



## GIS Based Evaluation of Population Density and Diversity of Birds of Prey of District Muzaffargarh, Punjab Pakistan

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### Abstract

Diversity and evaluation of populations of raptors were accomplished in District Muzaffargarh (South Punjab, Pakistan) by using belt transect (5 × 0.1Km) method. In current study we reported total 447 raptors, that related to 10 species present in 2 families (Accipitridae and Pandionidae) with a density of 34.38 birds/Km<sup>2</sup>. Values of dominance (0.185), Simpson 0.818, Shannon Wiener 2.00, and evenness (0.567) were measured, recommended in even distribution of the species Black Kite (*Milvus migrans*; relative abundance, RA 0.082) was most plentiful species, followed by Shikra (*Accipiter badius*; RA 0.038), Marsh Harrier (*Circus aeruginosus*; RA 0.0336), Black Shoulder Kite (*Elanus caeruleus*; RA 0.0537), Honey Buzzard (*Pernis ptilorhynchus*; RA 0.0201), and Brahminy's Kite (*Haliastur indus*; RA 0.0157). Another five species (Steppe Eagle, *Aquila nipalensis*; Common Buzzard, *Buteo*; Long Legged Buzzard, *Buteo rufinus*; White Eyed Buzzard, *Butastur teesa*; and Osprey, *Pandion haliaetus*) were uncommon (RA 0.0022).

**Keywords:** Biodiversity, Population density, Birds of Prey, GIS, Relative Abundance

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## 1. INTRODUCTION

Pakistan is included in the list of countries rich in avifauna and attracts researchers to explore nature. Pakistan is the only country that falls in three zoogeographical regions, viz. Oriental, Palearctic and

Ethiopian, and holds about 650 recorded species of the birds <sup>1</sup>. The diversity of species determines the health of an ecosystem; higher the diversity more stable/ healthy is the ecosystem. Birds are not only important as having a key role in maintenance of the ecosystem, but are also important in the dispersal of seeds and as pollinator for many species <sup>2</sup>. The birds also act as bio-indicators of health of the ecosystem, as changes in the ecological conditions can be readily noticed through changes in population levels of specific bird species. Long-term effects of habitat fragmentation can be examined through changes in bird populations, their reproductive ability and behavioural patterns <sup>3</sup>. The anatomy of bird community can be associated to the vegetation form of forests.

The Indus River travels for about 2,900 km in Pakistan, flowing from the north to the south. The river along with its tributaries, is regarded as the lifeblood of Pakistan, being the central origin of water for agriculture <sup>4</sup>. Winter migrant birds locate from Siberia to Pakistan and India across the Indus valley and the Indus River is known as the motorway of migratory birds because it is rich in food and shelter for these birds. There are 14 species of the family Ardeidae (egrets and herons), 4 kingfishers, 4 cormorants, and many other passerines, which are semi-endemic to this region and residents of the Indus River System. Passerines adapted to the riverine sugar-cane thickets <sup>4</sup> involve, Jerdon's Babbler (*Chrysomma altirostre*), White-Tailed Stonechat (*Saxicola leucurus*) and Long-Tailed Grass Warbler (*Locustella caudata*).

Some 44 species of diurnal raptors have been reported from different areas in Pakistan during different parts of the year. Most of these raptor species are winter visitors to the River Indus System. Lack of attention has been recompensed to the study of diversity of biology of many prey birds. However with the advent of falconry and price of falcons with the Arab Falconers, raptors have gained popularity and now almost every village child is aware of their economic importance <sup>5</sup>.

A good body of research is available on population decline and range constriction of most raptor species in the Europe. However, very few are available on raptor species with reference to the in Indian sub-continent, including Pakistan. This is because they are relatively difficult to be detected due to their secretive nature <sup>6,7</sup> and flying high.

In the process of occupying a high-ranking area, many ecological aspects are involved. Since predatory activity is difficult to be observed in most species breeding needs are associated with presence and abundance of prey species as well as plant types, structures, and/or land uses. The use of the soil or plant structure by raptors is often associated with positive hunting <sup>8</sup>.

In the last two decades, the distribution of genocidal raptors is becoming more commonly used as instruments for the management of utility protection. Rapid development of the GIS and, most recently, a satellite earth observation data collection with proper housing modelling techniques, handling is easy and provides large local scales and repetitive, standardized and verified information for the environment data management for monitoring environmental indicators on a long-term basis <sup>9</sup>.

When resources are supplied uniformly and regularly, the birds of prey nests can be isolated, conversely when the resources are unexpected or concentrated in specific locations, breeding concentrates in those places <sup>10</sup>. This is also the manner in which incidents of human misery and persecution are distributed.<sup>11,12</sup> However, the existence or non-appearance of a raptor bird species in a region may be an indicator of presence of living organism, but it says little about the area's quality. Measures of species multiplicity in each area, on the other hand, are frequently suggestive. However, the relative quality of the neighbourhood as a housing situation can be perplexing <sup>13,14</sup>.

A geographic information system (GIS) is a tool that works with geographic data, specifically a map. GIS is a system that allows the reading, modifying, storing, and controlling special data in general. GIS capabilities provides a wide spectrum of users, the vast majority of whom desire it. There would not

be such a solid basis for GIS if it were not for that. As a result, they become able to work together more effectively<sup>15</sup>. Looking at the format in its data sets, or layers, is a more thorough and straightforward way to explain GIS. “A collection of maps from the same area, where all of the maps in the system have the same coordinates”<sup>16</sup>.

In recent decades, geographic information system (GIS) employed in general policymaking both for ecological and wildlife organization and managing. (GIS) system that is Geographical information systems are computerized and stored to data<sup>17</sup>. A GIS model has been built to serve as a centralized, user-friendly template for Ammonite seam sample matching for species identification. GIS was created to allow computers to perform local analysis and geological mapping for environmental issues. Using GIS to apply local analysis approaches to ancient problems is a novel and inventive way to do it<sup>18</sup>. as required According to the case study, GIS technology enables local data management and analysis<sup>19</sup>. Wildlife is on the blink of extinction due to habitat disturbance by human influence, Pollution, climate change, habitat destruction and use of insecticide etc. Due to which birds' population is declining hence there is direct need to explore the birds' density.

## 2. material and methods

### 2.1. Study Area

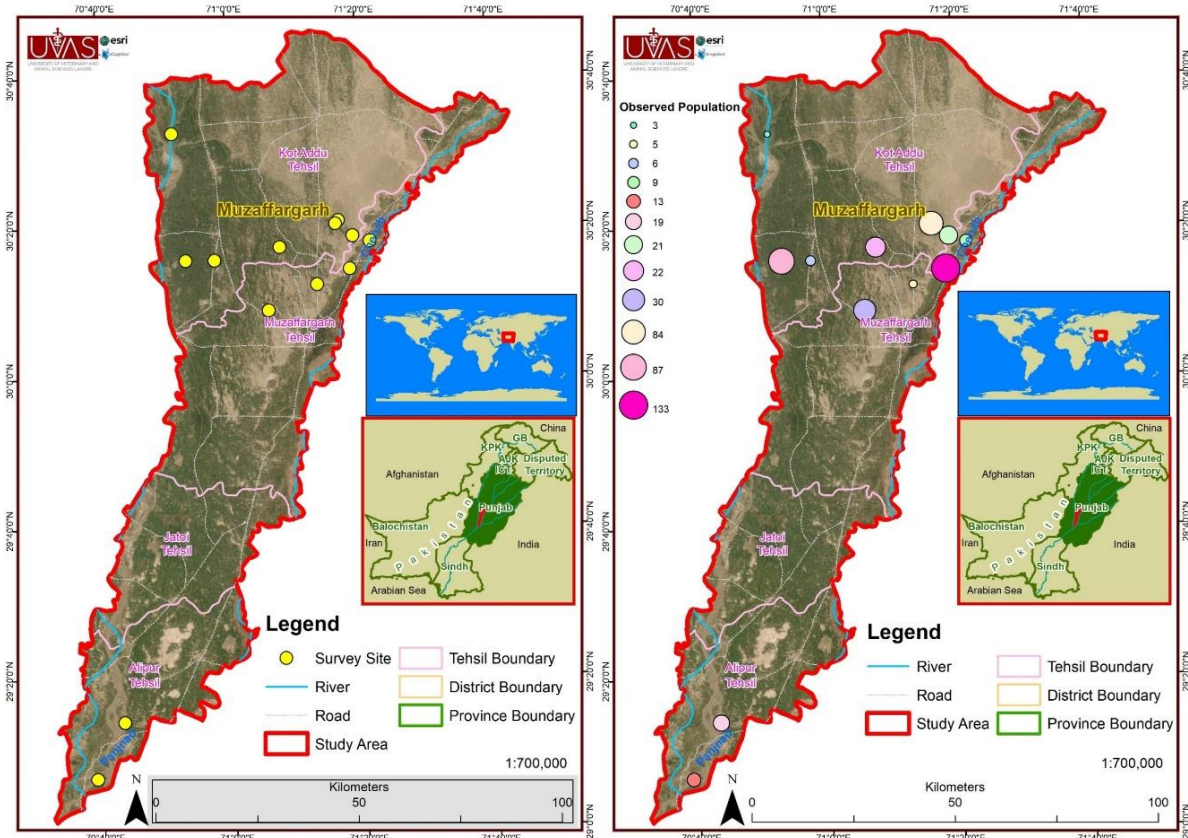
Area Muzaffargarh, with four its Tehsils, viz., Kot Addu (30.4685° NL, 70.9606°E), Muzaffargarh (30.0736° NL, 71.1805° E), Ali Pur(29.3817° NL, 70.9131° E), Jatoi (29.5069° NL, 70.8536°E) with an area of 8249 km<sup>2</sup>, is located between the two north-south running main rivers (Chenab in the east Indus River in the west) in the southern Punjab (Pakistan) (Figure 1). District has randomly distribution of crop fields, orchards, and forested plantations.

### 2.2. Methodology

The study was organized at Department of Zoology at University of Okara. Remote notice, GIS Laboratory, Department of Wildlife or Ecology at University of Veterinary or Animal Sciences, Ravi campus, Lahore, was nearly new for GIS mapping of sample spots.

Thirteen (13) transects (each transect  $5 \times 0.2 \text{ km}^2 = 1 \text{ km}^2$ : total transect sampling area = 13 km<sup>2</sup>) were established in different parts of the district Muzaffargarh to assess the population of raptors (Figure 2). Two workers (including the author) walked as well as covered the area on vehicles, through each transect area following a predefined transect line between 9:00 am and 3:00 pm at different dates during January-March, 2021, counting/ recording the flying raptors of different species encountered within a range of 100 m on each side of the transect lines (Pollard, 1977;<sup>20</sup>. Records on coordinates of location of each sighted birds were recorded using global positioning system (GPS Essentials App).

Total animals noted that were divided by strip's region and multiplied by total area of the district to obtain the total population demographic for the district<sup>21</sup>. The selected sites were visited several times for the observation of birds. The species of the spotted bird was identified, and scientific names assigned using<sup>1</sup>.



1: chart of Study Site

Figure 2: chart of the observed population in District Muzaffargarh

**2.3. Birds Diversity Index**

Bird diversity indices were calculated as:

**2.4. Simpson index 1-D.** it was calculated on the based of this formula (Simpson, 1949).

$$D = 1 - \{ \sum n(n-1) / N(N-1) \}$$

Where:

n = the total number of birds of a particular species

N= the total number of birds of all species

Population trend line series was run by using bird density as the dependent variable, while month’s-controlled variables.

**2.5. Shannon index (entropy).** There is a diversity index that takes into consideration both number of taxa and number of different species. People that belong to communities with only one taxon have values ranging from 0 to high values in communities with numerous taxa, each with a limited number of individuals.

**2.6. Shannon-Weiner Index:** Simpson Index (Simpson, 1949), Shannon-Weiner (Shannon & Weaver, 1949) indices to species evenness, abundance, diversity as well as Simpson Index (Simpson, 1949), were cast of evaluate the diversity of bird species. In accordance with individuals or Shannon Weiner Index are picked at random from the massive independent populations to ensure that all species are constitute in sample population. Substantially used metric for assess biodiversity in different types of ecosystems, Shannon

diversity is a generally used index for measuring biodiversity. <sup>22</sup> The following formula was cast off to determine the species that have diversity in different habitats <sup>23</sup>.

$$H' = - [\sum P_i \ln P_i]$$

Where in formula  $H'$  = Diversity Index;  $P_i$  = is proportion of every species in sample;  $P_i$  = natural logarithm of proportion

Presence of individual of species is doesn't need to suggest that the different species are widespread. Shannon Weiner Diversity Index gain typically range from 1.5-3.5, with relatively few exceptions above 4.5. A result approaching 4.6 indicates that the number of individuals in each species is dispersed evenly.

#### Population Density

Population density was calculated through the formulae:

$$\text{Population Density} = \text{Birds observed} / \text{Total transect area}$$

#### Estimated Population

Population in the study area was estimated by formula:  $P = AZ/2XY$

Where:

P = Population

Y = Average flushing distance

A = Total area of study

X = Length of strip

Z = Number of individuals observed

### 3.RESULTS

Total number of 447 birds, that are related by two families (Accipitridae and Pandionidae) and 11 species were recorded. The family Pandionidae was represented by only a single species, viz., Osprey (*Pandion haliaetus*). Other 10 species belonged to the family Accipitridae.

Black Kite was recorded in the highest frequency and recorded as the most abundant species with count of 370 (population density: PD 28.46/ km<sup>2</sup>). Five species, viz. steppe eagle, common buzzard, white eyed buzzard, long legged buzzard, and osprey showed their appearance through a single individual recorded in a single transect, yielding a population density of 0.08/ km<sup>2</sup>. Amongst other five species, Black Shoulder Kite (population density = 1.84; frequency= 24) appeared in the highest density followed by Shikra (population density=1.31, frequency = 17), Honey Buzzard (population density = 0.69, frequency = 9), Marsh Harrier (population density = 1.15, frequency = 15) and Brahminey's Kite (population density = 0.54, frequency = 7). (Table 1; figure 3).

**Table 1:** Population density (per km<sup>2</sup>) of different raptor species (Order Accipitriformes; Aves) recorded in District Muzaffargarh during January-March 2021. Sampled area for all species is 13 Km<sup>2</sup>.

Sr. No.	Common name	Scientific name	N	Transects positive for species (#, frequency)	Population Density per km <sup>2</sup>
<b>Family: Accipitridae</b>					
1.	Black Kite	<i>Milvus migrans</i>	370		28.46
2.	Black Shoulder Kite	<i>Elanus caeruleus</i>	24		1.84



3.	Shikra	<i>Accipiter badius,</i>	17	1.31
4.	Marsh Harrier	<i>Circus aeruginosus</i>	15	1.15
5.	Honey Buzzard	<i>Pernis ptilorhynchus</i>	9	0.69
6.	Brahminy's Kite	<i>Haliastur Indus</i>	7	0.54
7.	Steppe Eagle	<i>Aquila Nepalese's</i>	1	0.08
8.	Familiar Buzzard	<i>Buteo buteo</i>	1	0.08
9.	White Eyed Buzzard	<i>Butastur teesa</i>	1	0.08
10.	Large Legged Buzzard	<i>Buteo rufinus</i>	1	0.08
<b>Family: Pandionidae</b>				
11	Osprey	<i>Pandion haliaetus</i>	1	0.08
	<b>Overall</b>		445	0.08

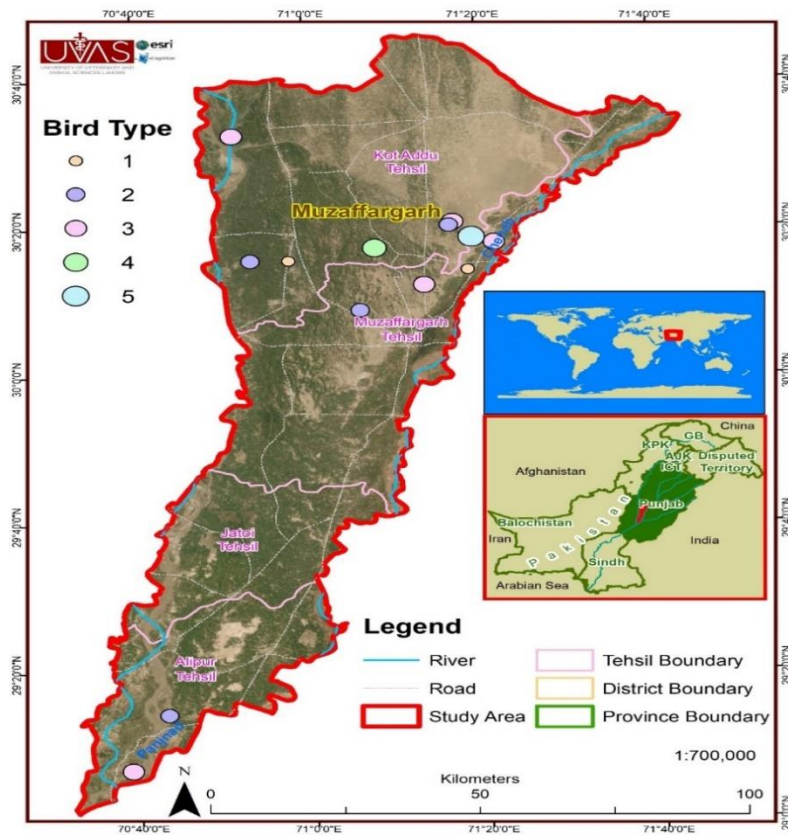


Figure 3: Types of birds observed in the study area.

### 3.1. Diversity Indices

Overall raptor diversity indices have been calculated and presented in Table 2). The overall value of evenness index has been calculated as 0.5666, suggesting a moderately even distribution of raptor population in different parts of the district Muzaffargarh. The value of Shannon-Weiner diversity index has been placed at 1.997, ranging from 1.5 and 4.5 for different species, which is indicative of a relatively low raptor diversity in the district under present study. Simpson's Diversity Index value for the overall raptor population has been calculated to be 0.8175, which also reflects a lower species diversity in the raptor population. The calculation on the dominance index yielded a value of 0.1825 indicating that none of the raptor species in the area has a higher dominance.

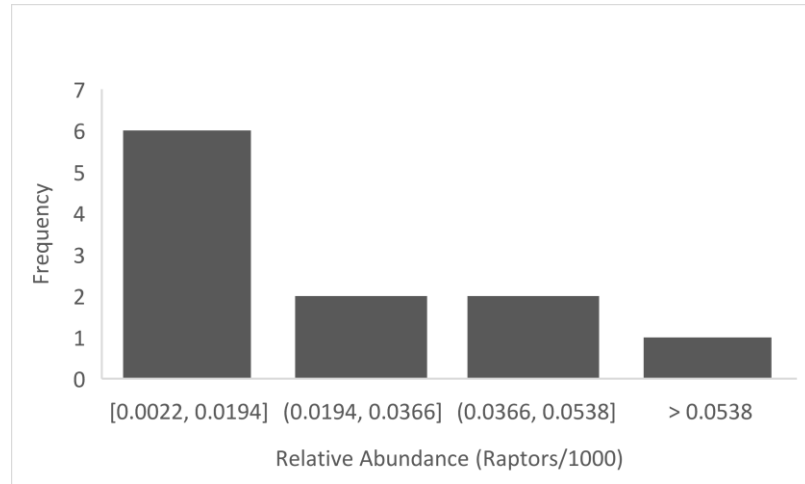
**Table 2.** Diversity indices of Raptors.

Diversity Index	Results
Dominance_(D)	0.1825
Simpson_(1-D)	0.8175
Shannon-Winner_(H)	1.997
Evenness_(e <sup>H</sup> /S)	0.5666

### 3.2. Relative Abundance

The terms defined by Levine and Bull <sup>24</sup> were used to describe frequency of occurrence and relative abundance. Extremely abundant species are those found more t1000 individuals each day in the area, abundant species are those found between 200 and 1000 individuals, very common species are those found between 51 and 200 individuals, and common species are those found between 21 and 50 individuals. Similarly, bird species with a population of seven to twenty individuals each day were classified as reasonably common, while those with a population of one to six individuals are classified as rare. Birds having only 1-6 species per season are classified that are extremely infrequent <sup>2</sup>.

Black kite (*Milvus migrans*) was found most abundant species with relative abundance of 0.8277. Black Shoulder Kite (*Elanus caeruleus*) was termed as common species having relative abundance of 0.0537. Four species namely *Haliastur indus* (Brahminy's Kite), *Accipiter badius* (Shikra), *Pernis ptilorhynchus* (Honey Buzzard), and *Circus aeruginosus* (Marsh Harrier) were found reasonably common with affluence of 0.0336, 0.0157, 0.0201, 0 .038 individually. Five species Pandion haliaetus (Osprey), *Aquila nipalensis* (Steppe Eagle), *Buteo buteo* (Common Buzzard), *Buteo rufinus* (Long Legged Buzzard) Butastur teesa (White Eyed Buzzard) were termed as rare species with relative abundance of 0.0022 equally (Figure 4).



**Figure 4:** Frequency of 'Relative Abundance (Raptors/1000)

**3.3. Habitat Preference**

Total raptor population in the study site was 437 raptors with population density of 34.38 raptors/Km<sup>2</sup>.

Three species have been sighted in Wandar (Black Kite =03, Shikra =01, and Honey Buzzard =01). Two line transects were taken at Langar Sarai, and the black kite was the most abundantly observed (n 138). Additionally, two species of shikra and marsh harrier were observed along these transects. The transect 4 was taken near Sinawan from Dharolli lake, Adda IR, and four species were observed (Marsh Harrier=2, Black Shoulder Kite=7, Black Kite=10, Honey Buzzard=2). Along GT Rd, Basti Tibbi Nizam, track 5 was observed, but only one species of black kite=6 was observed. Track 6 was taken from Bet Esan Wala and observed a black kite with a score of 85 and a shikra with a score of 2. Black kite=80, shikra=2, juvenile Brahminy's kite=06, adult Brahminy's kite=1, marsh harrier=10, and steppe eagle=1 was observed from track 7 and 9 along the Taunsa linked Canal, which originates from the Sindh River at Taunsa Barrage, flows west to east, and empties into the Chenab River at Head Muhammad Wala. The track 8 was taken from Khanpur North and included observations of a white-eyed buzzard=1, a black shoulder kite=2, and a black kite=2. In track 10, a black shoulder kite=1, a common buzzard=1, and a long-legged buzzard=1 was observed at Taunsa Barrage, a RAMSAR site declared on March 22, 1996. At Gul Wala, track 11 was observed with 28 black kites and 2 shikras. The tracks 12 and 13 were taken from Panjnad Headworks, and the following species were observed: shikra=3, honey buzzard=6, black shoulder kite=14, black kite=18, and osprey=1 (Table 4).

**Table 3.** Coordinates where the raptors were observed in the study area.

Sr. No.	Locations	(Coordinates)				Raptors Observed	Scientific Name	Habitat
		Starting Point		Ending Point				
		Longitude	Latitude	Longitude	Latitude			
1	Wandar,	30.346504	71.283607	30.309996	71.313995	Black Kite, Shikra,	<i>Milvus migrans, Accipiter</i>	Desert



						Honey Buzzard	<i>badius</i> , <i>Pernis ptilorhynchus</i>	
2	Langar Sarai, Pakistan	30.300056	71.363457	30.275961	71.319542	Black Kite, Shikra, Marsh Harrier	<i>Milvus migrans</i> , <i>Accipiter badius</i> , <i>Circus aeruginosus</i>	Wetland
3	Langar Sarai, Pakistan	30.239047	71.311142	30.209156	71.272286	Black Kite	<i>Milvus migrans</i>	Wetland
4	Adda 1R,	30.288837	71.132301	30.246294	71.115555	Marsh Harrier, Black Shoulder Kite, Black Kite, Honey Buzzard	<i>Circus aeruginosus</i> , <i>Elanus caeruleus</i> , <i>Milvus migrans</i> , <i>Pernis ptilorhynchus</i>	Marshy
5	GT Rd, Basti Tibbi Nizam	30.261583	70.965691	30.261583	71.017743	Black Kite	<i>Milvus migrans</i>	Grass land
6	Bet Essan Wala, Pakistan	30.261583	70.891609	30.261583	70.83957	Black Kite, Shikra	<i>Milvus migrans</i> , <i>Accipiter badius</i>	Canal Bank
7	Taunsa Canal	30.339054	71.276046	30.376383	71.246923	Black Kite, Shikra	<i>Milvus migrans</i> , <i>Accipiter badius</i>	Canal Bank
8	Khanpur North,	30.205094	71.226822	30.164767	71.201823	White Eyed Buzzard, Black Shoulder Kite, Black Kite	<i>Butastur teesa</i> , <i>Elanus caeruleus</i> , <i>Milvus migrans</i>	Desert
9	Taunsa Canal Rd,	30.312481	71.31971	30.336975	71.276046	Black Kite, Juvenile Brahminy's Kite, Adult Brahminy's Kite, Marsh Harrier,	<i>Milvus migrans</i> , <i>Haliastur indus</i> , <i>Circus aeruginosus</i> , <i>Aquila nipalensis</i>	Canal Bank

						Steppe Eagle		
10	Taunsa Barrage Ramsar Site,	30.543455	70.859642	30.528925	70.909032	Black Shoulder Kite, Common Buzzard, Long Legged Buzzard	<i>Elanus caeruleus</i> , <i>Buteo buteo</i> , <i>Buteo rufinus</i>	Riverine Land
11	Gul Wala	30.148943	71.101631	30.165925	71.149832	Black Kite, Shikra	<i>Milvus migrans</i> , <i>Accipiter badius</i>	Desert
12	Panjnad Headworks	28.95087	70.534851	28.986637	70.50372	Shikra, Honey Buzzard, Black Shoulder Kite	<i>Accipiter badius</i> , <i>Pernis ptilorhynchus</i> <i>Elanus caeruleus</i>	Riverine Land
13	Panjnad Headworks	29.255191	70.321802	29.297915	70.305633	Black Kite, Osprey	<i>Milvus migrans</i> , <i>Pandion haliaetus</i>	Crop Land

#### 4. Discussion

The study' was designed to know the distribution and plenty of bird of prey species that live at many different places are distributed in the district Muzaffargarh (southern Punjab, Pakistan). The study also attempted to understand as well as to explain as to how the raptor distributions and abundances is related to environmental variables in those habitats. Black Kite made up the bulk of the raptors counted (82.77%), and their abundance did not remain constant across research years<sup>25</sup>. This research was planned to determine their distribution, diversity and abundant of the raptors, in many ecosystems in District Muzaffargarh. In general, state indicators assessing species population trends were heavily favoured in newly published academic serve at avian indicators biodiversity, but pressure measured by reflecting climate exchange consequences are rare<sup>26</sup>. The loss of habitat threatens 46 percent of all tropical birds of prey. As a result, they are very adaptable to urbanization. Many of the birds of prey seen were near roads, most likely to feed on dead animals and birds killed by passing cars. This is similar with the findings of<sup>27</sup>, who claimed that the distribution of raptors was heavily influenced by the availability of food, water, and cover. Birds of prey are often employed as mark species due to its location that are present at head of food chain or diversity of life history characteristics (like fecundity or low density) that supply to it categorically susceptible to man-induced changes at buttress habitats<sup>28</sup>. Their prey species, like as rats and pigeons, are numerous in urban settings, and cities often include buildings that resemble their native habitats<sup>29</sup>. Raptors are typically the first to go extinct or severely impacted in a system following human perturbations such as pollution<sup>30</sup> or changes in ecosystem composition and structure<sup>31</sup>. Recent observation on different bird communities that produced conflicting findings at link between diversity, species richness and their domain change<sup>32</sup>. According to some research, these characteristics

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typically decline with agricultural intensification and urbanization<sup>33</sup>, while others indicate that both species richness and diversity peaked at medium rates development<sup>34</sup>. It was observed that raptors were found in riverine area, deserts, along canal bank, cropland grassland and wetlands.

Accipitrids are distributed all over the world. They are found on every continent except Antarctica, as well as on most marine islands. They are found in every major habitat type, apart from the extreme northern polar tundra and the driest deserts. Tropical areas have the greatest variety of accipitrid species<sup>35</sup>. According to another research, the species may be found throughout Asia, Europe, Australia and Africa. Moderate populations are beat it as migrant, other stifling populations are inhabitant. Central Asian birds (*M. m. migrans* and *M. m. lineatus*) and European migrate to the equatorial winter, while migrate toward warmer areas, like Australasian *M. m. affinis* (fork-tailed kite) and Indian *M. m. govinda* (little Indian/pariah kite) remain permanent. At certain places, like as black kite of United Kingdom is migrant hiker.

Large inhabitants of different tiger prey species that are sparsely spread across large geographical areas, lie across the sampling is a systematic and profitable technique for abundance or determining density. To examine these techniques, it is necessary to demonstrate that detected animal groups are limited with increasing the distance from transect line and that is perpendicular distance between each group of animals be determined for each animal group. The strategy is particularly effective when used to prey populations of moderate density that are organised into clearly recognised groups. The habitat should be open enough to allow for the observation of animal groupings on or near the line while still maintaining privacy<sup>36</sup>.

A number of 447 birds that are related with two families (Accipitridae or Pandionidae) and 11 species were observed. Ferguson-(2001) also found that black kite is most abundant species. The family Pandionidae consisted of only one species of Osprey (*Pandion haliaetus*). Other nine species belonged to the family Accipitriformes.

Black kite was found the most species with count of 370 while only one species of steppe eagle, common buzzard, white eyed buzzard, long legged buzzard, and osprey were observed. 17 species of shikra were observed. 9 species Honey buzzard were observed. 15 species of marsh harrier, 24 species of black shoulder kite and 7 species of Brahminy's kite were observed (Table 1). These findings were consistent with Bekele and Mengesha<sup>37</sup>. Bird variety is an indicator of heterogeneity place, and the number of species and individuals in an area indicates significance of that region. All habitat contains unique combination of the microenvironments which appropriate to particular individuals.

Constancy of birds' species analyses the characteristics of each species' their population size, which was 0.5666, while species richness was  $n = 437$ , Shannon-Weiner diversity is experienced by raptors assessed is 1.997. Measure diversity that exhibits evenness and richness into account. According to Bibi and Ali<sup>2</sup>, the range of this value is between 3.5 and 1.5, with just a few exceptions above 4.5. According to<sup>38</sup>, form in bird species variety, richness, and abundance is linked to plant structure, which causes in nutrients supplies, protection and nesting depending upon the bird home choice and feeding.

The black kite (*Milvus migrans*) was found most abundant species are compared with 0.8277. Kite Shoulder black (*Elanus caeruleus*) was termed as common species having compared with 0.0537. Four species namely *Haliastur indus* (Brahminy's Kite), *Accipiter badius* (Shikra), *Pernis ptilorhynchus* (Honey Buzzard), and *Circus aeruginosus* (Marsh Harrier) were found reasonably common are related with different values 0.038, 0.0201, 0.0157 and 0.0336. Five species *Pandion haliaetus* (Osprey), *Butastur teesa* (White Eyed Buzzard), *Aquila nipalensis* (Steppe Eagle), *Buteo buteo* (Common Buzzard) and *Buteo rufinus* (Long Legged Buzzard) were termed as rare species with relative abundance of 0.0022 equally (Figure 4).

These values communicate with geographical diversity in population community of humans, like as human waste and ceremonial sacrifices. At level of individual the home territory selection goes over up to population-level implications so these kite breeding couples were formally shown to choose locations with alike features. The subsidy impact on density, on the other hand, was more complicated since it was also influenced by breeding-site availability. In response to religious subsidies, increased availability of nest-site enabled the individual grow very rapidly by attained greater densities. Lower nest availability, on the other hand, limited the breeding population's responsiveness to religious clam. Thus, the availability of nesting structures influenced the individual of population have capacity to detect food supplies. At last, the considerable availability of both urban nesting and human subsidies facilities (towers, trees, artificial poles) enabled the individual of population achieve excessive densities, the consequences is that world's have highest raptor application<sup>39</sup>.

Measurement of density takes both evenness or richness into account. It was a good tool for determining the biodiversity profile across the research area<sup>2</sup>.

The Simpson index runs from 0-1, with 0 show the infinite diversity and 1 show no diversity; 0.8175 indicating moderate diversity in the research area.<sup>40</sup>

## 5.CONCLUSION

It is concluded that there is a need to focus the human activities to degrade its negative effects on biodiversity of raptors. Raptors are the best way to determine the changes and effects in the ecosystem. Using the line transect method, this thesis explains the diversity indices, population estimation of the District Muzaffargarh, and the relative abundance of the raptors. From this study, raptors have a wide range of habitat from deserts to the wetland and riverine areas even in cropland near the belt of Indus River in District Muzaffargarh. There is a decline in the species of common buzzard, white-eyed buzzard, long-legged buzzard, steppe eagle and osprey only one species of each recorded. There was an increase in the number of black kites, shikra and marsh harrier.

The major causes in the decline are destruction of habitat, increase in temperature due to deforestation, unawareness, and poverty of the community. Even though there are many reasons of bird population contract are still undisclosed, we must make usage of top available data to ensure that raptor conservation preferences formed that relate to solid scientific research. Collision of ecosystem services should be assessed on a daily foundation by using techniques like that bird mark to evaluate our failure or even our success in protect native species as a result, ecosystem biodiversity and their functions in general.

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Not applicable

## CONFLICT OF INTEREST

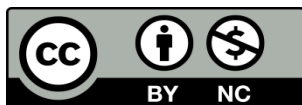
Regarding to this article all authors declare no conflict of interest

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