and enjoy an important relationship with trees. Trees provide food, nesting sites and protection to birds and in return birds are also advantageous for trees as their flowers are cross pollinated, seeds are dispersed by birds. Birds also eat insects that may harm the trees (Mathew *et al* 1983). The trees offer a habitat for birds and the relative abundance of birds is directly related to the presence of vegetation community, food resources and habitat structural complexity (Rajpar and Zakaria, 2011).

The introduction of exotic (non-native) flora can affect or modify inherent species richness, communal alignment and species abundance, as well as species relationships and communal structure. Exotic species have been recently found as the most common agent of evolutionary traps, influencing species diversity. The bird communities inhabiting urban ecosystem depends upon indigenous and exotic tree species for their survival in addition to other anthropogenic structures prevalent in modernized urban ecosystem.

There are more than 10,000 bird species in the world and India is among 12 mega diversity countries of the world. Birds are significant suppliers of environment facilities and are exclusively sensitive to ecological alterations (Whelan et al., 2008). Birds are exclusively sensitive to alterations both to environmental and ecological parameters. Plant incursions can modify communities in a variety of means, resultant in modifications to the species richness, variety and capability of inhabitant flora and fauna, as well as wider ecology-level practices and purposes (Ehrenfeld 2010; Schirmel et al. 2016; Vila et al. 2011). The biological effects of non-native plant arrivals are well recognized across varied biomes, taxa, spatial and progressive scales, and levels of natural density (Vila et al. 2011; Pyšek et al. 2012; Schirmel et al. 2016). Non-native plants can modify inherent species richness, communal alignment, and species abundance, as well as species relationships and communal structure through modifications in food web dynamics (Richardson et al. 2007; Hladyz et al. 2011; Hajzlerova and Reif 2014). These modifications result in damaging concerns for biome functioning and human welfare (Pejchar and Mooney 2009). Introduced plants may exchange high quality habitation to biological traps, surrounding chosen by birds even though conditions that decline ability (Battin 2004; Robertson and Hutto 2006). Plant incursions disturb animal populations through various ways and understanding the mechanisms underlying these alterations is serious for notifying management and controlling decisions.

Avian community structure on a particular tree species dependent upon the characteristics of the trees as well as on the various features of the habitat in vicinity (Faanes 1987). Older plantations of Teak (*Tectona grandis*) seem to support greater diversity of birds and have a more stable community structure than the younger monocultures (Daniels 1989, Mehta 1998, Trivedi 2006). Hence it is recognized that plantations of tree species which have long life span stabilizes the system by providing the habitat complexity which supports higher bird diversity. Various scientists claim that habitat structure (physiognomy) and floristics (composition) of a particular location are the key components affecting the assemblage of land birds. Marsden *et al* (2001) investigated that there is little or no under story vegetation in case of Eucalyptus plantations, so these plantations lack substantial avifauna.

Exotic species have been recently found as the most common agent of evolutionary traps, influencing species diversity and activating traps within a wide array of behavioral frameworks (Robertson et al. 2013). Exotics refer to the species carried from outside the country (Chauhan et al.2008). The introduction of exotic tree species arises either because the innate tree flora is revealing or is primarily composed of species which are very slow growing and are not freely obtainable for use. The introduction of exotic (non-native) flora can affect or modify inherent species richness, communal alignment and species abundance, as well as species relationships and communal structure. Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economical interactions between the different components (Chandra 2001). It is estimated that approximately 4.8 mha of *Eucalyptus sps.* and 60,000 ha of *Populus deltoids* is growing in India alone (Chandra 2001). In India total agroforestry area is 28. 03m.ha (Ahmad et al., 2021) and the projected area is estimated to be 53.32 m. ha in 2050 (Rizvi et al., 2019). In the light of these aspects, this chapter shed some light on the relationship between bird community with the indigenous tree's species in the urban ecosystem and sustainable utilization of indigenous tree species for conservation of bird diversity.

## 9.2 Bird Diversity and Habitat (Special Reference to Urban Ecosystems of Punjab):

The avifauna of India includes around 1314 species including 4.8% endemic to India (Praveen *et al.* 2016). Punjab has a rich bird fauna comprising 328 species of birds (Jerath and Chadha, 2006; Toor *et al.* 1982). The Punjab state, with an area of 50,362 $km^2$, is situated in the north western part of the country. It extends from latitude 29°33' to 32°32' North and longitude 73°55' to 76°50' East with an average elevation of 300 m above mean sea level. The state has been classified into five agro-climatic zones i.e. sub-mountain undulating zone, undulating plain zone, central plain zone, western plain zone and western zone on the basis of homogeneity, rainfall pattern, distribution, soil texture, cropping patterns etc. The climate of Punjab is characterized by extreme hot and extreme cold conditions. Annual temperatures in Punjab range from 1°C to 46°C (min/max), but can reach 49°C in summer and 0°C in winter. It has three defined seasons; summer, monsoon and winter. Summer season tends to be very hot and very dry and it ranges from April through June with average highs in May and June hovering around 40 °C. A slight decrease

in average temperature and an increase in humidity is witnessed in the monsoon season which runs from July through September with an annual precipitation average range between 960 mm in the sub-mountain region and 460 mm in the plains. Average temperature tends to decrease during the months of October and November. The winter months (December to February) are relatively mild with warm days and chilly nights and March is a transitional month from winter to summer. Compiled checklist of 213 species of birds belonged to 17 orders 62 families and 131 genera in agricultural ecosysytem was given (Kler et al. 2022) which was havning 24 additional species as compared to earlier checklist of 189 species of birds, belonging to 17 orders, 56 families and 117 genera recorded during the surveys conducted in more than 240 villages of 19 districts of Punjab (Kler and Kumar 2015). Based on different agricultural habitat preferences i.e. Type A (Agricultural Habitat); Type B Residential area - Urban/Rural); Type C (Aquatic Habitat/ponds/ canal/river/wetland) and Type D (Uncultivated area/ forest/barren land), bird species were recorded to be 139, 68, 84 and 34 bird species in Type A; Type B; Type C and Type D, respectively (Kler et al. 2022). Most preferred habitat by theses bird species were agricultural landscape and urban/rural habitation which comes out to be 69.01 %, showing the importance of tree diversity and vegetation as major factor in preference of habitat by the birds.

The "Checklist of Birds of Punjab and Chandigarh" by Toor *et. al.*, (1982) which recorded 240 bird species belonging to 17 order, 56 families and 150 genera was reported earlier. Kler and Kumar (2015) reported 111 resident birds' species and 77 migrant species as compared to 147 resident and 93 migrant bird's species reported by Toor *et. al.* (1982). Kler (2005) also recorded 64 species, belonging to 11 orders and 29 families from the crop fields of six districts of Punjab. A total of 97 bird species belonging to 14 orders and 40 families were also reported by Kler (2005; 2009) from the villages of Ludhiana districts of Punjab. Kler (2010) had sighted 70 species of birds in different crop ecosystems. Comparative record has shown that there were 65 species common between the former and the present study. There were 5 bird species which were not observed during the present survey. Some species were found to be habitat specific and their future conservation effort can be carried out in specific habitats.

Habitat loss, destruction and degradation are the major threats to avian species richness and diversity. As cities grow and expand, urbanization replaces native habitats with new man-made systems where natural and anthropogenic components interact (Parsons *et al.* 2006; Kler *et al.* 2015, Zagorski and Swihart 2021, Kaur and Kumar 2021). Most of the earlier research directed towards determining the habitat needs of various birds has centered on 'natural' communities, while urban ecosystems have been largely ignored. Now a days, urban avifauna are becoming increasingly appropriate targets for research and conservation efforts (Mortberg and Wallentius 2000, Kler and Kumar 2015; Arora *et al.* 2016) particularly when human population, social and demographic trends predict further urbanization. Bird communities respond to this environmental variation in several ways. But there are a number of bird species that survive successfully in the urban matrix. Urban environments are often characterized as supporting a few abundant, generalist species which are best adapted to living alongside humans, and as such, cities are seen as agents of biotic homogenization. Consequently, urban environments can no longer be viewed as lost habitat for wildlife, but rather as new habitat that, with proper management, has the potential to support diverse bird communities. The city buildings are well documented to provide

nesting, roosting and perching sites for some bird species. However, permanent presence of humans and higher densities of non-native predators have potential to affect avian nest placement (Mazumdar and Kumar 2014; Kler and Kumar 2015b; 2017; Kumar 2022). With the rapid expansion of urban development, the importance of understanding the relationship between avian fauna and urban habitats is evident. It draws attention to the fact that there is urgent need to focus on the conservation of bird species, their habitat and indigenous tree species so that there will be up gradation of their conservation efforts.

## 9.3 Indigenous Trees and Bird Diversity:

The common indigenous tree species i.e. Banyan (*Ficus benghalensis*), Jamun (*Syzgium cumini*), Mulberry (*Morus alba*), Neem (*Azadirachta indica*), Pipal (*Ficus religiosa*) and Sheesahm (*Dalbergisa sissoo*) harbor large number of bird species (Kaur and Kumar 2018, 2019, 2020; Jain and Kumar 2021; Kumar 2022) in the urban ecosystem of north-west India specifically Punjab region (Table 1).

### 9.3.1 Banyan *(Ficus Benghalensis):*

It is an evergreen tree of family Moraceae. It has a huge crown with the aerial roots extending to the ground which later on becomes trunk like and supports the crown. It has thick leathery leaves of oval shaped which are round at the tip. Fruiting generally occurs from March-May and also in September-October. Fruits are generally small in size and yellow to reddish brown in colour. A total 22 birds' species of were observed on banyan tree at selected locations. Species richness was maximum (16) during the fruiting period of tree, in the month of September and October. It was lowest (11) in the months June, July and January.

Relative abundance of Rose-ringed Parakeet (41.74) and House Crow (36.66) was found to be maximum in the month of January and June respectively. It was lowest (0.46) of both Blue Rock Pigeon and Little Brown Dove in the month of April. Species diversity was highest in the month of September (2.18). It was lowest (1.57) in the month of December. Species Evenness was found to be highest in the month of December (0.87) and it was lowest (0.71) in the month of January. Annual abundance of House Crow (27.09) and Common Myna (18.89) were found to be maximum. Indian Cuckoo and Spotted Dove were the least abundant species recorded on this tree both showing annual abundance of 0.05.

### 9.3.2 Jamun (*Syzugium Cumini*):

It is also called as Black Plum and belongs to family Myrtaceae. It is a medium sized evergreen tree with dense shady much branched crown. New leaves appear in February and are coppery red in colour. Flowers start appearing from March-April. Ripening of fruits takes place from June-July. Fruits are generally in purplish black in colour with juicy edible pulp. Total 16 species of birds were recorded on Jamun tree at location I. Species richness was highest in the month of February and March with values 15 and 12 respectively whereas it was 5 and 6 in June-July (fruiting period) respectively. This indicates that new foliage and flowering stage of tree attracts more bird species as compared to fruiting stage. Few workers also reported that jamun attracts a lot of bird diversity.

Relative abundance 50.29 and 45.16 of Common Myna was highest in the month of October and September respectively. Relative abundance of House Crow was second highest 44.32 in the month of July. Species diversity was highest (2.07) in month of February. Highest species evenness 0.83 was recorded in the month of January. Annual abundance 36.16 of Common Myna was found to be highest. Lowest annual abundance 0.07 was of Black-crowned Night-Heron followed by 0.14 of Greater Coucal.

### 9.3.3 Mulberry (*Morus Alba*):

Mulberry is a medium sized fruiting tree. Trees are bare in the month of January till the first week of February. New foliage starts appearing in the last week of February. Fruiting takes place in the month of March. A total of 30 bird species were observed on Mulberry tree.

Highest species richness (22) was recorded in both the months February and March. Lowest species richness 8 was recorded in the month of December. Highest relative abundance 40.22 and 36.84 was of Common Myna in the month of September and August respectively. Lowest relative abundance 0.51 was of Indian Roller and Red-vented Bulbul in the month of March. Highest species diversity 2.57 was recorded in the month of March. Aslan and Rejmanek stated that *Morus* sp. are favourite spot for birds for perching and eating.

It was lowest 1.69 in the month of December. Species evenness was recorded to be highest 0.84 in the month of November. It was lowest 0.72 in the month of August.

Annual abundance of Common Myna 26.12 was recorded to be highest. Lowest annual abundance 0.06 was of Brown-headed Barbet followed by 0.17 was of Brahaminy Starling.

### 9.3.4 Neem *(Azadirachta Indica):*

Neem tree belongs to family Meliaceae. Its fruits and seeds are the source of neem oil. Neem is a fast-growing tree that can reach a height of 15– 20 meters. It is evergreen, but in severe drought it may shed most or nearly all of its leaves. Shedding of leaves takes place in the month of January. The branches are wide and spreading. The fairly dense crown is roundish. New foliage appears in month of February. The (white and fragrant) flowering occurs in the month of March and fruiting starts in the beginning of April. The fruit is a smooth (glabrous) and olive-like. A total of 18 species of birds were recorded at location I. Species richness was recorded to be highest in the month of March (15) which was a flowering period. Second highest species richness (14) was recorded in the month of February.

Relative Abundance of Common Myna was highest 42.50 and 39.90 in the months July and October respectively. Least relative abundance (0.48) was of birds Common Golden-backed Woodpecker, Jungle Babbler, Little Brown Dove and White-breasted Kingfisher in the month of March. Highest species diversity (2.44) was recorded in the month of February. It was recorded to be lowest (1.63) in the month of December. Highest species evenness (0.84) was recorded in the month of May. Annual abundance of Common Myna (28.06) was found to highest followed by Rose-ringed Parakeet with second highest annual abundance (23.91). Common Golden-backed Woodpecker and White-breasted Kingfisher both shows the lowest (0.20) annual abundance.

### 9.3.5 Pipal (*Ficus Religiosa*):

Pipal belongs to family Moraceae. It is a large size tree with heart shaped leaves and spreading branches without aerial root. Figs turn dark purple on ripening and are consumed by flocks of birds. Ripening of fruits takes place in the month of March- April and also in October to November. In total 31 species of birds were observed on Pipal tree during the present study. Species richness was found highest 22 in month of April. Fruiting on tree occurs during February- April and October – November which attracts more bird species during these months. Highest species diversity 2.73 was recorded in month of March. Species evenness was recorded highest in month of December that was 0.89. Highest relative abundance 31.41 and 31.37 of Rose-ringed Parakeet was observed in month of December and January respectively. Coppersmith Barbet, Indian Treepie and Blue Rock Pigeon shows lowest relative abundance with value of 0.36 in month of April. Common Myna was the first dominant bird species with 23.51 annual abundance followed by House Crow and Rose-ringed Parakeet with 19.51 and 17.97 annual abundance respectively. Other species with less annual abundance were Coppersmith Barbet (0.13), Eurasian Wryneck (0.04), Common Golden-backed Woodpecker (0.13), Eurasian Golden Oriole (0.04), Indian Cuckoo (0.125), Asian Pied Starling (0.13) and White-breasted Kingfisher (0.13).

### 9.3.6 Sheesham (*Dalbergia Sissoo*):

It is fairly large deciduous tree with dark grey, rough and furrowed bark. It is fast growing tree adaptable and able to stand various temperatures. In the month of January- February tree is leafless and new foliage start appearing the month of March, flowering takes place in the month from March-April. Fruit ripens in the month of October and remain hanging on the trees for several months. Fruits are thin strap-shaped pods with kidney shaped light brown seeds. A total of 12 species of birds were recorded on Sheesham tree at location I. Species richness was maximum in the month of March (12). Species richness was almost same during all the three stages i.e. new foliage, flowering and fruiting stages. Marwaha also stated that Sheesham tree supports bird diversity [43]. Relative abundance of Common Myna (57.77) was highest in the month of September and July respectively. Least relative abundance of Little Brown Dove (0.56) was found in the month of February. Species diversity was highest in the month of March (1.93)). It was lowest 0.83 in the month of December. Species evenness was highest in month of February (0.79). It was found to be lowest 0.26 in the month of December. Annual abundance of Common Myna (39.52) was recorded to be highest. Second highest annual abundance (28.31) was of Rose-ringed Parakeet. Lowest annual abundance (0.38) was recorded of Spotted Owlet.

**Table 9.1: Indigenous Trees Preferences by Bird Species in Urban Ecosystem**

| Sr. No. | Common Name | Scientific Name | Feeding habits | Order | Banyan | Jamun | Mulberry | Neem | Pipal | Sheesham |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ashy Prinia | *Prinia socialis* | Insectivorous | Passeriformes | - | - | - | - | + | - |
| 2 | Asian Koel | *Eudynamys scolopacea* | Insectivorous/ Frugivorous | Cuculiformes | + | - | + | + | + | - |
| 3 | Asian Pied Starling | *Sturnus contra* | Insectivorous/ Frugivorous | Passeriformes | + | - | + | - | + | - |
| 4 | Bank Myna | *Acridotheres ginginianus* | Insectivorous | Passeriformes | + | - | + | - | + | + |

| Sr. No. | Common Name | Scientific Name | Feeding habits | Order | Banyan | Jamun | Mulberry | Neem | Pipal | Sheesham |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Barn Owl | *Tyto alba* | Insectivorous | Strigiformes | - | - | - | - | + | - |
| 6 | Bay-backed Shrike | *Lanius vittatus* | Insectivorous | Passeriformes | - | - | + | - | - | - |
| 7 | Black Drongo | *Dicrurus macrocercus* | Insectivorous | Passeriformes | + | + | + | + | + | + |
| 8 | Black Kite | *Milvus migrans* | Carnivorous | Ciconiiformes | + | + | - | - | + | + |
| 9 | Black-crowned Night-Heron | *Phoenicurus ochrurus* | Insectivorous | Passeriformes | - | + | - | - | - | - |
| 10 | Black Redstart | *Nycticorax nycticorax* | Insectivorous | Pelecaniformes | - | - | + | - | - | - |
| 11 | Blue Rock Pigeon | *Columba livia* | Granivorous | Columbiformes | + | + | - | - | + | |
| 12 | Brahaminy Starling | *Sturnus pagodarum* | Insectivorous/ Frugivorous | Passeriformes | - | - | + | - | - | - |
| 13 | Brown-headed Barbet | *Ketupa zeylonensis* | Insectivorous | Strigiformes | - | - | + | - | + | - |
| 14 | Brown Fish-Owl | *Megalaima zeylanica* | Insectivorous/ Frugivorous | Piciformes | - | - | - | - | + | - |
| 15 | Cattle Egret | *Bubulcus ibis* | Insectivorous | Ciconiiformes | + | - | - | - | - | - |
| 16 | Golden-backed Woodpecker | *Dinopium javanense* | Insectivorous | Piciformes | - | + | - | + | + | - |
| 17 | Common Hoopoe | *Upupa epops* | Insectivorous | Upupiformes | - | - | - | + | - | - |
| 18 | Common Myna | *Acridotheres tristis* | Omnivorous | Passeriformes | + | + | + | + | + | + |
| 19 | Common Starling | *Strnus vulgaris* | Insectivorous/ Frugivorous | Passeriformes | - | - | + | - | - | - |
| 20 | Common Tailorbird | *Orthotomus sutorius* | Insectivorous | Passeriformes | - | - | + | + | + | - |
| 21 | Coppersmith Barbet | *Psilopogon haemacephalus* | Frugivorous | Piciformes | - | - | - | - | + | - |
| 22 | Eurasian Collared-Dove | *Streptopelia decaocto* | Granivorous | Columbiformes | + | + | + | + | + | + |
| 23 | Eurasian Golden Oriole | *Oriolus oriolus* | Insectivorous/ Frugivorous | Passeriformes | - | - | - | - | + | - |
| 24 | Eurasian Wryneck | *Jynx torquilla* | Insectivorous | *Piciformes.* | - | - | - | - | + | - |
| 25 | Glossy Ibis | *Plegadis falcinellus* | Insectivorous | *Pelecaniformes* | + | - | - | - | - | - |
| 26 | Greater Coucal | *Centropus sinensis* | Insectivorous | Cuculiformes | - | + | + | - | - | - |
| 27 | Grey Wagtail | *Motacilla cinerea* | Insectivorous/ Frugivorous | Passeriformes | - | - | + | - | - | - |
| 28 | House Crow | *Corvus splendens* | Omnivorous | Passeriformes | + | + | + | + | + | + |
| 29 | House Sparrow | *Passer domesticus* | Granivorous/ Insectivorous | Passeriformes | - | - | + | - | + | - |
| 30 | Indian Chat | *Cercomela fusca* | Insectivorous | Passeriformes | - | - | + | + | - | - |
| 31 | Indian Cuckoo | *Cuculus micropterus* | Insectivorous | Cuculiformes | + | - | - | - | + | - |
| 32 | Indian Grey Hornbill | *Ocyceros birostris* | Insectivorous/ Frugivorous | *Bucerotiformes* | + | - | + | + | + | - |
| 33 | Indian Peafowl | *Pavo cristatus* | Omnivorous | *Galliformes* | + | - | - | - | + | - |
| 34 | Indian Roller | *Coracias* | Insectivorous | *Coraciiformes* | - | - | + | - | - | - |

| Sr. No. | Common Name | Scientific Name | Feeding habits | Order | Banyan | Jamun | Mulberry | Neem | Pipal | Sheesham |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *benghalensis* | | | | | | | | |
| 35 | Indian Shikra | *Accipiter badius* | Insectivorous | Accipitriformes | - | - | - | - | + | - |
| 36 | Indian Treepie | *Dendrocitta vagabunda* | Insectivorous | Passeriformes | + | - | + | + | + | - |
| 37 | Jungle Babbler | *Turdoides striatus* | Insectivorous /Frugivorous | Passeriformes | + | + | + | + | + | + |
| 38 | Little Brown Dove | *Streptopelia senegalensis* | Granivorous | *Columbiformes* | + | + | + | + | + | + |
| 39 | Little Cormorant | *Phalacrocorax niger* | Insectivorous | *Suliformes* | + | - | - | - | - | - |
| 40 | Oriental Magpie-Robin | *Copsychus saularis* | Insectivorous | Passeriformes | - | - | + | - | + | - |
| 41 | Pied Crested Cuckoo | *Clamator jacobinus* | Insectivorous | Cuculiformes | - | - | + | - | - | - |
| 42 | Pied Wagtail | *Motacilla maderaspatensis* | Insectivorous | Passeriformes | - | - | + | - | - | - |
| 43 | Purple Sunbird | *Nectarinia asiatica* | Plants/nectar | Passeriformes | - | - | + | + | + | - |
| 44 | Red-vented Bulbul | *Pericrocotus cafer* | Insectivorous/ Frugivorous | Passeriformes | + | + | + | + | + | + |
| 45 | Rose-ringed Parakeet | *Psittacula krameri* | Frugivorous | Psittaciformes | + | + | + | + | + | + |
| 46 | Small Bee-eater | *Merops orientalis* | Insectivorous | Coraciiformes | - | + | + | + | + | - |
| 47 | Spotted Dove | *Streptopelia chinensis* | Granivorous | Columbiformes | + | - | - | - | - | - |
| 48 | Spotted Owlet | *Athene brama* | Insectivorous | Strigiformes | + | - | + | - | + | + |
| 49 | White-breasted Kingfisher | *Halcyon smyrnensis* | Carnivorous | Coraciiformes | - | + | - | + | + | - |
| 50 | Yellow-legged Green-Pigeon | *Treron phoenicoptera* | Frugivorous | Columbiformes | + | + | + | + | + | + |
| 51 | Yellow Wagtail | *Motacilla flava* | Insectivorous | Passeriformes | - | - | + | - | - | - |
| | | | | | | | | | | |

("+" bird species utilizing the tree species and "-" bird species not observed utilizing the tree species; as per various researcher (Kaur and Kumar 2018, 2019, 2020; Jain and Kumar 2021; Kumar 2022)

## 9.4 Importance of the Bird Species (Ecological/Economic):

The presence of birds in the surrounding ecosystem serves as a barometer of ecological health. Birds are important part of the food chain; because threats like pesticides, habitat loss, and climate change have the most dramatic impact on birds and higher vertebrates, we refer to them as indicator species. Researching the population trends of birds provides a cost-effective and efficient means to detecting environmental change, allowing us to take conservation action that is driven by the latest scientific data. Rodent eating birds and insectivores also play an important ecological role by controlling populations of rodents, small mammals and insects.

### 9.4.1 Farmers Friends:

Since many of the birds feed on insects and some prey on rodents, many farmers truly appreciate them. The Black Drongo, Myna, Indian Roller, Kestrel and some species of owl feed on insects. The great horned owl and Barn owl feed on rodents. Grasshoppers, worms, as well as small mammals including squirrels, field mice are capable of destroying entire fields of crops if left to reproduce freely without any birds of prey to feed on them. Controlling pests through this method is called biological control.

If a farmer can control pests by natural predation, he has no need to use pesticides or insecticides, which helps protect the environment.

### 9.4.2 Natural Balancer:

Bird of preys feed at the top of many food chains. Mice, field rats, rabbits, squirrels and other rodents, as well as fish, insects, amphibians and reptiles may have their population explodes due to good weather and a surplus of food some time. This is a common experience with fish, amphibian and even snake populations. Birds of prey help to balance the size of these populations.

### 9.4.3 Barometer of Ecological Health:

Birds are also called “ecological barometers,” which simply means they help us gauge how healthy a habitat is. Birds of prey are extremely sensitive to many environmental changes in an ecosystem. They can even sense chemical and pollutant levels that can give people an early warning of any impending airborne threats. Pesticides and other chemicals can build up in our environment and are passed on to animals. This can lower raptor populations due to birds ingesting prey riddled with toxins, which in turn signals scientists that a possible problem exists.

### 9.4.4 Disease Management:

Some of the larger birds of prey like the vultures feed primarily on carcasses of dead animals. Occasionally, other birds of Prey will predate on weak or sick animals. This feeding habit actually helps the environment by getting rid of diseased animals or their carcasses to prevent further spread of any disease the animal was carrying. The stomach acids of the vulture are so powerful that it is resistant to most bacteria and germs. This is probably why the vulture has been around 40 to 50 million years. Several species of vultures practice feeding on dead animals and making the environment safe for other animals.

### 9.4.5 Threat and Conservation Status:

The main threats to the birds are the results of different anthropogenic activities which leads to changing land-use patterns, intensification of agriculture, excessive use of pesticides, poisoning, collision, electrocution from large structures related to urbanization, habitat degradation, hunting, disturbance at breeding sites and many more clandestine factors.

## 9.5 Conclusion and Future Aspects:

The indigenous species Total 51 species of birds were recorded belonging to 14 orders. Highest spices richness (31) was recorded on Pipal tree and lowest (10) was recorded on Sheesham. House Crow, Common Myna, Jungle Babbler and Rose-ringed Parakeet were the most abundant birds recorded on selected indigenous tree species. Black Kite and House Crow were abundant but were rarely observed at location II. Spotted Owlet, Doves, Red-vented Bulbul were commonly observed birds at both the locations where as White-breasted Kingfisher, Asian Koel, Indian Rollers and Indian Tree pie were observed in less frequently. Presence of some migratory birds like Brown Fish-owl, Glossy Ibis, Spotted Dove and Indian Cuckoo were observed on indigenous trees during the fruiting periods which coincide with their respective migratory season. The order Passeriformes was the most dominant order out of the total fourteen orders of bird species observed. Among feeding habits, omnivorous birds were in higher proportion as compared to birds having other feeding habits. The study suggested that different bird communities utilize the indigenous trees for roosting, feeding, nesting and other activities, in different ways. For the safe guard of these species and being our moral duty to conserve them for future generation; we must peruse a directed result-oriented approach to achieve the goal in a sustainable way. Awareness and education is the foremost step needed to be taken as soon as possible to avert the catastrophic consequences. In the light of these facts' plantation and protection of these indigenous trees over exotic trees is the need of the hour. Therefore, further studies are the need of the hour to support and strengthen this concept.

## 9.6 References:

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