

Human activities impact on distribution of mammalian species in the vicinity of Uchali complex, Punjab, Pakistan

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SUMMARY

This study was conducted to know the human activities effects on distribution of mammalian species in the vicinity of Uchali complex, Punjab, Pakistan. Direct count method includes notify the physical presence of mammals and it also includes to identify mammals by their voices. Indirect count was another method that was used to identify mammals with the help of their foot-prints, fecal material, marks on the trees and questionnaire of conducted by group survey. The highest Shannon wiener index ($H'=2.63$) and high richness ($R=2.68$) are recorded from forest habitat as compared to other habitats and disturbed areas have low diversity and high dominance, it is concluded that anthropogenically impacted landscapes are negatively impacting on the diversity and distribution of mammalian species.

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INTRODUCTION

Human populations reached one billion after 50,000 years, following which they increased significantly. If present rates of population increase continue, the world's population might be reached 9.3 billion by 2050 (Bloom, 2011). Asia was once thought to be one of the most diverse continents, but population growth has harmed the region's diversity (McDonald *et al.*, 2008), as enhancing populations have increased demand for food and shelter, resulting in agricultural development, enhanced development in housing societies and industries, pollution and climate change. Over the last thousands years, wild vegetations have been changed to agricultural regions; generalist species have adapted to new environments, while specialist species have become vanished (Di Giulio *et al.*, 2009). At the close of the twentieth century, intensive farming changed land use and had a large impact on the diversity of places. Conservation planning requires a population census of all species in urbanized and per-urban regions (Stoate *et al.*, 2009).

Ecologists interested in restoring species in urbanized regions confront numerous hurdles (Miller and Hobbs, 2002), hence this section was left unfinished. However, by the end of the twentieth century, patterns of urbanization had been

examined (Veech, 2006) and conservation of urbanized environments had become a priority (Clergeau *et al.*, 2006).

Mammalian species are an integral part of all different ecosystems and play a key role in ecosystem sustainability. Many animal species have nutritional value and serve as a good protein source in human nutrition (Robbins, 1983). Different animals play critical roles in tourism and studies (Bodmer *et al.*, 1994; Lindsey *et al.*, 2007).

Environment enthusiasts enjoy spending time with creatures and are entertained by their behaviours such as feeding, voice calls, and so on, and these actions inspire conservation programs among the general public (McKinney, 2002). Kit foxes are abundant in some urban settings in the United States (Nelson *et al.*, 2007), and residents of these areas are actively interested in management work for the species in both urban and forest habitats (Dearborn and Kark, 2010). Northern palm Squirrels choose to extant rural and gardens in urban areas in Pakistan (Altaf *et al.*, 2012). The first step in species conservation is the collection of data on mammalian distribution and abundance. (McKinney, 2002).

The main causes of the fall in mammalian diversity in Pakistan are urbanisation and habitat destruction (Altaf *et al.*, 2014). Other factors involve food scarcity, flora modification, pollution (Shochat *et al.*, 2010) and unfavourable human behaviour (Rytwinski and Fahrig, 2012). It is critical to know species habitat choices in order to comprehend diversity trends (Riem *et al.*, 2012). It is a common misconception that as human population density increases, variety declines. Few animals like to live in close proximity to humans; also, diversity is higher in regions of ecotone (Magura *et al.*, 2004). From natural environments to disturbed habitats, mammalian diversity varies. Considerable research on mammalian species variety has been undertaken in North America, Australia, and Europe, but Asian mammalian species have rarely been examined. The current study will analyse the mammalian variety of the Uchali complex's urban, peri-urban, and forest landscapes. This research on the animals of the Uchali complex is critical in exposing the diversity of species. The primary goal of this study was to better understand the distribution patterns of mammalian species in forest environments over different gradients.

MATERIALS AND METHOD

This investigation was guided by information gathered from Uchali Wetland, it is a Ramsar site. Uchali wetland is the three wetlands in the “Uchali wetlands complex” (Figure 1). Uchali complex is a “943-hectare” study area with depths ranging from 0.2 to 6 metres at an altitude of “764 metres above sea level”. The study area has an arid subtropical environment with chilly winters and scorching summers. The typical annual rainfall in the study area ranges from “300 mm to 800 mm”, and the “relative humidity” ranges from “22 percent to 85 percent”. Temperature varies from an average low of “0.5°C” in January to a high of “36°C” in June (Dauda *et al.*, 2017). The data collected from the four areas; including following Forest, Rural, Urban and Agricultural areas.

Purpose of study was to assess the diversity of mammals and to fulfill these purpose different methods was applied including direct, indirect and linear count methods. Direct count method includes notify the physical presence of mammals and

Statistical analysis was conducted by using “PAST version 2.17c” (Hammert et al., 2001) to find out the “Simpson diversity”, “Shannon diversity”, “Evenness”, “Margalef”, “Dominance” and “Principal component analysis” (PCA).

RESULTS AND DISCUSSION

Present survey was conducted to record different variety of mammals and it was recorded that study area carried 5 small and 15 medium and large mammalian species out of 20. Maximum mammalian species recorded from forest habitat, while other mammalian species found from agriculture forest habitat, rural forest habitat and urban forest habitat (Table 1). Total 20 species were recorded, out of total 17 were recorded from the forest, 4 from urban, 6 from rural and 7 from agriculture habitats of Uchali Complex. Highest number of individuals is noted from forest area (393) and further reduced as; urban (85), rural (91) and agriculture (36). Highest dominance (0.40) and Evenness (0.84) depicted that similar individuals and less diversity were highest in urban habitats in compared with others habitats. While highest population and diversity were witness highest Simpson diversity (0.91) in forest habitat in comparison with other habitats. High Shannon wiener index (2.63) was recorded in forest and high richness (2.68) show highest population and diversity in forest habitat as compared to other habitats (Table 2).

Total 20 species were recorded, out of total 17 were recorded from the forest, 4 from urban, 6 from rural and 7 from agriculture habitats of Uchali Complex. Highest number of individuals is recorded from forest (393) and further reduced as; urban (85), rural (91) and agriculture (36). Highest dominance (0.4012) and Evenness (0.8416) showed that less diversity and similar individuals were highest in urban habitats as compared with others. While highest diversity and population were documented highest Simpson diversity (0.9132) in forest habitat as compared with other habitats. Highest diversity and population were recorded from the forest habitat as compared with other habitats. The first two axes of the “PCA” explained 94.066 % of variation in sampled mammalian community (“Axis 1”: 71.973%; Axis 2: 22.093%). Variables loading onto “Axis 1” included Urban ($r = -0.39075$), Rural ($r = -0.2971$), Agriculture ($r = 0.0090634$) and Forest ($r = 0.87118$). The extent and direction of these associations indicate that Axis 1 integrated the natural response of mammalian groups to altered habitats. Axis 2 Urban ($r = 0.65471$), Rural ($r = 0.56397$), Agriculture ($r = -0.12582$), and Forest ($r = 0.4873$) habitats were also loaded. “Axis 2” extracted mammalian community patterns that are unrelated to those indicated by “Axis 1”. Most habitat factors have no significant relationship with other “PCA” components, indicating that human involvement impact was the primary factor influencing the mammalian diversity (Figure 2). Previous researcher used same finding (Altaf et al., 2018).

Study area has diversity of mammals and this diversity occupy different habitats which showed that the Uchali complex is heterogeneous mixture having different types of habitat. The observation of different types of habitat was helpful in conservation of mammalian species of Uchali complex. Present study survey showed that different mammalian species of study area occupy different habitats. Mammalian species prefer urban, rural and agriculture and forest habitats according to environment suited to them. Large and medium size mammalian species i.e. Asiatic

jackal, Indian crested porcupine, red fox, long eared desert hedgehog, desert hare, jungle cat, Indian wild boar, Indian desert cat, little Indian field mouse, Indian grey mongoose, small Indian mongoose, Indian pangolin, urial, small Indian civet and Brandt's hedgehog usually prefer forest habitats. Some of species such as little Indian field mouse, Asiatic jackal, Indian wild boar, red fox, small Indian mongoose, Indian grey mongoose and long eared hedgehog also occupy agriculture habitat. Northern palm squirrel, house mouse, house shrew and house rat species preferred to live in urban and rural habitats. Mammalian diversity is attracted by the urban area because urban habitat provide shelter and food source to many wildlife species. But, some wild species avoid human interaction because some wildlife species feel shy; such species prefer calm places and constricted their ranges over natural habitat. Nevertheless, these species, such as Asiatic jackal and wild boar, enter populated regions at night to avoid human interaction, and at night there is little human intervention. Similarly, a few species, such as the small Indian mongoose, Indian grey mongoose, jungle cat, Indian desert cat, and Indian crested porcupine, prefer to dwell near human settlements (Table 1). Other researchers agree with these findings (Altaf, 2016; Altaf, 2017; Azad *et al.*, 2018; Chughtai *et al.*, 2018; Iftkhar *et al.*, 2018).

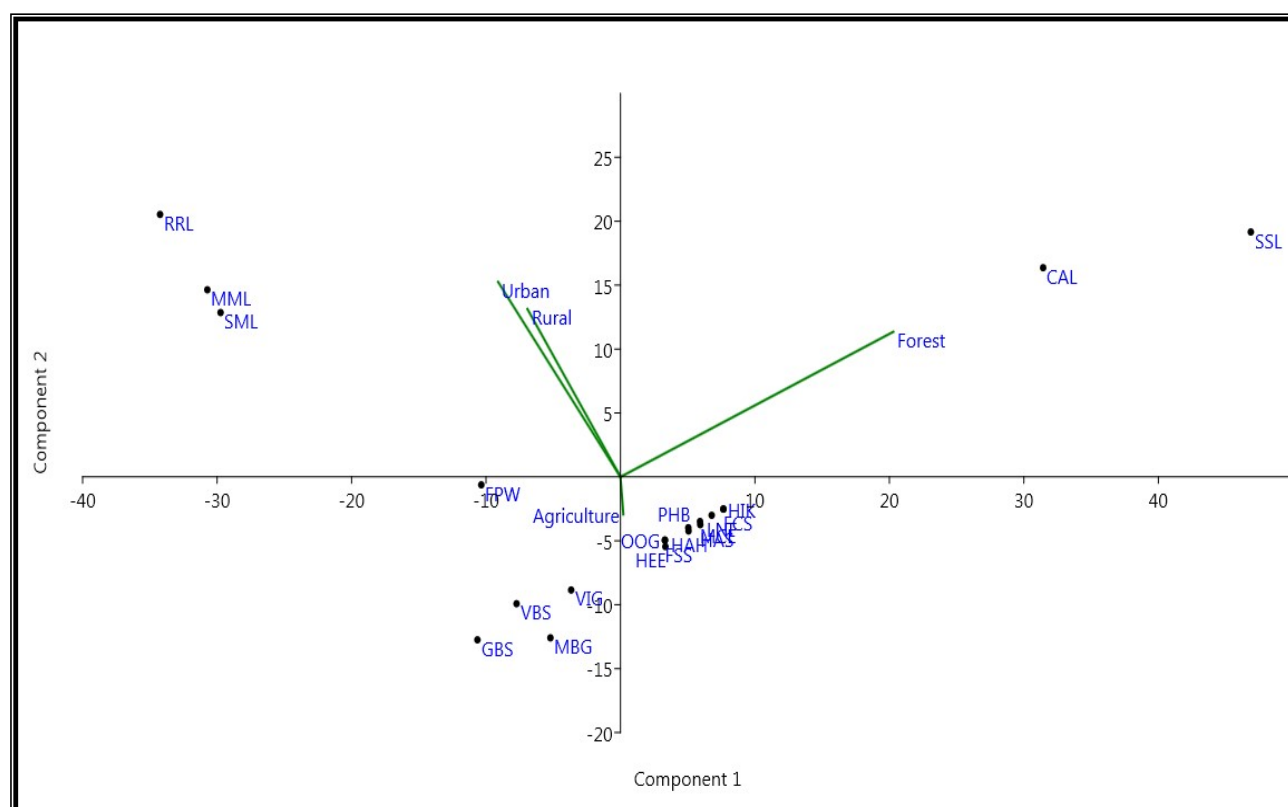


Figure 2: PCA shows the distribution of Mammalian species (code present in Table 1).

The landscape variations are the features that impacting the distribution of diversity of large, medium and small wild mammalian species around the river Chenab (Table 2). Depend on our statistical analysis, we can predict the wild mammalian in a given landscape gradients. Species of animal react rapidly to anthropogenic impact (Stoate *et al.*, 2009; Altaf, 2016; Altaf *et al.*, 2018). Large-scale

conservation and restoration programmes for mammalian species, particularly forest diversity, should be developed (Branton and Richardson, 2011). Small green spaces and corridors, on the other hand, are critical for mammal conservation in urban settings when big forest patches have vanished. Protection strategies must be concentrated on urbanisation planning.

Sightings of numerous animal species decreased as they moved from forest to urban areas; however some species favored somewhat or/and entirely disturbed landscapes. Large species as well as medium-sized species of mammals, such as Indian fox (Azad *et al.*, 2018), Indian wild boar (Chughtai *et al.*, 2018), Indian Pangolin (Iftkhar *et al.*, 2018), jungle cat (Bilal *et al.*, 2021) and desert hare are typically prominent in forest landscapes, according to several studies (Bateman and Fleming, 2012; Riem *et al.*, 2012). The slightly disturbed environments are preferred by the small Indian mongoose (Altaf *et al.*, 2018), Indian crested porcupine (Safeer *et al.*, 2018), Asiatic jackal, Mediterranean pygmy shrew, Northern palm squirrel soft-furred field rat species. While certain species, such as the house mouse (Manzoor *et al.*, 2018), house shrew and house rat like to live completely disturbed environments. This research has also been supported by similar findings (Altaf, 2016; Altaf *et al.*, 2018; Manzoor *et al.*, 2018; Younus *et al.*, 2018).

Garbages in urban areas have food for mammalian species, which can be used by mammalian species (Hirasawa *et al.*, 2006). The outcome indicates that open environment with the presence of animal food is a major determinant in the dispersion of mammals. Food and manmade shelters, such as roofs and home spaces, are provided by urban and rural environments. Some mammalian species are shy in nature; they do not appreciate human participation in their environments, and as a result, they are restricted and declining in the wild. However, Asiatic jackal and wild boar are introduced into populated areas in the absence of humans or at night. People, on the other hand, are frequently unaware of the presence of mid-sized and/or small mammals (e.g., small Indian mongoose, jungle cat, and Indian crested porcupine), despite the fact that these species live near buildings.

CONCLUSION

The current study was designed to analyze the study area's mammalian diversity, identify and quantify human influences on diversity of mammals, and investigate the level of human-mammal interaction along the Uchali complex in Pakistan. The diversity of mammalian species was documented along forest land, agricultural, semi-urban and urban territories. Jungle cat, Asiatic jackal, Indian crested porcupine, Long eared desert hedgehog, desert hare, Indian wild boar, Indian desert cat, Little Indian field mouse, Indian grey mongoose, small Indian mongoose, Indian pangolin, small Indian civet, Northern palm squirrel, chinkara, house shrew and Brandt's hedgehog usually prefer forest landscape and to some extent natural habitats while house mouse, Northern palm squirrel, house rat and house shrew species favoured human habitations. Correspondingly, species such as northern palm squirrel, Indian crested porcupine, house shrew, Asiatic jackal, Indian grey mongoose, small Indian mongoose, little Indian field mouse, Indian desert hare, house mouse, Indian desert cat and Jungle cat also occupy agriculture habitat to live in Urban and Rural habitats. Throughout the year a total of 20 mammalian species were recorded from nearby

areas of Uchali complex. The output of survey is that that Uchali complex area supplies sources for mammalian species but due to lack of care and conservation, mammalian species are facing many problems.

Table 1: The diversity of the Mammals of Uchali Complex, Pakistan

Sr.	Names	Code	Order, Family	F	U	R	A
1	<i>Rattus rattus</i> (Linnaeus, 1758) “House rat”	RRL	Rodentia, Muridae	0.00	0.4	0.25	0.00
2	<i>Mus musculus</i> (Linnaeus, 1758) “House mouse”	MML	Rodentia, Muridae	0.00	0.29	0.25	0.00
3	<i>Mus booduga</i> (Gray, 1837) “Little Indian field mouse”	MBG	Rodentia, Muridae	0.02	0.00	0.00	0.61
4	<i>Herpestes javanicus</i> (Geoffroy Saint-Hilaire, 1818), “Small Indian mongoose”	HAH	Carnivora, Herpestidae	0.05	0.00	0.00	0.05
5	<i>Funambulus pennant</i> (Wroughton, 1905) “Northern Palm Squirrel”	FPW	Rodentia, Sciuridae	0.02	0.02	0.15	0.00
6	<i>Canis aureus</i> (Linnaeus, 1758) “Asiatic jackal”	CAL	Carnivora, Canidae	0.13	0.00	0.08	0.05
7	<i>Hystrix indica</i> (Kerr, 1792) “Indian Crested Porcupine”	CIL	Rodentia, Hystricidae	0.06	0.00	0.00	0.00
8	<i>Suncus murinus</i> (Linnaeus, 1766) “House shrew”	SML	Eulipotypha, Soricidae	0.00	0.28	0.23	0.00
9	<i>Sus scrofa</i> (Linnaeus, 1758) “Indian wild boar”	SSL	Cetartiodactyla, Suidae	0.17	0.00	0.00	0.05
10	<i>Felis chaus</i> (Schreber, 1777) “Jungle cat”	FCS	Carnivora, Felidae	0.06	0.00	0.00	0.00
11	<i>Felis silvestris</i> (Schreber, 1777) “Indian desert cat”	FSS	Carnivora, Felidae	0.05	0.00	0.00	0.00
12	<i>Lepus nigricollis</i> (F. Cuvier, 1823), “Desert hare”	LNF	Lagomorpha, Leporidae	0.06	0.00	0.00	0.00
13	Indian Long-eared Hedgehog (Gray, 1830) Indian Long-eared Hedgehog	HAS	Eulipotyphla, Erinaceidae	0.05	0.00	0.00	0.05

14	<i>Gazella bennettii</i> (Sykes, 1831) “Chinkara”	GBS	Arteodactyla, Bovidae	0.01	0.00	0.00	0.00
15	<i>Herpestes edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818) “Indian grey mongoose”	HEE	Carnivora, Herpestidae	0.05	0.00	0.00	0.11
16	<i>Ovis vignei punjabiensis</i> (Lydekker, 1913), “Punjab Urial”	OOG	Cetartiodactyla, Bovidae	0.05	0.00	0.00	0.00
17	<i>Hemiechinus hypomelas</i> (Brandt, 1836) “Brand's hedgehog”	PHB	Eulypotypha, Erinaceidae	0.05	0.00	0.00	0.00
18	<i>Viverricula indica</i> (Geoffroy Saint-Hilaire, 1803) “Small indian civet”	VIG	Carnivora, Viverridae	0.03	0.00	0.00	0.00
19	<i>Manis crassicaudata</i> (É. Geoffroy, 1803) “Indian Pangolin”	MCE	Pholidota, Manidae	0.05	0.00	0.00	0.00
20	<i>Vulpes vulpes</i> (Linnaeus, 1758) “Red fox”	VVL	Carnivora, Canidae	0.02	0.00	0.02	0.05

Note: U (urban); A (agriculture); R (rural); F (Forest).

Table 2: “Diversity indices of the study area”.

“Diversity indices”	Forest	Urban	Rural	Agriculture
“Species” (Spp.)	17	4	6	7
“Individuals” (I)	393	85	91	36
“Dominance” (D)	0.09	0.33	0.21	0.40
“Simpson diversity” (S)	0.91	0.67	0.79	0.59
“Shannon -wiener Index” (H')	2.63	1.17	1.62	1.35
“Evenness” (E)	0.82	0.81	0.84	0.55
“Margalef/Richness” (R)	2.68	0.68	1.11	1.67

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