

A Study of distribution of herptiles among disturbed and undisturbed habitats of Haveli, Azad Jammu and Kashmir, Pakistan

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SUMMARY

Many negative things influence reptiles and amphibians. There are 10,272 reptile species reported worldwide. There are 195 reptilian species divided into 23 families. Pakistan is home to 13 reptilian and 9 amphibian species. Many amphibian and reptile species have become extinct as a result of direct or indirect anthropogenic impact. The objective of the study was to estimate the diversity and density of herpetofauna of the study area and the level of human herpetofauna interaction in the study area. For the statistical analysis PAST version 2.17 was used to find the Simpson diversity (S), Shannon diversity (H), Evenness (E), (Margalef) and dominance (D). During the research it is noted 20 species (16 genus 10 families and 2 orders) are recorded from Haveli AJ&K.

Keywords: Amphibian, Reptiles, Urbanization, Industrialization

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INTRODUCTION

Today's Earth's ecosystems are a mosaic of fragmented landscapes (Steffen *et al.*, 2020), mainly in tropical habitats (Ndriantsoa *et al.*, 2017). As a result, assessing the functionality and organization of flora and fauna populations in disturbed systems caused by agricultural, livestock, or forestry activity is of great interest (Altaf, 2016). Animals grazing, for e.g., has been shown to harm undisturbed vegetation as it prevents nutrient deletion and reuse (Thompson *et al.*, 2016). Human habitat modification can have severe consequences for the reproductive, physiological and ecological characteristics of the herptiles that inhabit it (Doherty *et al.*, 2020; Jerem and Mathews, 2021). While plant cover is removed, changes in humidity, temperature and photoperiod can all have an impact on the feasibility of the livings that live in the disturbed environment, affecting their richness (Gibbons *et al.*, 2000; Cruz-Elizalde *et al.*, 2016; Doherty *et al.*, 2020).

Research findings in anthropogenic impacted ecosystems have concentrated on awareness and assessing the composition of herptiles populations, as well as the causal factors of their decrease, such as native phytoconstituents fragmentation and buffer zones (Gibbons *et al.*, 2000; Gardner *et al.*, 2007). Researchers note, moreover,

ASSESSMENT OF HERPETOFAUNA DIVERSITY AND ANTHROPOGENIC IMPACT

The linear count method was applied to assess the amphibian and reptilian diversity through “direct” and “indirect counts”. Physical presence and voices are counted directly, while corpses and group questionnaire surveys are counted indirectly. From January to December of this year, data was gathered. The animals were found using binoculars; Khan (2006) was referred to recognize the species.

To evaluate the human influences on biodiversity, the marked area was divided into different parts i.e. agriculture, rural, urban and forest. Diversity and habitat of herpetofauna of every area was also observed.

RESULTS AND DISCUSSION

During the research noted that having 20 species (17genus, 9 families and 2 orders) recorded from Haveli (Table 1). *Amphiesma stolatum* was recorded from rural (0.023809524) agiculture (0.08) and forest (0.02173913). *Bufo Himalayanus*, was recorded from urban (0.133333333) rural (0.071428571) agriculture (0.08) and forest (0.043478261). *Bufo melanostictus* was recorded from urban (0.066666667) rural (0.071428571) agriculture (0.16) and forest (0.04347826). *Bungarus caeruleus caeruleus* was recorded from rural (0.047619048) agriculture (0.12) and forest (0.02173913). *Calopes versicolor* was recorded from rural (0.119047619) forest (0.086956522). *Daboia russelii russlii* was recorded from rural (0.047619048) and forest (0.065217391). *Eryx johani* was recorded from rural (0.071428571) agriculture (0.04) and forest (0.043478261). *Hemibactylus flabiviridis* was recorded from urban (0.08) and rural (0.333333333). *Lacodon mackinnoni* was recorded from agriculture (0.12) and forest (0.086956522). *Laudakia agorensis* was recorded from rural (0.023809524) agriculture (0.08) and forest (0.02173913). *Laudakia himayalayna* was recorded from forest (0.02173913). *Laudakia pakistanica* was recorded from forest (0.02173913). *Laudakia tuberculate* was recorded from forest (0.043478261). *Lycodon aulicus* was recorded from forest (0.02173913). *Naja oxiana* was recorded from forest (0.065217391). *Oligodon arnesis* was recorded from forest (0.065217391). *Ptyas mucosus* was recorded from agriculture (0.16) and forest (0.152173913). *Scincella himalayana* was recorded from forest (0.065217391) (Table 1).

A total of 02 herpatofauna species was recorded from the urban area as; *Bufo himalayanus* and *Bufo melanostictus*. A total 13 herpatofauna species are recorded from the rural area as; *Amphiesna stolautm*, *Bufo himalayanus*, *Bufo latasti*, *Bufo melanostistus* *Bungarus caeruleus caeruleus*, *Calopes versicolor*, *Daboia russelli russelli*, *Eryx johani*, *Hemidactylus flabiviridis*, *Laudakia agorensis*, *Naja oxiana*, *Ptyas mucosus* and *Scincella himalayna* (Table 1).

A total of 09 herpatofauna species recorded from the agriculture area as; *Amphiesma stolatum*, *Bufo himalayanus*, *Bufo melanostictus*, *Bungarus caeruleus caeruleus*, *Eryx johani*, *Lacodon mackinnoni*, *Laudakia agorensis*, *Ptyas mucosus* and *Spalerosophis diadema* (Table 1).

A total of 19 herpatofauna species recorded from the agriculture area as; *Amphiesma stolatum*, *Bufo himalayanus*, *Bufo latasti*, *Bufo melanostictus*, *Bungarus caeruleus caeruleus*, *Calopes versicolor*, *Daboia russelli russelli*, *Eryx johani*, *Lacodon*

mackinnoni, *Laudakia agrorensis*, *Laudakia himalayana*, *Laudakia pakistanica*, *Laudakia tuberculata*, *Lycodonauolicus*, *Naja oxiana*, *Oligodon arnesis*, *Ptyas mucosus*, *Scincella himalayana*, and *Spalerosophis diadema* (Table 1).

DIVERSITY INDICES

Diversity indices of urban study area recorded as: Dominance (0.6622), Simpson (0.3378), Shannon (0.6277), Evenness (0.6244) and Margalef (0.7385). Diversity indices of rural study area recorded as: Dominance (0.8435), Simpson (0.7494), Shannon (2.22), Evenness (0.7086) and Margalef (3.211). Diversity indices of agriculture study area recorded as: Dominance (0.1264), Simpson (0.87736), Shannon (2.123), Evenness (0.9289) and Margalef (2.485). Diversity indices of forest study area recorded as: Dominance (0.07183), Simpson (0.9282), Shannon (2.783), Evenness (0.8505) and Margalef (4.01) as shown in (Table 2).

4.2.6 Principal Component Analysis

The first two axes of the “PCA” explained 85.238% of variation in sampled herpetofauna species (Component 9.6358%; Component 94.8738%) Variables loading onto “Component 1” included urban ($r = 0.56402$), rural ($r = 0.82109$), agriculture ($r = 0.07815$) and forest ($r = 0.07815$). The direction and length of these associations shows that created the response of gradient of development extent. “Undisturbed” to “disturbed habits” “Component 1” as also loaded into “Component 2” (urban: $r = 0.090124$; rural: $r = 0.035887$; agriculture: $r = -0.067672$ and forest: $r = -0.99298$). Most variable habitat, does not relate significantly with other “PCA” Components showing that anthropogenic impacts were the principal factor shaping the herpetofauna species (Figure 2). During the research noted that decline in herpetofauna that focus in habits, due to habitat change most of the species decline in the rural, urban and agriculture areas. Similar index was used by Altaf *et al.* (2018).

In other cases, it has been recorded that when a surroundings is changed in such a way that the native vegetation is significantly simplified, the biota's original composition is also altered, and only a few taxa have a constructive reaction to the conversion (Berriozabal-Islas *et al.*, 2017; Leyte-Manrique *et al.*, 2019). This response could include increased adaptation, as evidenced by increased thermoregulation, survival and reproduction rates, as well as victorious activity of the altered environments (Germaine and Wakeling, 2001).

Moreover, the low abundance and representativeness of some species, particularly amphibians, was reflected in this composition, which could be due to the habitat's already high disturbance level. Researchers suggest that average environmental changes can endorse enhance in the richness, diversity and abundance of few groups. This was the case in this study, where reptiles like snakes and lizards had a higher taxonomic diversity (Chamberlain *et al.*, 2009; Altaf *et al.*, 2018; Leyte-Manrique *et al.*, 2019).

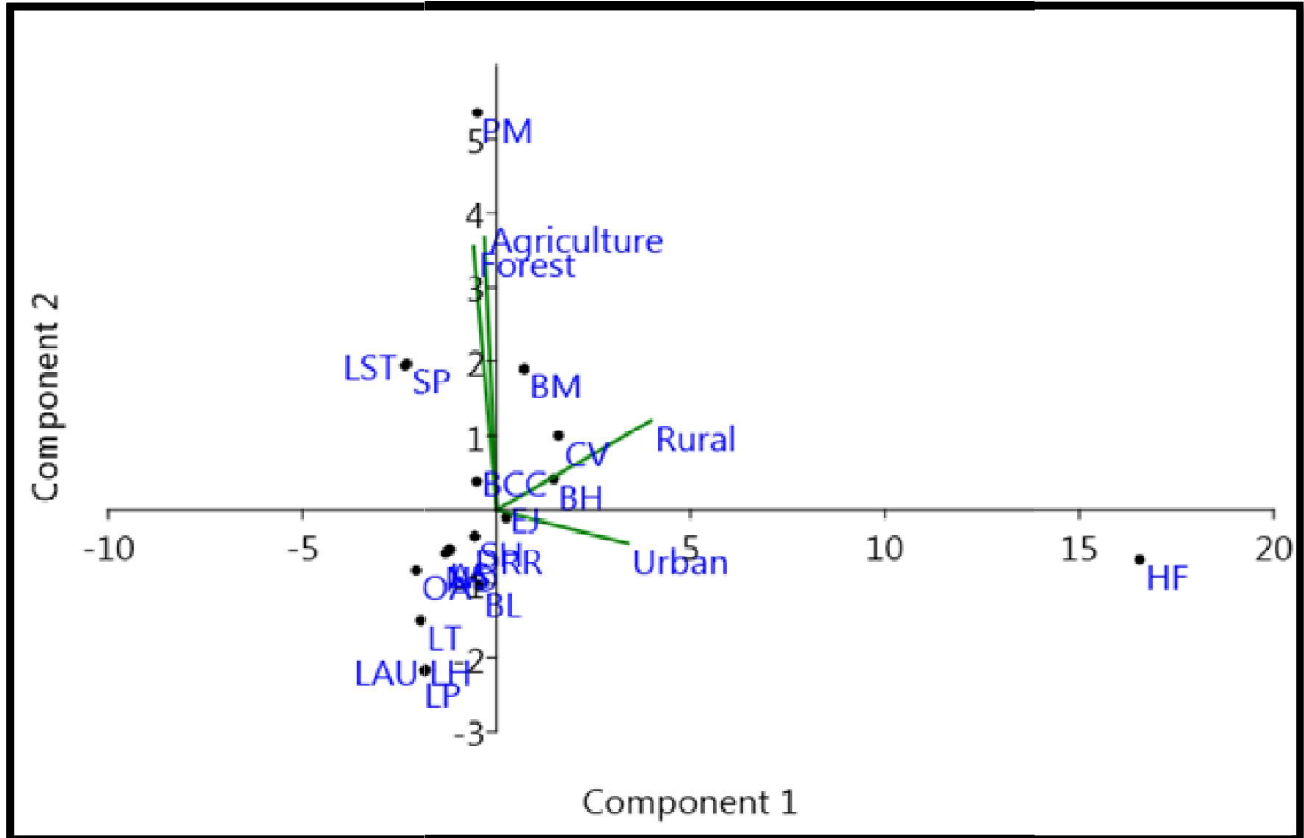


Figure 2: PCA demonstrates the distribution with code of herpetofauna species (Table 1) at “Undisturbed” and “disturbed” habits.

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Table 1: Anthropogenic impacts on the distribution of the herpetofauna diversity in study area.

Common Name	Scientific Name	Code	Urban	Rural	Agriculture	Fest
Striped Keelback	<i>Amphiesma stolatum</i> Linnaeus 1758	SAS	0.000	0.024	0.080	0.022
Himalayan toad	<i>Duttaphrynus himalayanus</i> (Günther, 1864)	HBH	0.133	0.071	0.080	0.043
Ladakh toad	<i>Bufo latastii</i> Boulenger, 1882	LBL	0.000	0.048	0.000	0.043
Black spectacled toad	<i>Bufo melanostictus</i> Schneider, 1799	BBM	0.067	0.071	0.160	0.043
Common Krait	<i>Bungarus caeruleus caeruleus</i> , Schneider, 1801	CBCC	0.000	0.048	0.120	0.022
Oriental Garden Lizard	<i>Calotes versicolor</i> , (Daudin, 1802)	OCV	0.000	0.119	0.000	0.087
Russell's viper	<i>Daboia russelii russelii</i> , Nodder, 1797	RDRR	0.000	0.048	0.000	0.065
Common sand boa	<i>Eryx johani</i> , Russel 1801	CEJ	0.000	0.071	0.040	0.043
Yellow belly/common house	<i>Hemibactylus flabiviridis</i> , Ruppel, 1835	YHF	0.800	0.333	0.000	0.000
Mackinnon's Wolf Snake	<i>Lacodon mackinnoni</i> Wall, 1906	GLS	0.000	0.000	0.120	0.087
Monitor lizard	<i>Laudakia agrolensis</i> , Stoliczka, 1872	MLA	0.000	0.024	0.080	0.022
Himalayan Agma	<i>Laudakia himalayana</i> , 1869	LH	0.000	0.000	0.000	0.022
North-Pakistan agma	<i>Laudakia Pakistanica</i> , Baig and Bohame, 1996	LHP	0.000	0.000	0.000	0.022
Blue rock agma	<i>Laudakia tuberculata</i> , Hardwicke and Gray, 1827	BLT	0.000	0.000	0.000	0.043
White spotted wolf snake	<i>Lycodon aulicus</i> , Linnaeus, 1903	WLAU	0.000	0.000	0.000	0.022
Brown cobra	<i>Naja oxiana</i> , Eichwald, 1831	BNO	0.000	0.024	0.000	0.065

Banded kukri snake	<i>Oligodon arnesis</i> , Shaw, 1802	BOA	0.000	0.000	0.000	0.065
Rope snake	<i>Ptyas mucosus</i> , Daudin 1803	RPM	0.000	0.071	0.160	0.152
Himalayan skink	<i>Scincella himalayana</i> , Eremchenko and Szczbak, 1980	HSH	0.000	0.048	0.000	0.065

Table 2: The diversity indices of the herpetofauna of study area.

Indices	Urban	Rural	Agriculture	Forest
Species	3	13	9	19
Individual	15	42	25	46
Dominance (D)	0.6622	0.1565	0.1264	0.07183
Simpson (S)	0.3378	0.8435	0.8736	0.9282
Shannon (H')	0.6277	2.22	2.123	2.783
Evenness (E)	0.6244	0.7086	0.9289	0.8505
Richness (R)	0.7385	3.211	2.485	4.701