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12. Birds of Prey of Agroecosystem

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12.1 Introduction to the Group:

Raptors also known as birds of prey, are predatory birds whose powerful talons and beak, as well as their speed and keen vision, allow them to detect and catch their prey during flight. The word "raptor" comes from the Latin word "rapere," which means to seize or plunder & to carry away. Today, the word is used to describe a group of birds also known as "birds of prey." All birds share some common traits such as feathers, wings, laying eggs, and being warm-blooded. They feed on animal flesh, distinguished by a hooked bill and sharp talons. Most of these bird's hunt and feed on other smaller bird species, rodents or fish. A huge diversity of predatory birds is found all over the world. There are more than 500 species of raptors found throughout the world, and different types of raptors can be found in every type of habitat. From frozen tundras and scorching deserts to dense forests and bustling cities, raptors are key apex predators in every environment. Raptor is a generic term for all birds of prey. Raptors are carnivorous birds with strong bills, large talons, and exceptional flight capabilities. Orders Falconiformes (the diurnal birds of prey) and Strigiformes (the owls) represents a clear definition of bird of prey, a bird that has very good eyesight for finding food, strong feet for holding food, and a strong curved beak for tearing flesh. Accipitridae is a family of *birds of prey*, which includes hawks, eagles, kites, harriers and Old-World vultures. These birds have powerful hooked beaks for tearing flesh from their prey, strong legs, powerful talons and keen eyesight. Falconidae is a family of diurnal birds of prey. They differ from hawks, eagles and kites in that they kill with their beaks instead of their talons. There are 62 species worldwide and 15 species of this family occur in India (Grimmett et al. 1998; Ali 2002; Kler &Kumar 2015; Praveen *et al.* 2016, Kaur and Kumar 2021, Zagorski and Swihart 2021).

Predator and prey interactions often have a great influence on the life of organisms, such as habitat selection, selection of feeding sites, sociality and group living and vigilance (Lima and Dill, 1990). They can also generate morphological adaptations and counter adaptations in the predator and prey species to enhance performance of capturing and escaping, respectively. Size, morphology, and hunting strategy have probably coevolved among predatory species to maximize success in hunting their most common prey (Dawkins, 1982). In birds, the predator is typically larger than the prey, and because size has profound effects on aerodynamic performance during the hunting (Cade, 1960; Howland, 1974, Kaur and Kumar 2021, Zagorski and Swihart 2021). Variations in shape and size of bird of prey is well known fact i.e. eagles tend to be large birds with long, broad wings and massive feet. Booted eagles have legs and feet feathered to the toes and build very large stick nests. Ospreys, a single species found worldwide that specializes in catching fish and builds large stick nests. Kites have long wings and relatively weak

legs. They spend much of their time soaring. They will take live vertebrate prey, but mostly feed on insects or even carrion. The true hawks are medium-sized birds of prey that usually belong to the genus *Accipiter*, are mainly woodland birds that hunt by sudden dashes from a concealed perch. They usually have long tails for tight steering. Buzzards are medium-large raptors with robust bodies and broad wings, or, alternatively, any bird of the genus *Buteo*. Harriers are large, slender hawk-like birds with long tails and long thin legs. Most use a combination of keen eyesight and hearing to hunt small vertebrates, gliding on their long broad wings and circling low over grasslands and marshes. Vultures are carrion-eating raptors of two distinct biological families: the *Accipitridae*, which occurs only in the Eastern Hemisphere; and the *Cathartidae*, which occurs only in the Western Hemisphere. Members of both groups have heads either partly or fully devoid of feathers. Falcons are medium-size birds of prey with long pointy wings. They belong to the *Falconidae* family, many are particularly swift flyers. Owls are variable-sized, typically night-specialized hunting birds. They fly almost silently due to their special feather structure that reduces turbulence. They have particularly acute hearing. Many of these English language group names originally referred to particular species encountered in Britain. As English-speaking people travelled further, the familiar names were applied to new birds with similar characteristics. Names that have generalized this way include: kite (*Milvus milvus*), sparrow-hawk (*Accipiter nisus*), goshawk (*Accipiter gentilis*), kestrel (*Falco tinninculus*), hobby (*Falco subbuteo*), harrier (simplified from "hen-harrier", *Circus cyaneus*), buzzard (*Buteo buteo*). Some names have not generalised and refer to single species (or groups of closely related (sub) species); merlin (*Falco columbarius*), osprey (*Pandion haliaetus*) (Manakadan and Pittie 2001; Ali 2002; Praveen *et al.* 2016; Kler & Kumar 2017, Zagorski and Swihart 2021, Kaur and Kumar 2021).

Raptors are known to display patterns of sexual dimorphism. It is commonly believed that the dimorphisms found in raptors occur due to sexual selection or environmental factors. Dimorphisms can also be the product of intrasexual selection between males and females. It appears that both sexes of the species play a role in the sexual dimorphism within raptors; females tend to compete with other females to find good places to nest and attract males, and males competing with other males for adequate hunting ground so they appear as the healthiest mate. In birds of prey, the opposite is the case. For instance, the kestrel is a type of falcon in which males are the primary providers, and the females are responsible for nurturing the young. In this species, the smaller the kestrels are, the less food is needed and thus, they can survive in environments that are harsher. This is particularly true in the male kestrels. It has become more energetically favorable for male kestrels to remain smaller than their female counterparts because smaller males have an agility advantage when it comes to defending the nest and hunting. Larger females are favored because they can incubate larger numbers of offspring, while also being able to breed a larger clutch size. A recent study discovered new connections between migration and the ecology, life history of raptors. Some worker reports that the clutch size and hunting strategies have proved to be the most important variables in shaping distribution areas, and also the geographic dissimilarities may mask important relationships between life history traits and migratory behaviors.

12.2 Review of the Group in Brief, Pertaining to India:

The avifauna of India includes around 1314 species including 4.8% endemic to India (Praveen *et al.* 2016). 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). Bird communities respond to this environmental variation in several ways. Habitat loss, destruction and degradation are the major threats to avian species richness and diversity. But there are a number of bird species that survive successfully in the urban matrix. 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. 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. 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). With the rapid expansion of urban development, the importance of understanding the relationship between avian fauna and urban habitats is evident.

12.3 Diversity and Distribution in Agro-Ecosystem of North-West Region in India (Special Reference to Agro-Ecosystems of Punjab):

12.3.1 Punjab Agro-Ecosystem:

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. A total 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 since last six years.

The present bird recordings were further compared with 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. During this study 111 resident birds' species and 77 migrant species were recorded as compared to 147 resident and 93 migrant birds 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.

Out of these 189 bird species, eighteen bird species falls under birds of prey category (Table 1) (Javed and Kaul 2002; Kler and Kumar 2015a). These bird species come under two orders i.e. Falconiformes and Strigiformes and four families i.e. Accipitridae, Falconidae, Pandionidae and Strigidae. Based on the resident status 12 were resident, 5 resident migrant and 1 migrant species. Keeping in view the IUCN list, 1 species each comes under vulnerable, neat threatened & endangered categories and rest were in least concern category (IUCN 2001).

It draws attention to the fact that there is urgent need to focus on the conservation of these three bird species (Eastern Imperial Eagle, Pallied Harrier and Egyptian Vulture) and their habitat so that there will be upgradation of their conservation status. Based on the feeding habits, 7 species feed on Small vertebrates, fishes, mice, rat, small birds, eggs and reptiles; 10 on both insects and small vertebrates and one on carrion (Egyptian Vulture).

The preferred habitat of these bird of prey includes Agricultural & Residential area (5); Agricultural, Residential & Uncultivated area/forest/barren land (2); Agricultural & Uncultivated area/forest/barren land area (8); agricultural area & aquatic Habitat/ponds/canal/river/wetland (1) and Uncultivated area/forest/barren land area (2).

Table 12.a: Bird of prey observed in agro-ecosystem of north-west region in India

Sr. No.	Order	Family	Common Name	Scientific Name	Status	Food	IUCN status	Habitat
1	Falconiformes	Accipitridae	Besra Sparrow Hawk	*Accipiter virgatus* (Temminck, 1822)	R	SV, I	LC	D
2			Black-shouldered Kite	*Elanus caeruleus* (Desfontaines,1789)	R	I, SV	LC	AB
3			Black Kite	*Milvus migrans* (Boddaert,1783)	R	I, SV	LC	AB
4			Crested Serpent-Eagle	*Spilornis cheela* (Latham, 1790)	R	SV	LC	AD
5			Changeable Hawk Eagle	*Spizaetus cirrhatus* (Gmelin, 1788)	R	SV	LC	AD
6			Egyptian Vulture	*Neophron percnopterus* (Linnaeus,1758)	RM	Carrion	EN	D
7			Eastern Imperial Eagle	*Aquila heliacal* Savigny, 1809	RM	SV	VU	AD
8			Oriental-Honey-Buzzard	*Pernis ptilorhyncus* Temminck, 1821	RM	I, SV	LC	AD
9			Pallied Harrier	*Circus macrourus* Gmelin, 1770	M	SV	NT	ABD
10			Shikra	*Accipiter badius* (Gmelin,1788)	R	I, SV	LC	AB
11			Tawny Eagle	*Aquila rapax* (Temminck, 1828)	R	SV	LC	ABD
12			White-eyed Buzzard	*Butastur teesa* (Franklin, 1832)	R	SV, I	LC	AD
13		Falconidae	Common Kestrel	*Falco tinnunculus* Linnaeus,1758	RM	I, SV	LC	AD
14		Pandionidae	Osprey	*Pandion haliaetus* Linnaeus,1758	RM	SV	LC	AC
15	Strigiformes	Strigidae	Barn Owl	*Tyto alba* (Scopoli, 1769)	R	SV	LC	AD
16			Spotted Owlet	*Athene brama* (Temminck,1821)	R	I, SV	LC	AB
17			Eurasian Eagle-Owl	*Bubo bubo* (Linnaeus, 1758)	R	I, SV	LC	AB
18			Collared Scops-Owl	*Otus bakkamoena* Pennant,1769	R	I, SV	LC	AD

Habitat: Type A - Agricultural Habitat; Type B -Residential area: Urban/Rural; Type C - Aquatic Habitat/ponds/canal/river/wetland; Type D-Uncultivated area/forest/barren land. **Status:** R -Resident, RM - Resident migrant; M- Migrant. **Food Habit:** I - Insectivorous; SV – Small vertebrates/fishes/mice/rat/small birds/eggs/reptiles); Carrion. **IUCN Status:** EN – Endangered; VU – Vulnerable; NT - Near Threatened; LC - Least Concern. (Kler and Kumar 2015a, b)

The commonly observed birds of prey in agro-ecosystem of Punjab are discussed below:

Shikra *Accipiter badius* (Gmelin, 1788)

The Shikra *Accipiter badius* (Gmelin, 1788) comes under order Ciconiiformes and family Accipitridae. It is a lightly built hawk, 33 cm, ashy blue grey above, white below cross-barred with rusty brown. Female browner above and larger. Immature, brown and rufous above with brown vertical streaks on the underside. Tail with broad, blackish cross bands. It is usually present Singly or pairs in lightly-wooded country, open wooded country and avoids heavy forests. Flight swift, several rapid wing strokes followed by glide. Fond of groves of large trees in villages and cultivation. It feeds on Lizards, mice, birds, squirrels, etc. The nesting season ranges from march-June and nest is an untidy loose platform of twigs, like a crow's Nest: lined with grass and roots, high up in a large leafy mango or such like trees. The clutch size is 3-4 and eggs are bluish white, faintly speckled and spotted with grey. It is beneficial to farmers and agricultural ecosystem.

Spotted Owlet *Athene brama (Temminck,1821)*

The Spotted Owlet *Athene brama (Temminck,1821)* comes under order Strigiformes and family Strigidae. It is 21cm having Grayish brown plumage, spotted white. Yellowish eyes, brown whitish buff nuchal collar, no ear tuffs. Sexes alike. It is resident, Pairs or small parties, roosts during day in leafy branches, tree cavities or a cavity in a wall, ruins and groves of ancient trees. Villages, towns, cities, ruins, cultivation, grooves of old trees, open

forests. It feeds on Beetles, moths, locusts, other insects. Also prey on lizards, mice and small birds. The nesting season is from November to April and nest is Untidy pad of tow or fibres in tree holes, hollows in crumbling walls, ceilings and roofs. The clutch size is 3-4 white roundish oval eggs. It is beneficial to agricultural ecosystem.

Barn Owl *Tyto alba* (Scopoli, 1769)

The Barn Owl *Tyto alba* (Scopoli, 1769) comes under order Strigiformes and family Strigidae. It has white face, black eyes, white to golden buffy under parts finely spotted with black, golden grey upper parts which are finely spotted with black and white. Lack wing patches. Its size approximates 36cm with wings and tail appear uniform during flight. It is resident, widespread but very local subcontinent and associated with people, nests in buildings especially within cities and villages, also in caves and wells. It feeds on rats and mice, hence has economic importance. The nesting season is undefined, all Year and nest is a collection of straws, twigs, rags into tree hollow, holes in walls. The clutch size is 4-7, eggs are white smooth roundish.

Black-shouldered Kite *Elanus caeruleus (Desfontaines, 1789)*

The Black-shouldered Kite *Elanus caeruleus (Desfontaines, 1789)* comes under order Falconiformes and family Accipitridae. The Black-shouldered Kite is dainty hawk, 33cm, ashy grey above, with white below. Black line above eyes. Black patches on shoulders,

When closed, the wing tips extend beyond the short, square, white tail. It usually inhabits well-wooded country and cultivation, thin deciduous forests and grasslands. Avoid dense jungles as well as arid plains. crepuscular, but also active in daytime, Also hovers in mid-air to scan the ground and parachutes down in steps with motionless wings raised vertically above the body. It feeds on Locusts, crickets, mice, lizards, etc. The nesting is practically all around the year and nest is loose, untidy, crow-like, twigs lined with roots and grass, in small trees. The clutch size is 3-4 eggs having yellowish white color, densely blotched with brownish red. It is beneficial to agricultural ecosystem.

The Collared Scops-owl *Otus bakkamoena*

The Collared Scops-owl *Otus bakkamoena (Pennant, 1769)* comes under Order Strigiformes and family Strigidae. The owl is grey brown or rufous brown in color and 24 cm in length, also known as little horned owl. It has a pale half collar on upper back and sexes alike. It is usually present in open deciduous forest and groves of trees in or near towns and villages. It feeds on small beetles, insects, mice and lizards. The nesting season ranges from January – April and nest is a natural hollow in a tree-trunk. The clutch size is 3-5 and eggs are white in color and spherical in shape. The Collared Scops-owl is beneficial to farmers as its diet mainly includes insects.

The Black Kite Milvus migrans

The Black Kite *Milvus migrans (Boddaert,1783)* comes under order Falconiformes and family Accipitridae. The Black Kite is large brown hawk having forked tail and grey brown or rufous brown in color, 61 cm in length. Sexes alike and can be seen singly or gregariously scavenging in towns and villages. It is usually present in neighborhood of human habitations and confirmed commensal of man. It feeds on Offal, garbage, earthworms, winged termites, lizards, mice, disabled or young birds. The nesting season ranges from January – June and nest is an untidy platform of twigs, iron wire, tow, rags, rubbish, up in a large tree or on roof or cornice of building. The clutch size is 2-4 and eggs are dirty pinkish, white, lightly spotted and blotched with reddish brown. It is beneficial to farmers and agricultural ecosystem.

Egyptian Vulture *Neophron percnopterus* (Linnaeus,1758)

One of the most picturesque birds of prey which graces the shores of Malta during its migratory route is the **Egyptian Vulture** *Neophron percnopterus* (Linnaeus,1758), also known as the white scavenger vulture. Although this bird is usually present locally during autumn, it can sometimes be seen during winter and spring as well. It's not very big, being only around 56cm in length. However, the distinctive wedge shape of its tail makes it conspicuous, since its flights are concentrated during the warmer parts of the day. It feeds on carrion as well as rodents and reptiles, as well as eating the eggs of other birds. It is mostly white in colour with black wing tips and a yellow beak, and it usually builds its nest amidst the crags and cliffs on the coast.

Crested Serpent-Eagle *Spilornis cheela* (Latham, 1790)

The Crested Serpent-Eagle *Spilornis cheela* (Latham, 1790) comes under Order Falconiformes and family Accipitridae. It is a medium-large, dark brown eagle, with rounded wings and a short tail. The bird is dark brown with promiant black and white nuchal crest, full when erected. The bare facial skin and feet are yellow. The underside is spotted with white and yellowish-brown color.

During perching the wing tips do not reach until the tail tip. The tail and underside of the flight feathers are black with broad white bars. It is usually present in better wooded areas. It feeds on frog lizards, rats, snakes etc. The nesting season ranges from December to March and nest is a large stick platform, lined with green leaves, high in lofty forest tree, preferably near streams or clearing. Egg mostaly single, creamy or yellowish white boodly blotched with redish brown color. It beneficial to farmers as its diet also includes rats.

12.4 Importance of the Group (Ecological/Economic):

The presence of raptors in the wild serves as a barometer of ecological health. Birds of prey are predators at the top of the food chain; because threats like pesticides, habitat loss, and climate change have the most dramatic impact on top predators, we refer to them as indicator species. Researching the population trends of raptors 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. Raptors also play an important ecological role by controlling populations of rodents and other small mammals.

12.4.1 Farmers Friends:

Since many of the smaller raptors feed on insects and larger one's prey on rodents, many farmers truly appreciate them. The American kestrel, a smaller falcon, and the Eastern screech owl feed on insects. The great horned owl and the red-tailed hawk feed on rodents. Grasshoppers, cutworms, as well as rabbits and 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.

12.4.2 Natural Balancer:

Raptors 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 years when their population explodes due to good weather and a surplus of food. This is a common experience with fish, amphibian and even snake populations. Birds of prey help to balance the size of these populations.

12.4.3 Barometer of Ecological Health:

Raptors have been 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.

12.4.4 Disease Management:

Some of the larger birds of prey like the turkey vulture feed primarily on carcasses of dead animals. Occasionally, they will prey 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 turkey vulture are so powerful that it is resistant to most bacteria and germs. This is probably why the turkey vulture has been around 40 to 50 million years. Several species of vultures and condors besides the turkey vulture practice feeding on dead animals and making the environment safe for other animals.

12.5 Threat and Conservation Status:

The main threats to the birds of prey 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. 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 are the foremost step needed to be taken as soon as possible to avert the catastrophic consequences.

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