

## A record of amphibians and reptiles of District Talagang, Pakistan

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**Abstract.** Amphibians and reptiles are integral components of biodiversity, offering essential ecosystem services. However, many species within these groups are threatened with extinction. A significant challenge for conservation biologists worldwide is the insufficient documentation of species across regions. Research on amphibians and reptiles is notably lacking in many areas of Pakistan. This study documents amphibian and reptile species in District Talagang. Between 2022 and 2023, a total of 5 amphibian and 19 reptile species were recorded across cropland, freshwater streams, and rangeland habitats. Habitat fragmentation, environmental pollution, and poaching were identified as major threats to herpetofauna species in the region. Future research on agricultural practices and habitat changes will help develop effective conservation strategies for herpetofauna. Citizen science initiatives, community awareness, and collaboration between research institutions and wildlife organizations can enhance conservation efforts. Promoting sustainable agrochemical use, proper waste disposal, and reducing human-wildlife conflict are crucial to protecting the region's herpetofauna.

**Keywords:** habitat loss, *Lissemys punctata*, *Naja oxiana*, *Saara hardwickii*, *Varanus bengalensis*, *Varanus flavescens*, *Eutropis dissimilis*, conservation.

### Introduction

Amphibians and reptiles, sensitive to environmental changes, serve as vital bioindicators and provide valuable information on habitat quality and overall environmental health (Mifsud 2014). They play a significant role in controlling insect and pest populations, thereby contributing crucially to the dynamics of food webs. Their other contributions include balancing algal communities, facilitating nutrient cycling, and supporting biodiversity within ecosystems (Ali et al. 2016). Diversity is closely linked to a country's climatic conditions and geographic location (Petrov 2004). Collectively referred to as herpetofauna, they are notably the most imperiled terrestrial vertebrates (Gibbons et al. 2000). Amphibians are acknowledged as the most endangered creatures in nature (Pimm et al. 2014). About 41% amphibians and 21% reptiles are identified as

threatened with extinction according to the International Union for Conservation of Nature (IUCN) Red List (Farooq et al. 2024, Junaid 2024, Dodge et al. 2025, Gunderson et al. 2025, Speight et al. 2025). Habitat loss, diseases, invasive species, pollution, climate change, over-exploitation and unsustainable trade are major drivers of herpetofauna species decline (Blaustein & Kiesecker 2002, Pounds et al. 2006, Meiri & Chapple 2016, Tingley et al. 2016, Woinarski et al. 2018, Doherty et al. 2020, Hansen et al. 2020, Cox et al. 2022, Nordstrom et al. 2022, Akçakaya et al. 2023, Luedtke et al. 2023, Meiri et al. 2023, Mi et al. 2023, Edmonds et al. 2024, Larson et al. 2024, Junaid 2025, Lindberg et al. 2025, McKnight et al. 2025).

Pakistan has rich biodiversity, particularly in its arid and semi-arid regions, which cover nearly 80% of the country's total area. The unique geography of Pakistan, which places it in three of the world's eight biogeographic realms

(Afrotropical, Indo-Malayan, Palearctic), provides habitat for some of the planet's unique wildlife species (Baig & Subaiee 2009). In Pakistan, amphibians are represented by anurans only (Rais et al. 2021) and comprise 21 species (Rais et al. 2023). A comprehensive record indicates that Pakistan is home to more than 190 reptile species, comprising Squamates, Testudines, and Crocodiles (Rais et al. 2012, Ali et al. 2018, Junaid & Sheraz 2025). Due to a lack of management strategies and research policies, amphibians are not well studied in Pakistan (Ali et al. 2016, Rais et al. 2021). Similarly, reptiles have also been understudied in many respects (Balouch et al. 2016, 2022, Junaid & Sheraz 2025). Studies to date on herpetofauna species in Pakistan have mainly focused on areas of Chakwal, Islamabad, Murree, and Rawalpindi (Masroor 2011, Rais et al. 2015, 2021, 2023, Balouch et al. 2016, 2022, Akram et al. 2021).

Global declines in amphibian and reptile populations have raised significant concerns within the scientific community in recent years. Regional documentations of species are crucial for enhancing ecological knowledge and conservation efforts (Rais et al. 2012). Information on the geographical distributions of species, both locally and globally, is lacking — the Wallacean shortfall (Whittaker et al. 2005, Liz et al. 2025). Regional studies on herpetofauna are important because they help compile overall data and underscore the value of national-level presentations. There is a notable lack of research on herpetofauna species in many areas of Pakistan. No prior studies have been recorded on herpetofauna species in District Talagang, Punjab Province, Pakistan. This study aimed to provide a detailed record of herpetofauna species in District Talagang.

## Materials and methods

The research was conducted at three selected village sites in District Talagang: Bilalabad, Pira Fatehal, and Wanhar (Figure 1). District Talagang, situated at 32.9172° N and 72.4081° E,

is part of the Pothohar Plateau in Punjab Province, Pakistan (Khan et al. 2023, Ghaffar et al. 2024). The soil in Talagang is generally low in organic matter (Balouch et al. 2016). The winter temperature ranges between  $-4^{\circ}\text{C}$  and  $25^{\circ}\text{C}$ , while the temperature of summer ranges between  $15^{\circ}\text{C}$  and  $40^{\circ}\text{C}$  (Rehman et al. 2017, Latif et al. 2022). Average annual rainfall in the region is 620 mm. The vegetation in the area falls under a dry subtropical broadleaved scrub type. Dominant plant species include *Broussonetia papyrifera*, *Calotropis procera*, *Capparis decidua*, *Cenchrus ciliaris*, *Convolvulus arvensis*, *Cymbopogon jwarancusa*, *Cynodon dactylon*, *Dalbergia sissoo*, *Dodonaea viscosa*, *Heteropogon contortus*, *Melia azedarach*, *Morus nigra*, *Olea ferruginea*, *Prosopis juliflora*, *Senegalia modesta*, *Trianthema portulacastrum*, *Vachellia nilotica* and *Ziziphus nummularia* (Hussain et al. 2015, Balouch et al. 2016, Khan et al. 2016, Rehman et al. 2017). Major crops cultivated in the area are canola, chickpea, groundnut, guar, maize, millet, sorghum, and wheat (Balouch et al. 2022). Chinji National Park, established in 1987, is an important protected area of the district, characterized by its landmass featuring igneous rocks, sandstones, and salt rocks (Naeem et al. 2000, Qadeer et al. 2022).

The selected cropland, freshwater stream, and rangeland habitats were surveyed (Figure 2A, B, C, D, E, F) from January 2022 to December 2023. Each survey session lasted one day, totaling three hours: one hour in the morning, one in the afternoon, and one in the evening. In total, 72 surveys, three surveys per month, were conducted. Area-constrained methods were used to document herpetofauna species, as followed by Davenport & Scott (2009), involving a 500 x 500 m transect at each sampling site. The data collection approach involved a combination of direct sightings, binocular spotting, hand capturing, and camera recording. A few dead specimens collected during the surveys were preserved in the Herpetology Lab, Department of Zoology, Wildlife & Fisheries, PMAS-AAUR. Amphibian and reptile species were identified using the keys of Rais et al. (2021) and Khan

(2006), respectively.

Line plots were generated to illustrate the species abundance among cropland, freshwater stream, and rangeland habitats, using “ggplot2” (Wickham 2011, Junaid 2025), “tidyr” (Wendt & Anderson 2022), and “dplyr” (Foster et al. 2018) packages in R version 4.4.1 (R Core Team 2024).

## Results

A total of 5 amphibian species belonging to 3

families, and 19 reptile species belonging to 11 families were recorded from cropland, freshwater stream, and rangeland habitats (Table 1). Amphibians were commonly recorded from freshwater stream habitats (Figure 3). *Firouzophrynus stomaticus* was the most frequently observed amphibian across all three habitat types. *Euphlyctis adolfi* and *Hoplobatrachus tigerinus* were recorded in both freshwater streams and croplands. *Sphaerotheca maskeyi* was exclusively found in freshwater streams, while *Microhyla nilphamariensis* was observed in wheat croplands post-harvest.

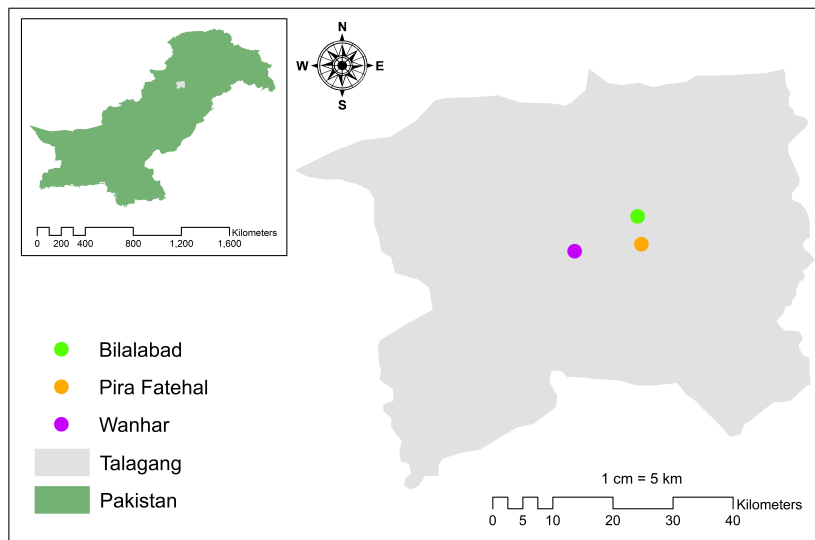


Figure 1. Map of study area showing sampling sites of herpetofauna species in District Talagang, Punjab Province, Pakistan.



Figure 2. A. Wheat and field mustard croplands; B. Groundnut croplands; C. Freshwater stream with fast flow; D. Freshwater stream with normal flow; E. Rangelands with dense vegetation; F. Rangelands with sparse vegetation. © Ahmed Junaid.

Table 1. Amphibian and reptile species recorded from cropland, freshwater stream, and rangeland habitats in District Talagang, Punjab Province, Pakistan.

Order	Family	Common Names	Scientific Names	IUCN Status
Anura	Bufonidae	Marbled Toad	<i>Firouzophrynus stomaticus</i>	Least Concern
		Bangladesh Skittering Frog	<i>Euphyctis adolfi</i>	Least Concern
	Dicroglossidae	Indian Bullfrog	<i>Hoplobatrachus tigerinus</i>	Least Concern
		Maskey's Burrowing Frog	<i>Sphaerotheca maskeyi</i>	Least Concern
	Microhylidae	Nilphamarai Narrow-mouthed Frog	<i>Microhyla nilphamariensis</i>	Least Concern
Squamata	Colubridae	Indian Gamma Snake	<i>Boiga trigonata</i>	Least Concern
		Oriental Rat Snake	<i>Ptyas mucosa</i>	Least Concern
		Diadem Snake	<i>Spalerosophis diadema</i>	Least Concern
	Elapidae	Central Asian Cobra	<i>Naja oxiana</i>	Near Threatened
	Typhlopidae	Brahminy Blind Snake	<i>Indotyphlops braminus</i>	Least Concern
	Viperidae	Western Russel's Viper	<i>Daboia russelii</i>	Least Concern
	Agamidae	Changeable Lizard	<i>Calotes versicolor</i>	Least Concern
Agror Agama		<i>Laudakia agrorensis</i>	Least Concern	
Himalayan Agama		<i>Paralaudakia himalayana</i>	Least Concern	
Hardwicke's Spiny-tailed Lizard		<i>Saara hardwickii</i>	Vulnerable	
Eublepharidae	Common Leopard Gecko	<i>Eublepharis macularius</i>	Least Concern	
Gekkonidae	Yellow-bellied House Gecko	<i>Hemidactylus flaviviridis</i>	Least Concern	
	Common House Gecko	<i>Hemidactylus frenatus</i>	Least Concern	
Lacertidae	Indian Fringe-fingered Lizard	<i>Acanthodactylus cantoris</i>	Least Concern	
	Punjab-snake-eyed Lacerta	<i>Ophisops jerdonii</i>	Least Concern	
Scincidae	Striped Grass Mabuya	<i>Eutropis dissimilis</i>	Least Concern	
Varanidae	Bengal Monitor Lizard	<i>Varanus bengalensis</i>	Near Threatened	
	Yellow Monitor	<i>Varanus flavescens</i>	Endangered	
Testudines	Trionychidae	Indian Flapshell Turtle	<i>Lissemys punctata</i>	Vulnerable

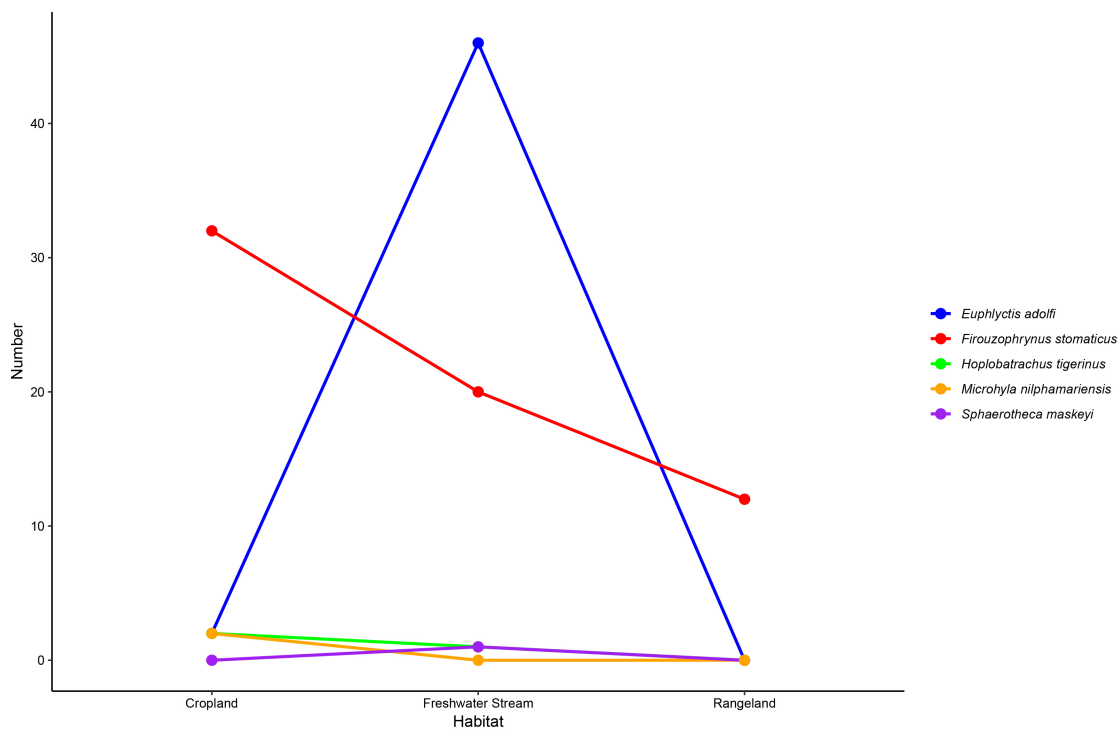


Figure 3. Line plot showing the abundance of each amphibian species recorded in cropland, freshwater stream, and rangeland habitats.

Reptiles were particularly abundant in cropland habitats (Figure 4). Among all snake species, *Ptyas mucosa* was the most observed. *Ptyas mucosa* was seen in wheat croplands after harvesting and among vegetation, including *Morus nigra*, *Vachellia nilotica*, and *Ziziphus nummularia*. *Boiga trigonata* was spotted inhabiting areas with *Momordica charantia* and *Dalbergia sissoo* plants. The habitats of *Spalerosophis diadema* and *Naja oxiana* included both croplands and rangelands. *Spalerosophis diadema* was also observed in proximity to *D. sissoo*. *Indotyphlops braminus* and *Daboia russelii* were observed inhabiting croplands. *Indotyphlops braminus* was also noted in the vicinity of *D. sissoo* and *Z. nummularia*. Among lizards, *Acanthodactylus cantoris*, *Hemidactylus flaviviridis*, *Laudakia agrorensis*, *Ophisops jerdonii*, and *Paralaudakia himalayana* were only seen in rangeland habitats. *Calotes versicolor* was documented in both croplands and rangelands. *C. versicolor* was observed inhabiting *D. sissoo*, *Senegalia modesta*, *V. nilotica*, and *Z. nummularia*. *Saara hardwickii* was noted in wheat and chickpea

croplands. *Eublepharis macularius*, *Hemidactylus frenatus*, and *Varanus flavescens* were sighted in croplands. *Eutropis dissimilis* and *Varanus bengalensis* were observed in both croplands and rangelands, where *D. sissoo* and *Z. nummularia* were predominant tree species. Groundnut croplands were a common habitat of *E. dissimilis*.

## Discussion

This study documents the herpetofauna of Talagang, addressing the prior lack of herpetological data in this region of Pakistan. Amphibians recorded in this study predominantly belonged to the families Bufonidae and Dicroglossidae. Only one representative of the family Microhylidae was recorded. Among the recorded amphibians, *Firouzophrynus stomaticus* was the only representative of toads, while the remaining four species recorded were frogs. Reptiles recorded in this study include lizards, snakes, and a turtle.

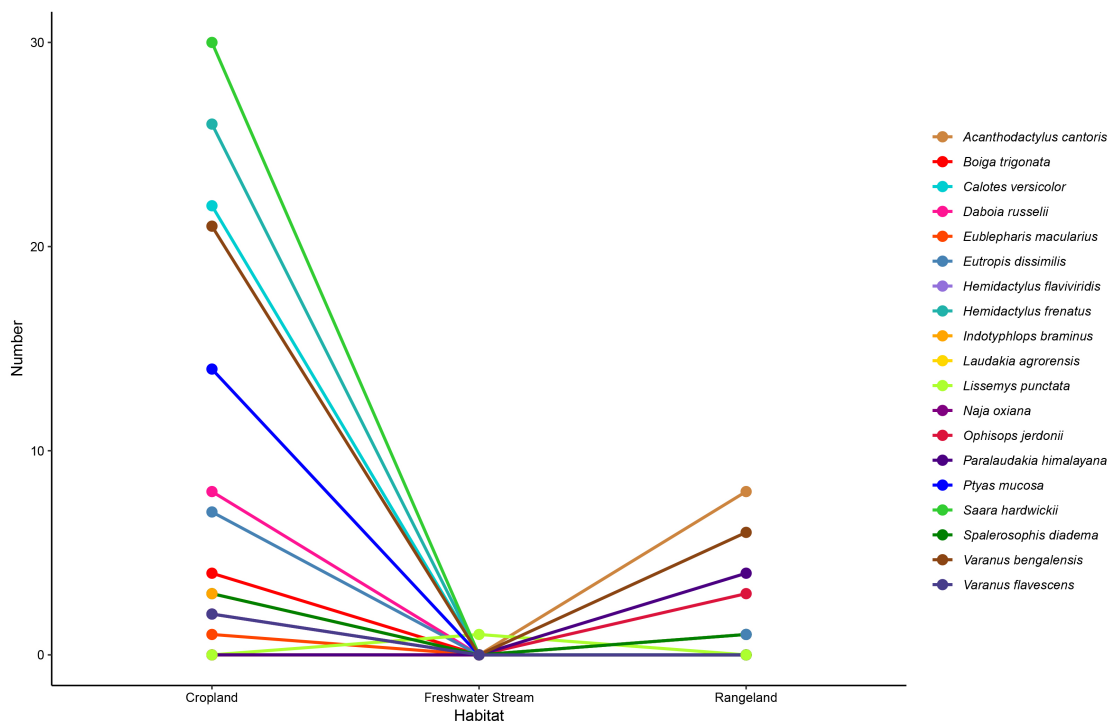


Figure 4. Line plot showing the abundance of each reptile species recorded in cropland, freshwater stream, and rangeland habitats.

Among lizards, the family Agamidae had the most records, followed by Gekkonidae, Varanidae, Lacertidae, Scincidae, and Eublepharidae. Among snakes, the family Colubridae accounted for the highest number of records, followed by Viperidae, Typhlopidae, and Elapidae, respectively. Only one turtle species of the family Trionychidae was recorded.

Understanding the patterns of species diversity is crucial to ecology, biogeography, and conservation (Ricklefs 2004). Insufficient documentation of species poses a major obstacle for biologists in devising conservation strategies and determining the extinction status of species. The next challenge, the lack of clarity regarding species distribution, is of greater concern (Pimm et al. 2014). Herpetofauna species are often regarded as fearsome creatures and have received relatively little attention from scientific communities (Ali et al. 2018, Doherty et al. 2020, Olson & Pilliod 2022). Many regions of Pakistan lack comprehensive studies of herpetofauna (Rais et al. 2012, 2015, 2021). Amphibians have often been overlooked in research endeavors in Pakistan (Rais et al. 2023). Likewise, reptiles have not received significant attention in research (Rais et al. 2012). The Talagang region has not been the subject of any prior herpetofauna studies. This initial research endeavor will not only benefit future researchers but also fill the knowledge gap regarding species data from this region of Pakistan.

Worldwide, the conservation of amphibians and reptiles is a pressing matter (Valencia et al. 2023). Assessment of threats to herpetofauna species in any given region is essential for devising effective conservation strategies (Gibbons et al. 2000). Among the recorded species in this study, five are currently listed in threatened categories of the IUCN Red List (Figure 5), i.e., *Naja oxiana* and *Varanus bengalensis* as Near Threatened (Ananjeva et al. 2021, Cota et al. 2021), *Lissemys punctata* and *Saara hardwickii* as Vulnerable (Rahman et al. 2021, Vyas et al. 2022) and *Varanus flavescens* as Endangered (Das et al. 2021). Habitat

fragmentation in croplands and rangelands, due to activities such as road network development and various agricultural practices, was identified as the primary threat to both amphibians and reptiles. Additionally, environmental pollution, including the use of agrochemicals in croplands and the presence of plastic waste in freshwater streams, was identified as a significant challenge to herpetofauna. Another major threat noted, specific to reptile species, was poaching and killing. This includes poaching for sale, killing out of fear, and hunting to protect livestock.

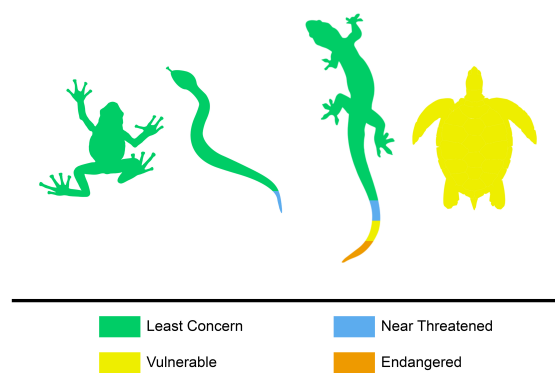


Figure 5. Percentage breakdown of herpetofauna species in different IUCN Red List categories.

In the future, rigorous scientific investigations, including studies of the effects of agricultural practices and habitat structure changes, will enable the identification of threats to the survival of herpetofauna and help develop effective conservation strategies in this region of Pakistan. A detailed systematic survey is recommended to obtain reliable data, and the eDNA approach can be included as it is a non-invasive and powerful tool for detecting species presence (Pérez-Fleitas et al. 2023, Nordstrom et al. 2022, 2024, Sun et al. 2024, Newton et al. 2025). The eDNA method can be used for future studies in the region. Citizen science initiatives should encourage public involvement in data collection and species monitoring, fostering stronger connections between communities and conservation efforts. Strengthening collaborations between wildlife organizations and research institutions can

further enhance conservation outcomes. Raising awareness within the community is essential for the conservation of herpetofauna species (Junaid 2025). By involving residents, educational institutions, and stakeholders, a deeper understanding of the importance of these species and their habitats can be highlighted. Promoting the sustainable use of agrochemicals, ensuring proper disposal of plastic waste, and advocating against harming species out of fear should be encouraged within the local community. Implementing these measures collectively will help conserve the region's herpetofauna.

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