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URBAN HERPETOFAUNA AND PUBLIC ATTITUDE TOWARDS THEIR CONSERVATION IN RAWALPINDI AND ISLAMABAD, PAKISTAN

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Abstract

Registering association between urban features and occurrence of herpetofauna provides useful information to urban planners and wildlife managers. We conducted the present study to see if likelihood of occurrence of various herpetofauna species is explained by land use categories, such as forest, open area, croplands, urban areas or wetlands. We aimed to document changes in the urban extent (from 2006 to 2016) and evaluate perception about herpetofauna in Rawalpindi and Islamabad. We recorded ten species of amphibians and 25 of reptiles including Narrow-headed Soft-shell Turtle (Chitra indica) and Soft-shell Turtle (Nilssonia gangetica), listed as Endangered and Vulnerable in the IUCN list of threatened species, respectively. The binary logistic regression was statistically significant and explained likelihood of occurrence of Murree Hills Frog, Hazara Torrent Frog, Fat-tail Gecko, Striped Grass Skink and Russell's Viper in natural areas such as forest and open land while Brown River Turtle, House Gecko, Black Cobra and Saw-scale Viper in urban features such as roadside, residential areas, urban streams and croplands. The satellite images showed considerable increase in built up and urban areas in Rawalpindi, Gujar Khan, and Islamabad Capital Territory. The univariate generalized linear model revealed that the change in area of all the other studied land use categories was also significant. Of 251 respondents interviewed from the study area, 76% were interested in the study of birds, 20% in mammals and only 1% in amphibians and reptiles. Interestingly, 58% of the respondents were unaware of significance of herpetofauna such as their role as bio-indicator and role in food chain which might have caused this bias in their perception. The awareness level differed significantly between male and female respondents. The survey data suggested that social media is the best platform to create awareness about amphibians and reptiles.

Keywords*: Balloon frog; Chitra indica; Deforestation; Herpetofauna; Invasive species; Nilssonia gangetica; Public perception*

Introduction

The species of amphibians and reptiles have widely been considered as bio-indicators of the environmental quality. They play an important role in the food web by maintaining populations of invertebrates [1, 2]. Amphibians and reptiles inhabit a variety of habitats such as wetlands, forest, and desert. Amphibians are closely connected to wetlands and have highly sensitive permeable skin which can immediately absorb toxic materials [3, 4]. Reptiles are

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associated with various habitats. For instance, turtles are common in riverine habitats in the lowlands along with muddy ditches, lakes, and marshes. Lizards live in rocky or stony areas with few grasses and bushes in moderate to dry conditions, whereas some species prefer hard soil with moderate dry vegetation. The house geckos are common around the human settlements, whereas the rock geckos inhabit dry stony hilly areas with typically xerophytic vegetation. Snakes' species frequent grasslands, agriculture fields along with margin of the marshes, some species are found in areas with rocky to sandy soil [5].

Populations of amphibians and reptiles are declining globally due to climate change, ultraviolet radiation, pathogens, chemical pollutants such as pesticides and fertilizers, habitat destruction and conversion of wild habitats into urban areas [6]. As urbanization is growing rapidly across the world, the main challenge to improve conservation practices is to understand how urbanization affects biodiversity [7]. Amphibians and reptiles also live-in urban area and are currently threatened due to rapid development and construction of impervious surfaces [8].

Amphibians and reptiles have remained unexplored in many parts of Pakistan with scarce data on their distribution, abundance, and their responses to changes in their habitats. Some studies have quantified change in land-use land cover of various major cities of Pakistan such as Islamabad, Rawalpindi, Sargodha, Sheikhupura, Faisalabad, Gujranwala, and Lahore [9-14]. This is expected to affect wildlife diversity particularly amphibians and reptiles.

The built-up area in Islamabad Capital Territory (ICT) has increased from 50 to 332km^2 [15], during 1975 to 2010. About 34% decrease in conifer forest, 29% decrease in scrub forest and 231% increase in human development was reported from watershed of Rawal Lake, ICT, during the decade 1992-2010 [16]. Rapid developments of industrial zones and housing schemes have altered habitat conditions creating suitable urban breeding habitats for species adapted for degraded and altered habitats. The studies suggest that land-use changes and habitat conversion for residential and road development has caused decrease in the diversity of amphibians and reptiles in the Chakwal District, Punjab, Pakistan [17]. The effluent discharge containing toxic chemicals into water bodies has also been reported as a serious threat to herpetofauna in Pakistan [18]. Many myths, misunderstanding, negative perceptions and superstitious beliefs about amphibians and reptiles prevail. The idea of conservation of birds, mammals, and aquatic species receives more acceptance than that of insects and herpetofauna [19]. For instance, the wall lizard is abhorred and considered poisonous without considering its ecological importance and role in preventing insect-borne disease such as mosquito plagues [19]. Studies showed that people dislike animals which pose some threat to humans. These fears are often irrational and associated with animal phobias, cultural issues, emotional reactions and lack of awareness [20, 21].

We conducted the present study to see if likelihood of occurrence of various herpetofauna species is explained by land use categories, such as forest, open area, croplands, urban areas or wetlands. We aimed to determine changes in the urban extent (from 2006 to 2016) and to evaluate public attitude towards amphibians and reptiles' urbanization in the study area (District Rawalpindi and Islamabad Capital Territory, Pakistan).

Materials and Methods

Study Site

The topography of Islamabad (33.6844° N, 73.0479° E) consists of plains and mountains. The northern part of Islamabad includes mountainous region of the Margalla Hills which is a part of Himalayas. The main streams of the area include the Soan and Kurang Rivers. Rawal, Simli, and Khanpur Dam are three man-made water storage reservoirs [22-24]. The minimum and maximum recorded temperature in Islamabad is 2 and 45°C, respectively, while the average annual precipitation is about 941mm [25].

The Rawalpindi District (33.4620° N, 73.3709° E) comprises of seven administrative units (tehsils): Rawalpindi, Taxila, Gujar Khan, Kotli Sattian, Kallar Syedan, Kahuta and

Murree. Seasonal conditions such as temperature and rainfall of both Islamabad and Rawalpindi are similar. The climate is warm and temperate. The summers are lot rainier than the winter due to monsoon. The monsoon rains usually start in June and end in September with peak time in August [25]. The average temperature in Rawalpindi district is 21.5°C [23]. The average rainfall in Rawalpindi and Taxila ranges from 970-990mm [26, 27]. Gujjar Khan tehsil lies in medium rainfall zone (450-750mm) [28] whereas, average annual rainfall in Murree, Kotli Sattian, and Kahuta, is about 1249mm, most of which falls in the monsoon season, which peaks in July [29].

Study Design

We surveyed the sampling sites in District Rawalpindi and Islamabad Capital Territory (ICT) from 2017-2019 (Fig. 1) on three occasions. We stratified major habitats as wetlands, croplands, open areas, forests and urban area.

The satellite images (LANDSAT TM 30m imagery) of the study area (Rawalpindi and ICT) were downloaded from USGS Earth Explorer (http://earthexplorer.usgs.gov), path, row and acquisition date of the images is provided in Appendix A). The images were then stacked, and the areas of interest were extracted from the image using supervised classification (4, 5 and 7 band combination). The urban areas, water bodies, cropland, open area and various forms of vegetation were quantified. The above-mentioned analysis was done in programs ERDAS Imagine 2014 while final processing was carried out in Arc Desktop 10.1. The univariate general linear model was applied using years (2006, 2011, 2016) and land-use categories (croplands, forest, open area, urban area and wetlands) as fixed factors and area (in ha.) as a dependent factor in SPSS 25.

We used time-constrained searches in each stratum of the urban areas [30] to record presence of the herpetofauna by actively searching the area for a specified time (2-3 hours). To augment active searching and confirm presence of threatened species such as freshwater turtles and rare species such as Balloon Frog (*Uperodon systoma*) reported from the study area, we used pitfall traps without fences and hoop nets (for turtles), at some sites (See sites denoted as stars in Fig. 1).

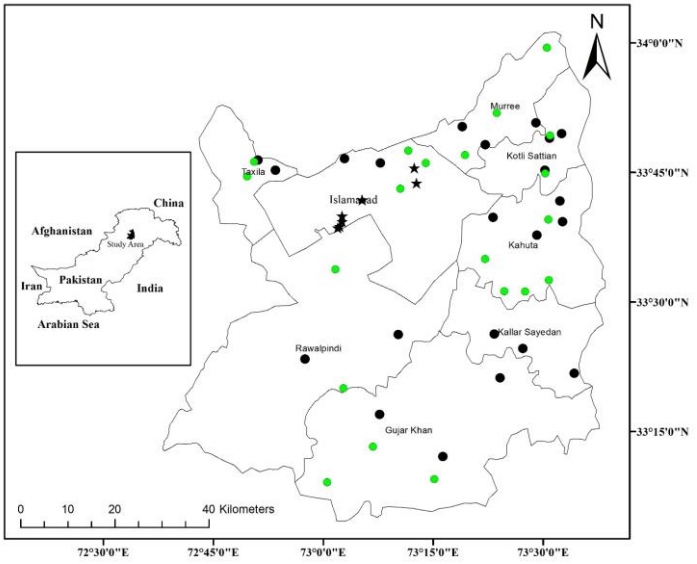

Fig. 1. Map of the study area showing sampling (green and black circles) and trapping (star) locations of herpetofauna species in District Rawalpindi (Administrative units Rawalpindi, Kotli Sattian, Murree, Kallar Syedan, Taxila, Gujar Khan and Kahuta) and Islamabad Capital Territory

The trapping could not be done throughout the study area due to limitations such as resources, manpower and permit issues. We monitored the trap for three consecutive days during morning (8:00-10:00am) and evening (4:00-6:00pm). The specimens caught or sighted were identified up to species level using [31] and were then released back. We selected sampling sites that were covered by invasive vegetation species like *Parthenium hysterophorous*, *Cannabis sativa* and *Lantana camara*. We performed binary logistic regression to see if elevation (of sampling sites, in meters) and land-use category (urban which included sampling sites in residential areas, along the roads and roadside vegetation, educational premises, backyards, recreational parks, urban streams and seasonal ponds or pools, and sited located in natural forest, open area and away from human settlements) had any effect on occurrence of species of amphibians and reptiles (dependent factor, 0 = absent, 1= present).

We developed a structured questionnaire with few open-ended questions to register public response about their awareness regarding herpetofauna including their significance, diversity, and sources to conserve these species. We selected respondents randomly and interviewed total of 251 respondents. Of these, 39% were male and 61% were female. Out of 251 respondents, 73% were matric (10 years of education)/ under matric (< 10 years of education), 16% were undergraduates (12-16 years of education) while 11% of respondents were graduate/ masters (> 16 years of education). The majority of respondents belonged to the age categories of 10-14 years (57%) while 39% belonged to 15-25 age groups. The responses between males and females were compared using chi-square test ($\alpha = 0.05$).

Results

Land-use land-cover change

The satellite images from year 2006 to 2016 showed considerable increase in built up and urban area (Fig. 2-4). The tehsils of Rawalpindi and Gujar Khan have experienced a very high rate, about two folds of urbanization. Likewise, Islamabad Capital Territory also suffered rapid urbanization. The increase in urban and built-up area took place at the expense of reduction of forest and open areas (Figs. 2-4).

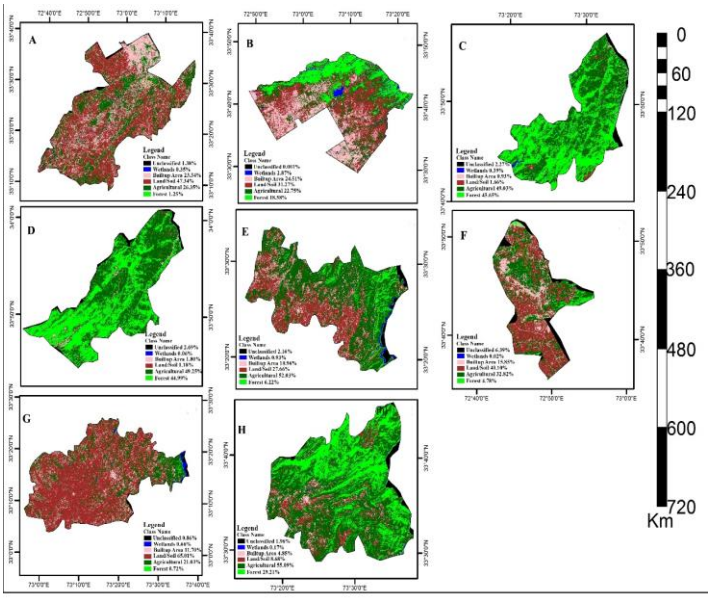

Fig. 2. Satellite image of Tehsils of Rawalpindi District:
(**A**) Rawalpindi; (**C**)Kotli Sattian; (**D**) Murree;(**E**) Kallar Syedan;(**F**): Taxila;(**G**) Gujar Khan; (**H**) Kahuta and (**B**) Islamabad Capital Territory showing extent of urban/ built up area and other major habitats in Year 2006

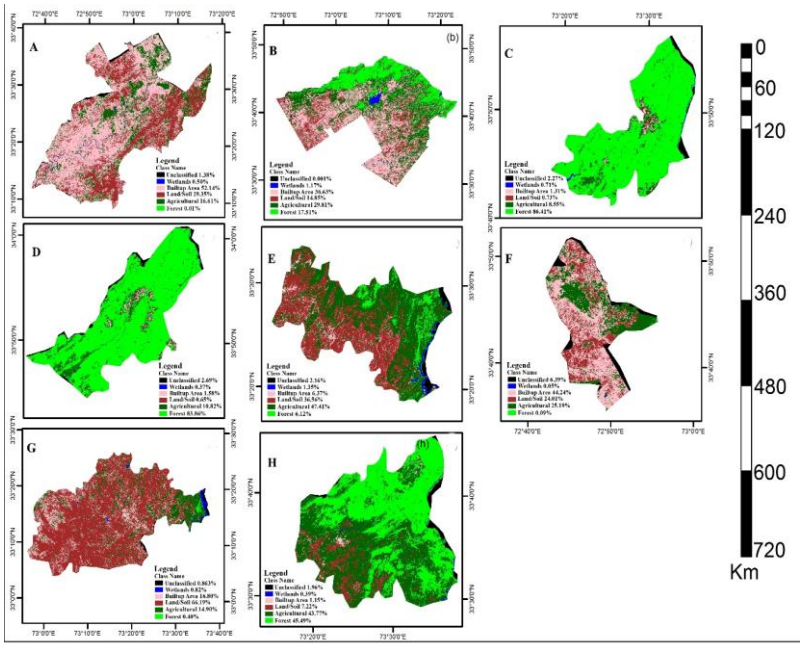

Fig. 3. Satellite image of Tehsils of Rawalpindi District:
(**A**) Rawalpindi;(**C**) Kotli Sattian;(**D**) Murree; (**E**) Kallar Syedan, (**F**) Taxila; (**G**) Gujar Khan;(**H**) Kahuta and (**B**) Islamabad Capital Territory showing extent of urban/ built up area and other major habitats in Year 2011

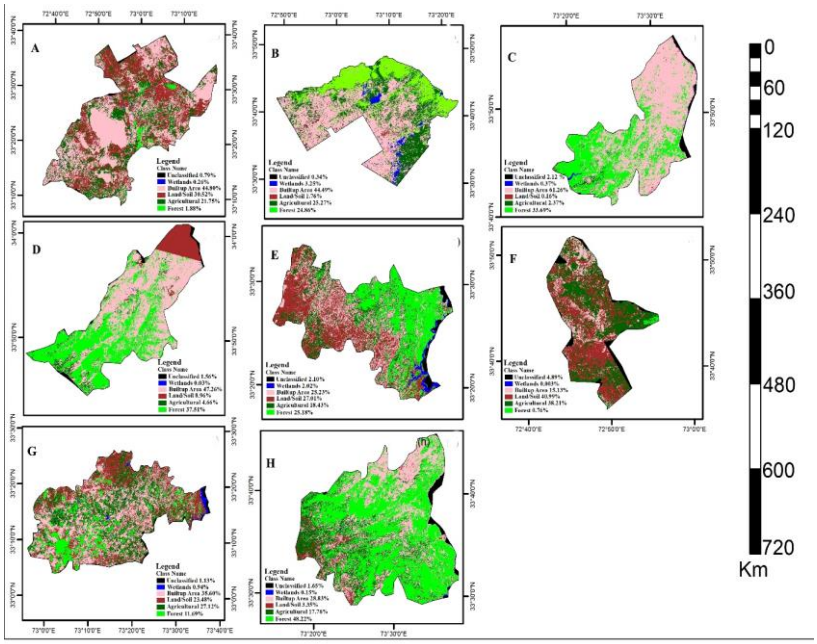

Fig. 4. Satellite image of Tehsils of Rawalpindi District:
(**A**) Rawalpindi; (**C**)Kotli Sattian; (**D**) Murree;(E) Kallar Syedan; (**F**) Taxila; (**G**) Gujar Khan;(**H**) Kahuta and (**B**) Islamabad Capital Territory showing extent of urban/ built up area and other major habitats in Year 2016

The area under forest of Tehsil Murree, the type locality of endemic Murree Hills Frog and breeding habitat for endemic Hazara Torrent Frog (along Murree Hills Frog), has also decreased which poses serious conservation concerns for these species. The univariate generalized linear model revealed that the change in area of all of the studied land-use categories was significant ($P < 0.05$).

Herpetofauna and their Assocaition with Urban Features

We recorded 35 herpetofauna species from the sampling sites of urban and natural areas of Rawalpindi-Islamabad. This included ten species of amphibians (nine genera, three families) and 25 reptiles (24 genera, 11 families – Table 1).

Table 1. Checklist of amphibians and reptiles and their associated urban and natural features recorded from of Rawalpindi-Islamabad.

	Urban					Natural				
	Roadside	Backyards	Recreational Parks	Urban Streams	Residential Areas	Educational premises	Seasonal ponds/pools	Croplands	Wetlands	Forest/ Open space
Duttaphrynus melantostictus[1]	+	+	+	+	+	+	+	+	+	+
Duttaphrynus stomaticus[1]	+	+	+	+	+	+	+	+	+	+
Microhyla nilphameriensis[2]	+	+	+	+	+	+	+	+	+	+
Uperodon systoma[2]									+	+
Euphlyctis kalasgramensis[3]	+	+	+	+	+	+	+	+	+	+
Hoplobatrachus tigerinus[3]	+	+	+	+	+	+	+	+	+	+
Minervarya spp.[3]	+	+	+	+	+	+	+	+	+	+
Sphaerotheca maskeyi[3]							+	+	+	+
Nanorana vicina[3]									+	+
Allopaa hazarensis[3]									+	+
Pangshura smithii[4]				+					+	
Pangshura tecta[4]				+					+	
Nilssonia gangetica[5]				+					+	
Chitra indica[5]				+					+	
Lissemys punctata andersoni[5]				+					+	
Calotes versicolor[6]	+	+	+	+	+	+	+	+	+	+
Laudakia spp. [6]										+
Eublepharis macularius[7]								+	+	+
Cyrtopodion scabrum[8]	+	+	+			+		+		+
Hemidactylus brookii[8]	+	+	+	+	+	+	+	+	+	+
Hemidactylus flaviviridus[8]	+	+	+	+	+	+	+			
Eutropis dissimilis[9]		+	+			+		+	+	+
Ophisops jerdonii[10]								+	+	+
Saraa hardwickii[11]										+
Varanus bengalensis[12]	+	+	+	+	+	+	+	+	+	+
Indotyphlops barminus[13]		+	+	+	+	+	+	+	+	+
Herpetoreas stolatum[14]				+					+	
Oligodon arnensis[14]								+		+
Platyceps ventromaculatus[14]								+		+
Ptyas mucosa[14]				+		+	+	+	+	+
Spalerosophis diadema[14]						+		+		+
Fowlea piscator[14]				+		+			+	
Bungarus caerulus[15]				+		+		+	+	+
Naja naja[15]						+		+	+	+
Daboia russelii[16]								+		+
Echis carinatus[16]								+		+

Legend: [1]Anura: Bufonidae; [2]Anura: Microhylidae; [3]Anura: Dicroglossidae;[4]Testudines: Geoemydidae; [5] Testudines: Trionychidae; [6]Squamata: Agamidae; [7] Squamata: Eublepharidae; [8] Squamata: Gekkonidae; [9] Squamata: Scincidae; [10] Squamata: Lacertidae; [11] Squamata: Uromastycidae; [12]Squamata: Varanidae; [13] Squamata: Typhlopidae; [14] Squamata: Colubridae; [15] Squamata: Elapidae; [16] Squamata: Viperidae

The road network and associated roadside invasive vegetation such as *Parthenium hysterophorous*, *Cannabis sativa* and *Lantana camara* had habitat value for toad species such as Indus Valley Toad (*Duttaphrynus stomaticus*), South-east Asian Toad (*Duttaphrynus melanostictus*) and Garden Lizard (*Calotes versicolor*); Backyard gardens and recreational parks for toad species Indus Valley Toad (*Duttaphrynus stomaticus*), South-east Asian Toad (*Duttaphrynus melanostictus*), Skittering Frog (*Euphlyctis kalasgramensis*), Spotted Barn Gecko (*Hemidactylus brookii*), Common Wall Lizard (*H. flaviviridis*) and Brahminy Blind Snake (*Indotyphlops braminus*); residential areas for toad and frog species, Garden Lizard (*Calotes versicolor*), Common Wall Lizard (*H. flaviviridis*); urban streams for toad species, Soft-shell Turtle (*Nilssonia gangetica*), Narrow-headed Soft-shell Turtle (*Chitra indica*), Brown River Turtle (*Pangshura smithii*), Indian Flapshell Turtle (*Lissemys punctata*) while dumping sites of urban areas had value for Bengal Monitor Lizard (*Varanus bengalensis*). We recorded snake species such as Common Krait (*Bungarus cearulus*) from educational premises such as National University of Science and Technology (NUST, ICT). Black Cobra (*Naja naja*) was rescued from Pak-China Friendship Centre, Shakarparian, Islamabad. (Table 1).The binary logistic regression was statically significant and explained likelihood of occurrence of Murree Hills Frog, Hazara Torrent Frog, Fat-tail Gecko, Striped Grass Skink and Russell's Viper (X^2 = 58.12, *df*= 2, *P*< 0.05, Nagelkreke,N= 0.74, Percentage of correctly classified cases,%= 95) in natural areas such as forest and open land while Brown River Turtle, House Gecko, Black Cobra and Saw-scaled Viper (X^2 = 2.97, *df*= 2, *P*< 0.05, N= 0.33, %= 52) in urban features such as roadside, residential areas, urban streams and croplands. The model did not yield significant results for other species.

Evaluation of Public Attitude about Herpetofauna and their Conservation

The results from questionnaire survey showed that out of 251 respondents, 76% respondents were interested in birds, 20% in mammals and only 1% in amphibians and reptiles. Interestingly, 58% of the respondents were unaware of significance, such as their role as bio-indicator and role in food chain, of amphibians and reptiles. The awareness level differed significantly between male and female respondents (x2= 3.88, df=; 1 P= 0.04). About 64% did not know about role of frogs in forest and cropland ecosystems (x2= 8.28, df=; 1 P= 0.003), 58% unappreciated role of wall lizards in controlling insect populations (x2= 3.88, df=; 1 P= 0.04), 73% had no knowledge of endemic amphibians and reptiles 91% considered all lizards venomous and dangerous (x2= 5.13, df=; 1 P= 0.02), 43% knew about global decline in the populations of amphibians and reptiles, 98% were in favor of killing reptiles upon sight (x2= 10.18, df=; 1 P= 0.001), and 39% vowed to conserve species of amphibians and reptiles. The survey data suggested that social media 42% (Facebook, Twitter, and Instagram) is the best way to spread awareness about herpetofauna followed by TV and Internet.

Discussion

Our results indicate increase in urban areas in tehsils of District Rawalpindi and Federal Capital Territory. It has not affected the area under forest in Islamabad, because the forest area is protected. However, open areas have been lost to rapid urbanization. The same is true for Tehsil Rawalpindi where open space and croplands areas have been reduced. Tehsil Murree is of particular interest, it has pine forest and Himalayan moist temperate forest which provide refuge to endemic anurans of the country. The forest area has reduced while urban area has increased. Hassan *et al.* [32] reported increase in built up area (31%) of Islamabad Capital Territory from 16,281ha. in 1992 to 51,039ha. in 2012. Hassan *et al.* [32] reported increase in built up area (56.73%) while and reduction in open area (1.87%) and forest (6.82%) in 2012, respectively, in Rawalpindi. We observed that the trend still continues, for our findings suggested increase in built up area while reduction in open area and forest in ICT and Tehsils of Rawalpindi District. Studies have shown that urbanization has decreased emergent vegetation

exposing Green Frog (*Rana clamitans*) and Rufous Frog (*Leptodactylus fuscus*) to predators and thereby affecting their population [33, 34]. In response to changes in land-use land-cover and conversion of habitats to urban areas leaf-litter thickness and canopy cover are impacted which may alter microhabitat or change in heat exposure [35, 36]. Mitrovich *et al.* [37] recorded reduction in site occupancy of Arroyo Toad (*Anaxyrus californicus*) due to urbanization and land use change in Santa Margarita River, USA. Rais *et al.* [17] observed that conversion of habitat and urbanization was expected to alter some herpetofauna species patterns of diversity in Chakwal, Punjab, Pakistan, including Indus valley toad, Indian Flap-Shell Turtle, Garden Lizard, and House Gecko species whereas eliminate other species, such as Indian Soft-shell Turtle. Our findings showed that the increase in urban area could cause change in species composition favoring the spread of species adapted to with a wide range of habitat conditions including the degarded habitats such as Indus Valley Toad, South-east Asian Toad and House Gecko while reduction in wetlands, forest, open space and cropland areas may put threatened/ uncommon and endemic species such as Balloon Frog (*Uperdon systoma*), Burrowing Frog (*Sphaerotheca maskyei*), Murree Hills Frog (*Nanorana vicina*), Hazara Torrent Frog (*Allopaa hazarensis*) which are known from these habitats. Freshwater turtles such as Narrow-headed Soft-shell Turtle (*Chitra indica*) and Soft-shell Turtle (*Nilssonia gangetica*) are mostly found in rivers and lakes. The former is Endangered while latter is Vulnerable as per IUCN Redlist of threatened species. We recorded these species from polluted urban water streams however they are known to occur in clean and clear water (Fig. 5) [38]. Some anthropogenic activities like urbanization, deforestation, habitat degradation, have jeopardized survival of turtle populations worldwide [39]. The invasive species mostly bring big alteration to natural ecosystems [40-42]. It was observed by conservationists that non-native species are one of the 50 biggest threats to biodiversity [42, 43]. Indus Valley Toad (*Duttaphrynus melanostictus*) and Common Skittering Frog (*Euphylctis cyanophlyctis*) are known to show great adaptability for changes brought about by urbanization [44]. Some species which are adapted to wide range of environmental conditions in their native range may become a problem elsewhere. The invasive Cane Toad (*Bufo marinus*) has affected several native wildlife species in tropical Australia [45]. Invasive geckos were observed to bring negative impact on the local gecko diversity due to several reasons one of which may be resource utilization [46]. Common Wall Lizard (*H. flaviviridis*) are being larger in size compared to other *Hemidactylus* species was observed to reduce the resources available for its native relatives [47]. In Pakistan, *Parthenium hystersophoros* weed is spreading aggressively in wasteland, degraded land, along water bodies, roadsides, and railway tracks. It has also been reported in agriculture land [48]. The weed has been observed to affect crop production, human health, and biodiversity [48, 49]. Studies on the tolerance level, to degraded and altered habitat conditions, of species of amphibians and reptiles of Pakistan and their ability to invade new localities are unavailable.

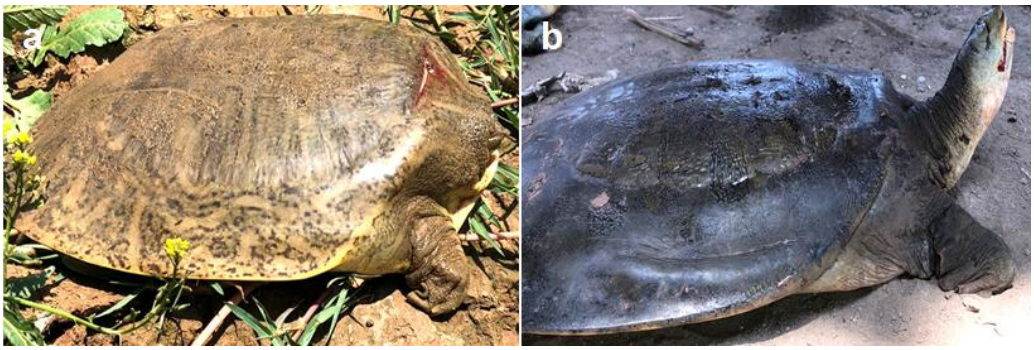

Fig. 5. Narrow-headed Soft-shell Turtle (*Chitra indica*), Endangered (a) and Soft-shell Turtle (*Nilssonia gangetica*), Vulnerable (b).

Despite best efforts, we could not record a few species such as Balloon Frog (*Uperodon systoma*) reported previously by [5, 31] It is reported as the rare frog of Pakistan [50], we retain the frog in our species list, and it is known from Islamabad. We believe that species specific extensive trapping and field surveys might help report the species. The diversity of amphibians of Pakistan is not very rich with only 25 known species. The present study showed low amphibian diversity. We recorded anurans belonging to families Bufonidae, Microhylidae and Dicroglossidae as common. Three amphibian species recorded during present study were reported by Masroor [5] and Rais *et al.* [17] and from Rawalpindi-Islamabad previously.

We have presented first systematic survey conducted on evaluation of public attitude towards amphibians and reptiles. Our survey indicated people's affection for birds and mammals. Not all wildlife species are fortunate to get appreciation from people whether they are endangered or not. In fact, throughout the world, humans prefer birds and other appealing pets like cats and dogs. They mostly dislike invertebrates, reptiles and owls [51]. The results of our survey are in line with Nolan *et al*. [52] who reported that reptiles were mostly disliked species as compared to mammals and birds. Even educated respondents (82%) did not show compassion for the reptiles and expressed their willingness to kill reptiles. Ceríaco [53] reported prevalence of myths and misconceptions in different communities, age and education level. Older people had more misconceptions based on their experience, cultural beliefs and knowledge than younger people. We believe that by engaging community, organization of field activities in the croplands and forests, reaching out educational institutes the attitude towards amphibians and reptiles could be changed.

Conclusions

We conclude that the study area has as many as ten species of amphibians and 25 of reptiles including Endangered Narrow-headed Soft-shell Turtle and Vulnerable Soft-shell Turtle. However, this list may expand in future based on more robust field work and molecular data. We found that occurrence of Murree Hills Frog, Hazara Torrent Frog, Fat-tail Gecko, Striped Grass Skink and Russell's Viper in natural areas such as forest and open land while Brown River Turtle, House Gecko, Black Cobra and Saw-scale Viper in urban features such as roadside, residential areas, urban streams and croplands. The built up and urban areas in Rawalpindi, Gujar Khan, and Islamabad Capital Territory have increased. Due to low level of awareness about significance of herpetofauna, the general public showed little interest in amphibians and reptiles.

Acknowledgments

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Appendix A.

Details of satellite images of Tehsils of Rawalpindi, Murree, Kahuta, Kallar Syedan, Gujar Khan, Kotli Sattyan, Taxila and Islamabad Capital Territory for the years 2006, 2011 and 2016

Sr. No.	Path/Row	Data set	Image ID	Acquisition Date
1	150/37	L4-5TM C1 LEVEL 1	LT05_LTP15003720061103_20161029_01_T1	25 Sep 2006
2	150/37	L4-5TMC1 Higher level	LT05_L1TP15003720061002_20161029_01_T1	02 Oct 2006
3	150/36	L4-5 ™ C1 Level 1	LT05_L1TP_15003600_20081002_20161029_01_T1	25 Oct 2006
4	150/37	L7ETM+SLC-off (2003-present)	LE71500372011324PFS00	20 Nov 2011
5	150/36	L4-5TM	LT51500362011268KHC00	25 Sep 2011
6	150/37	L4-5TM	LT51500372011268KHC00	25 Sep 2011
7	150/37	L4-5TM	LT51500372011172KHC00	21 Jun 2011
8	150/36	L4-5TM	LT51500362011156KHC00	05 Jun 2011
9	150/37	L8OLITRS	LC81500372016314LGN00	09 Nov 2016
10	150/36	L8OLI/TIRS	LC81500362016362LGN00	27 Dec 2016