Journal of Wildlife and Ecology (2021). 5(4):168-175
www.jwepak.com

Research Paper **Open Access**

Anthropogenic impacts on the distribution of mammalian species in the vicinity of Head Trimmu, Punjab, Pakistan

Sharmeen Ijaz[1*] and Saba Adil[1]

1. Department of Zoology, University of Lahore, Sargodha campus, Sargodha-Pakistan

***Corresponding author e-mail:** humanisticprincess20@gmail.com

SUMMARY

Forests favor a rich diversity of mammals. Our understanding of forest reserve conservation is deficient, so this research was planned to examine the relationship between anthropogenic impacts and the diversity and distribution of mammals within four ecosystems, viz. forest, agriculture, rural, and urban, in the vicinity of Head Trimmu, Punjab, Pakistan. A total of 18 species were recorded, of which 14 were recorded from the forest, 7 from rural areas, 9 from agriculture and 4 from urban habitats in the study area. This research documented that the highest diversity (H = 2.255 and S = 0.8771) and richness (R = 2.389) were documented from natural landscapes, and the highest dominance (D = 0.3169) and evenness (E = 0.8537) were recorded in highly anthropogenically impacted landscapes. However, moderate human activity impacts were less negatively impacted on slightly disturbed habitats, i.e. rural.

Keywords: Mammals, Diversity, Richness, Evenness, Trimmu

Citation: Ijaz, S., S. Adil. 2021. Anthropogenic impacts on the distribution of mammalian species in the vicinity of Head Trimmu, Punjab, Pakistan. Journal of Wildlife and Ecology. 5: 168-175.
Received: October, 2021**; Accepted**: December, 2021

INTRODUCTION

All tropical forests are familiar for high variety of animals (Gentry, 1992; Ceballos and Ehrlich, 2002), actually these forests have more than fifty person of ungulates species (Jeffers, 1992), and lots of mammalian species are declining in anthropogenically impacted landscape (Wanyama *et al.*, 2010), and due to hunting (Reyna-Hurtado *et al.*, 2010). These forests are being destroyed and degraded at a very high ratio (Hansen *et al.*, 2013). The high ratio of deforestation is mostly affected by geometric growth of human population (Chapman *et al.*, 2013; Altaf, 2016; Altaf, 2018).

In Pakistan, rural societies living nearby to forests usually perform continuation shifting agriculture but are greatly reliant on products of forest (i.e. meat, fuel-wood, ethnomedicine, timber and food) (Altaf *et al.*, 2018b). This practice has been going on since the origin of human but has currently enhanced noticeably in strength and led to total disappearance or reduction of few mammalian populations in forests of unprotected through countrywide and worldwide processed (Baig and Ahmed, 2007; Chapman *et al.*, 2013). Even lots of protected areas have unsuccessful to effectively protect some species of mammals (Maisels *et al.*, 2013).

Wildlife biologists spend time with fauna and flora to observe their activities and these activities are important for conservation of mammals (McKinney, 2002). Northern palm squirrels (*Funambulus pennantii*) like to exist in peri-urban areas of Pakistan (Altaf *et al.*, 2012). Indian wild boar (*Sus scrofa*) (Chughtai *et al.*, 2018), Indian crested porcupine (*Hystrix indica*) (Safeer *et al.*, 2018) and small Indian mongoose (*Herpestes javanicus*) (Altaf *et al.*, 2018a) desire to exist in the vicinity of cultivated landscapes. Rats and mouse prefer to live urban habitats (Altaf, 2016; Manzoor *et al.*, 2018). Material related diversity as well as distribution of mammals are the step towards species conservation (McKinney, 2002). In present research, we examine the relationship between anthropogenic impacts and diversity and distribution of mammals in the vicinity of head Trimmu, Pakistan.

MATERIALS AND METHODS

STUDY AREA

The research was conducted to explore the diversity and distribution of mammals near head Trimmu Barrage, research was organized during a period of 2017-2018 in sub-areas for forest, rural, agricultural and urban area of Trimmu Barrage. For research purpose, these regions were interviewed: Population near Trimmu Barrage: Rasheed-pur village, Village Athara Hazari, Baila Forest and hang district (Figure 1).

Trimmu Barrage was constructed at an interval of "21km" on Jhang-Bhakkar road in southwest of Jhang city. It is a network of watery and land ecological structure (Mahboob and Nisa, 2013). Head Trimmu was designed between 1937 and 1939 mainly as overwhelmingly flow regulation System. It is constructed neat the junction of Jhelum and Chenab water-flow and is almost25 Km distant from the locality Jhang, nearby Atharan Hazari village (Latif *et al*., 2017).

METHODOLOGY

Data were collected through "indirect count method" like pug marks, hair mounting techniques, carcasses, fecal pellet and meeting with native citizens and questionnaire was consist of following questions, are you know about mammalian species, diversity, and distribution? And also collected information through "direct count method" was used to collect data (Altaf, 2016; Haider and Altaf, 2018). Binoculars (32x50) was utilized to observe the Mammals and books known as "Small Mammals of Pakistan" and "Large and medium sized Mammals of Pakistan" (Roberts, 2005a, b) were studied to know about classification of mammalian species.

STATISTICAL ANALYSIS

For the statistical analysis "PAST version 2.17c" was used (Hammert *et al.*, 2001) to determine the "Simpson diversity index", "Shannon diversity index", "Evenness index", "Richness index", "Dominance index" and "Principle Component Analysis". Interaction among mammalian species and various landscape was analyzed in chord diagrams using "circlize package" in "R software 3.6.1" (Gu *et al.*, 2014).

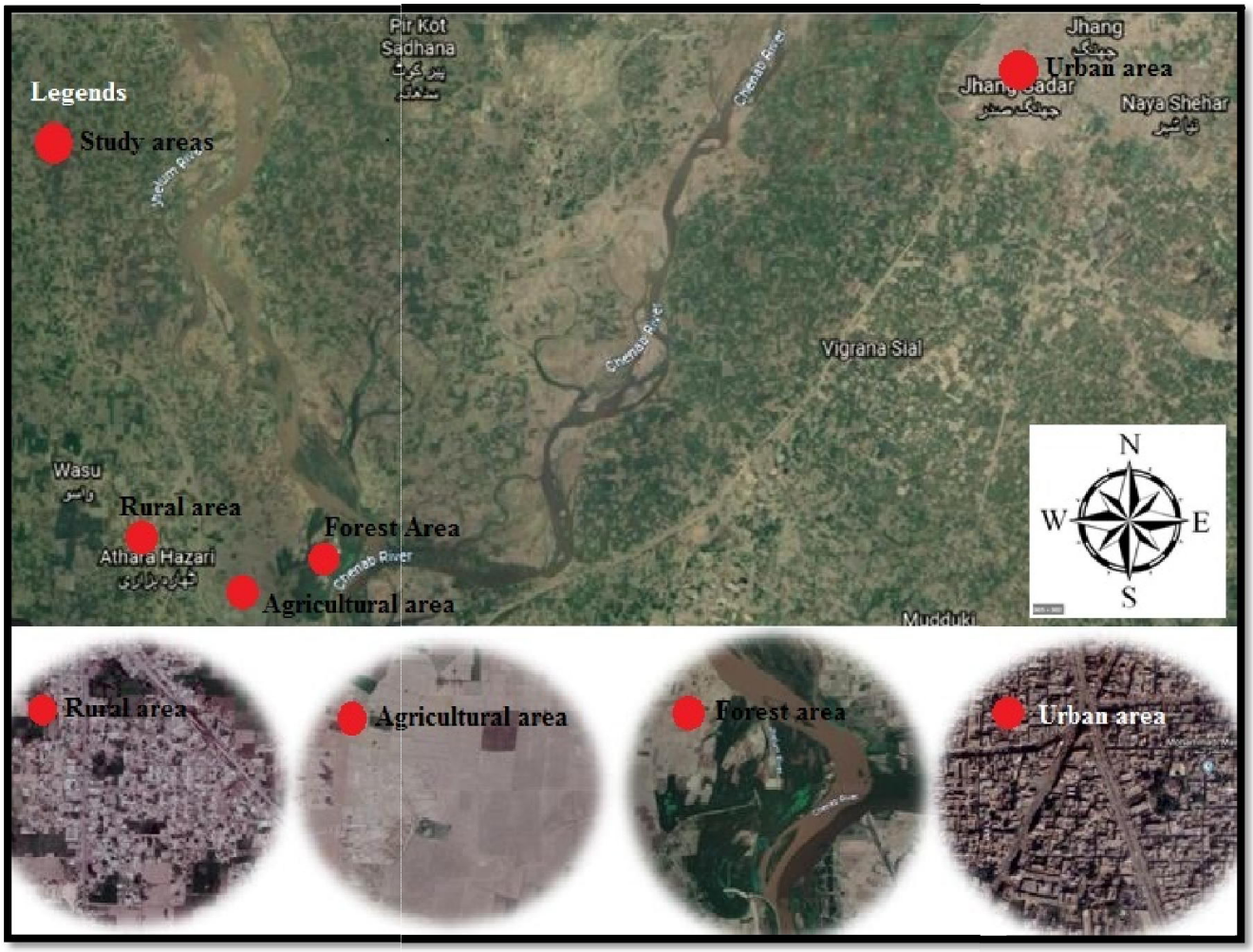

Figure 1: Map of the study area.

RESULTS AND DISCUSSION

A Total 18 species were recorded (Table 1), out of total 14 were recorded from the forest, 7 from rural, 9 from agriculture and 4 from urban habitats of the study area. During this research documented that the highest diversity (H′=2.255 and S=0.8771) and richness (R=2.389) were documented from natural landscape, and highest dominance (D=0.3169) and evenness (E=0.8537) are recorded from highly anthropogenically impacted landscapes. However, moderate human activities impacts were less negatively impacts on slight disturbed habitats i.e. rural (Table 2).

The first "2 axes" of the "PCA" explained 87.645% of variation in sampled mammalian community (Axis 1: 59.095%; Axis 2: 28.55%). Variables loading onto Axis 1 included Urban (r=-0.49527), Rural (r=-0.27272), Agriculture (r=0.16615), and Forest (r=0.80791). The direction and magnitude of these association shows that Axis 1 synthesized the response of the mammalian communities natural to disturbed habitats documented. Each habitats also lo added into Axis 2 Urban (r=0.61687), Rural (r=0.53267), Agriculture (r=-0.07841) and forest (r=0.57409). Axis 2 extracted mammalian community patterns that were unrelated to those explained by Axis 1. Most habitat variables did not have a significant relationship with other PCA

components, indicating that anthropogenic impact was the primary factor influencing the mammalian community (Figure 2). These finding are supported with other findings (Altaf, 2016).

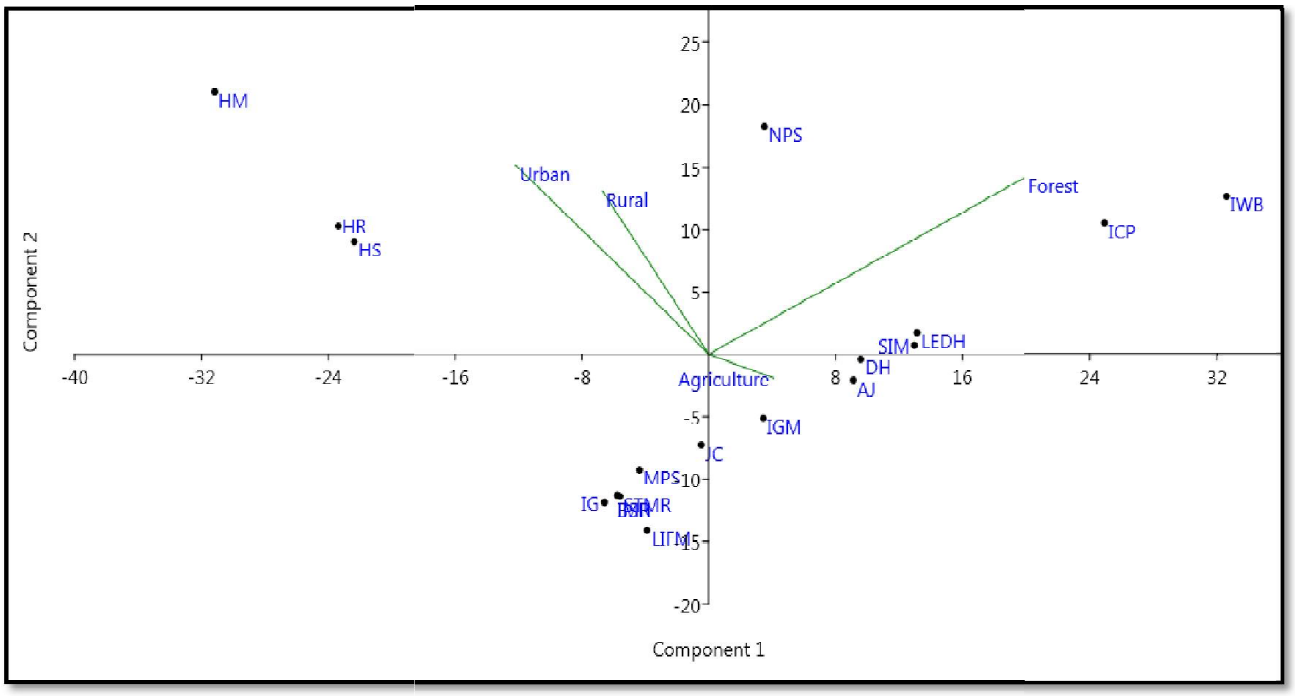

Figure 2: The distribution of mammalian species (Table 1) in different habitats is depicted using principal component analysis. The arrow positions relative to axes 1 and 2 indicate how strongly independent variables are correlated with each habitat, i.e. agriculture, forest, rural, and urban.

During this research documented that *Funambulus pennanti* was reported all types of habitats except agriculture. Few species (like *Hemiechinus collaris*, *Herpestes javanicus*, *Canis aureus, Sus scrofa*, *Felis chaus, Herpestes edwardsii, Suncus estruscus* and *Nesokia indica*) were documented from natural and agricultural landscape. *Felis chaus* and *Herpestes javanicus* were observed from rural and forest habitats. Few species of mammals (viz. *S. murinus, Rattus rattus*, *Mus musculus*) only recorded from urban and peri-urban landscapes. While *Mus booduga* are recorded from natural ecosystems (Table 1 and Figure 3).

Few mammals were usually positively linked and while others were negatively behaved with people existence. These patterns are lot of similar to other geographic landscapes; e.g., *Tayassu pecari* and *Tapirus bairdii* were species of mammals to removed when human beings colonize fresh natural landscapes (Reyna-Hurtado and Tanner, 2007; Reyna-Hurtado *et al.*, 2010).

CONCLUSION

In conclusion, this research suggests that forest is a main issue in conservation of wildlife. this research also show that human activities negatively impacts on mammalian species in any landscape and thus strongly suggested decrease in the humans involvement in natural landscapes, including education programs,

enforcement of laws, as well as, the organization of protected areas, ecotourism lands and research centers.

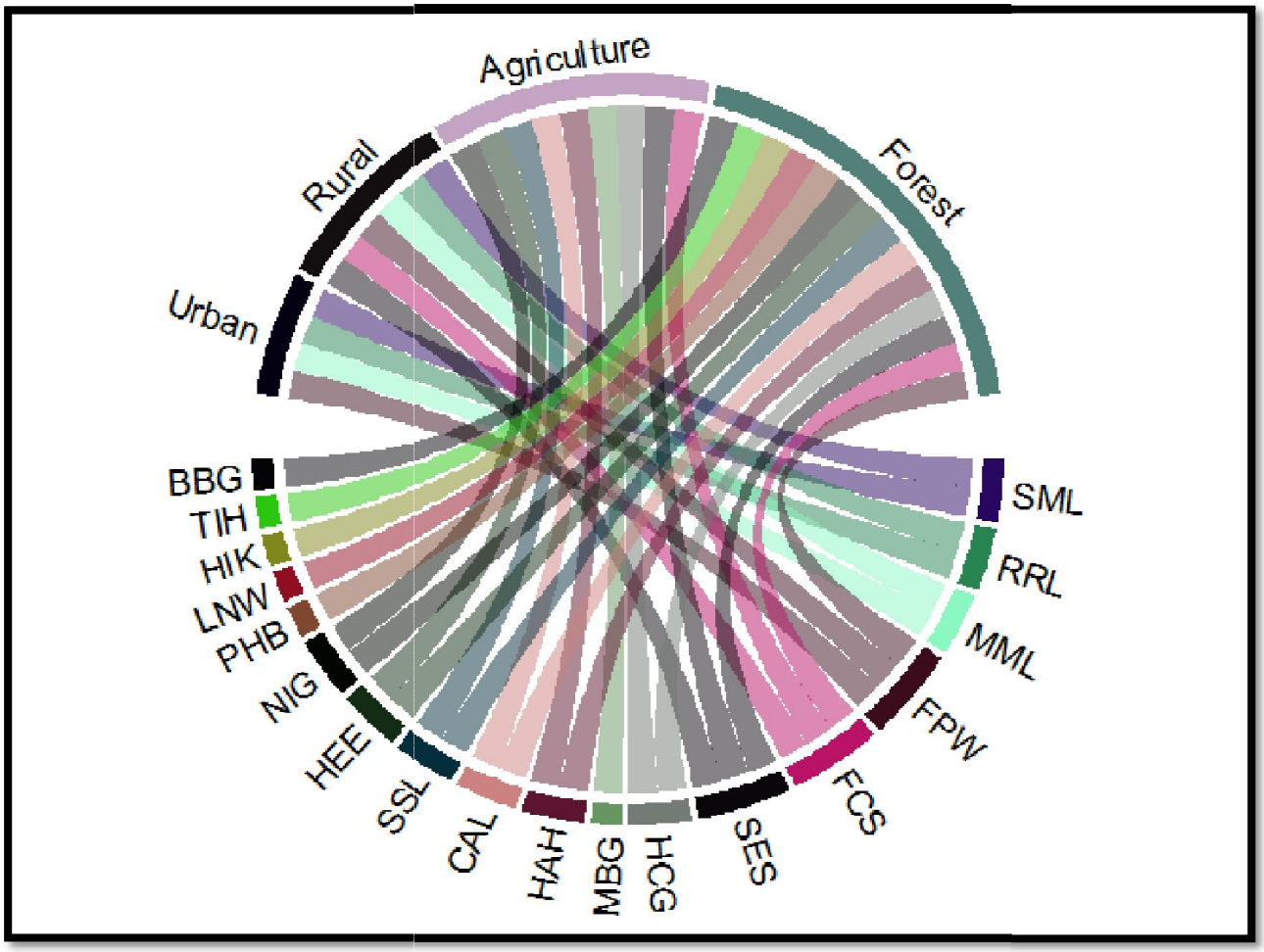

Figure 3: Interaction among the mammalian species and various ecosystems.

Table 1: Diversity of Mammalian species in different landscapes (i.e. U-urban, R-rural, A=agriculture and F-forest) of study area.

Sr.	Scientific name Common name	Code	Order Family	U	R	A	F
1	*Hemiechinus hypomelas* (Brandt, 1836) Brand's hedgehog	PHB	Eulypotyphla Erinaceidae	0.000	0.000	0.000	0.009
2	*Hemiechinus collaris* (Gray, 1830) Long eared desert hedgehog	HCG	Eulypotyphla Erinaceidae	0.000	0.000	0.028	0.108
3	*Lepus nigricollis* (Cuvier, 1823) Desert hare	LNW	Lagomorpha Leporidae	0.000	0.000	0.000	0.091
4	*Suncus murinus* (Linnaeus, 1766) House shrew	SML	Eulypotyphla Soricidae	0.250	0.185	0.000	0.000
5	*Rattus rattus* (Linnaeus, 1758) House rat	RRL	Rodentia Muridae	0.273	0.185	0.000	0.000

6	*Mus musculus* (Linnaeus, 1758) House mouse	MML	Rodentia Muridae	0.420	0.247	0.000	0.000
7	*Mus booduga* (Gray, 1837) Little Indian field mouse	MBG	Rodentia Muridae	0.000	0.000	0.292	0.000
8	*Herpestes javanicus* (Geoffroy Saint-Hilaire, 1818) Small Indian mongoose	HAH	Carnivora Herpestidae	0.000	0.025	0.194	0.100
9	*Funambulus pennanti* (Wroughton,1905) Northern Palm Squirrel	FPW	Rodentia Sciuridae	0.057	0.309	0.000	0.108
10	*Canis aureus* (Linnaeus, 1758) Asiatic Jackal	CAL	Carnivora Canidae	0.000	0.000	0.097	0.082
11	*Hystrix indica* (Kerr, 1792) Indian Crested Porcupine	HIK	Rodentia Hystricidae	0.000	0.000	0.000	0.173
12	*Sus scrofa* (Linnaeus, 1758) Indian Wild boar,	SSL	Cetartiodactyla Suidae	0.000	0.000	0.236	0.199
13	*Felis chaus* (Schreber, 1777) jungle cat	FCS	Carnivora Felidae	0.000	0.025	0.083	0.035
14	*Herpestes edwardsii* (É. Geoffrey Saint-Hilaire, 1818) Indian grey mongoose	HEE	Carnivora Herpestidae	0.000	0.000	0.028	0.056
15	*Suncus etruscus* (Savi ,1822) Mediterranean pygmy shrew	SES	Eulypotyphla Soricidae	0.000	0.025	0.028	0.017
16	*Tatera indica* (Hardwicke, 1807) Indian gerbil	TIH	Rodentia Muridae	0.000	0.000	0.000	0.004
17	*Bandicota bengalensis* (Gray 1835) Indian mole rat.	BBG	Rodentia Muridae	0.000	0.000	0.000	0.009
18	*Nesokia indica* (Gray, 1830) Short tail mole rat	NIG	Rodentia Muridae	0.000	0.000	0.014	0.009

Table 2: Diversity indices of the study area.

Diversity Indices	**Urban**	**Rural**	**Agriculture**	**Forest**
Species	4	7	9	14
Individuals	88	81	72	231
Dominance index (D)	0.3169	0.2266	0.1975	0.1229
Simpson diversity index (S)	0.6831	0.7734	0.8025	0.8771
Evenness index (E)	0.8537	0.7125	0.6792	0.6811
Richness index (R)	0.67	1.365	1.871	2.389
Shannon-Wiener diversity index (H´)	1.228	1.607	1.81	2.255

REFERENCES

Altaf, M. 2016. Assessment of Avian and Mammalian Diversity at Selected Sites along river Chenab University of Veterinary and Animal Sciences, Lahore-Pakistan.

Altaf, M. 2018. Study of human-mammals conflict and interaction-A review Journal of Wildlife and Ecology. 2: 20-24.

Altaf, M., A.M. Khan, M. Umair, Irfan, M.A. Munir. 2012. Status of wild birds and mammals in urban habitats of Gujranwala, Punjab, Pakistan. Punjab University Journal of Zoology. 27 9-12.

Altaf, M., S. Nazer, Musarat, I. Manzoor, B. Safeer, S. Yasrub. 2018a. Study of human activities impacts and interaction with small Indian mongoose in Dhirkot, district Bagh, Azad Jammu and Kashmir. Journal of Wildlife and Ecology. 2: 31-37.

Altaf, M., M. Umair, A.R. Abbasi, N. Muhammad, A.M. Abbasi. 2018b. Ethnomedicinal applications of animal species by the local communities of Punjab, Pakistan. Journal of ethnobiology and ethnomedicine. 14: 55.

Baig, M.B., M. Ahmed. 2007. Biodiversity in Pakistan: Status challenges and strategies for its conservation. International Journal of Biol. and Bio-Tech. 4: 283-292.

Ceballos, G., P.R. Ehrlich. 2002. Mammal population losses and the extinction crisis. Science. 296: 904-907.

Chapman, C.A., R. Ghai, A. Jacob, S.M. Koojo, R. Reyna-Hurtado, J.M. Rothman, D. Twinomugisha, M.D. Wasserman, T.L. Goldberg. 2013. Going, going, gone: a 15-year history of the decline of primates in forest fragments near Kibale National Park, Uganda Primates in fragments. p 89-100. Springer.

Chughtai, M.S., M. Altaf, I. Manzoor, B. Safeer, S. Yasrub. 2018. Assessment of human and wild boar (*Sus scrofa*) conflict from district Bagh, Azad Jammu and Kashmir, Pakistan. Journal of Wildlife and Ecology. 2: 10-21.

Gentry, A.H. 1992. Tropical forest biodiversity: distributional patterns and their conservational significance. Oikos. 19-28.

Gu, Z., L. Gu, R. Eils, M. Schlesner, B. Brors. 2014. circlize implements and enhances circular visualization in R. Bioinformatics. 30: 2811-2812.

Haider, R., M. Altaf. 2018. Hair mounting techniques for conservation of mammals-A review. Journal of Wildlife and Ecology. 2(1).

Hammert, Q., D.A.T. Harper, P.D. Ryan. 2001. Past paleontological statistical software package for education and data analysis. Palaeontol. stat.: 4.

Hansen, M.C., P.V. Potapov, R. Moore, M. Hancher, S.A. Turubanova, A. Tyukavina, D. Thau, S. Stehman, S.J. Goetz, T.R. Loveland. 2013. High-resolution global maps of 21st-century forest cover change. Science. 342: 850-853.

Jeffers, J. 1992. Conserving Biodiversity: A Research Agenda for Development Agencies, National Academy Press, Washington, DC (1992). Academic Press.

Maisels, F., S. Strindberg, S. Blake, G. Wittemyer, J. Hart, E.A. Williamson, R. Aba'a, G. Abitsi, R.D. Ambahe, F. Amsini. 2013. Devastating decline of forest elephants in Central Africa. PloS one. 8: e59469.

Manzoor, I., M. Altaf, B. Safeer, S. Yasrub. 2018. Study of diversity, distribution and cultural uses of house mouse (*Mus musculus*) in district Bagh, Azad Jammu and Kashmir-Pakistan. Journal of Wildlife and Ecology. 2: 22-29.

McKinney, M.L. 2002. Urbanization, Biodiversity, and Conservation The impacts of urbanization on native species are poorly studied, but educating a highly urbanized human population about these impacts can greatly improve species conservation in all ecosystems. BioScience. 52: 883-890.

Reyna-Hurtado, R., E. Naranjo, C.A. Chapman, G.W. Tanner. 2010. Hunting and the conservation of a social ungulate: the white-lipped peccary Tayassu pecari in Calakmul, Mexico. Oryx. 44: 89-96.

Reyna-Hurtado, R., G.W. Tanner. 2007. Ungulate relative abundance in hunted and non-hunted sites in Calakmul Forest (Southern Mexico). Biodiversity and Conservation. 16: 743-756.

Roberts, T.J. 2005a. Field guide to the large and medium-sized mammals of Pakistan. Oxford University Press.

Roberts, T.J. 2005b. Field guide to the small mammals of Pakistan. Oxford University Press.

Safeer, B., Z. Rasheed, M. Altaf, I. Manzoor, S. Yasrub. 2018. Assessment of human-Indian crested porcupine (*Hystrix indica*) conflict in district Bagh, Azad Jammu and Kashmir. Journal of Wildlife and Ecology. 2: 1-12.

Wanyama, F., R. Muhabwe, A.J. Plumptre, C.A. Chapman, J.M. Rothman. 2010. Censusing large mammals in Kibale National Park: evaluation of the intensity of sampling required to determine change. African Journal of Ecology. 48: 953-961.

***Competing interests**:* Authors have declared that no competing interests exist.
***Funding**:* Authors have no source of funding for this work.
Authors' contributions: Ijaz has designed this project, collected data and written this article; while Ijaz and Adil have critically analyzed this article and approved as final.