

DIVERSITY AND ABUNDANCE OF HERPETOFAUNA AT JAHANGIRNAGAR UNIVERSITY CAMPUS, BANGLADESH

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Abstract: Herpetofauna, comprising amphibians and reptiles, are highly sensitive to habitat alterations, making them valuable indicators of the ecosystem health of a landscape. Despite their ecological importance, these taxa remain poorly studied, particularly within human-dominated urban environments. This study was conducted at Jahangirnagar University campus, an area enriched with wetlands and woodlands, from May to October 2023, to assess the diversity and abundance of herpetofauna using the plot sampling method. A total of 33 species were recorded, comprising 12 amphibian species under five families and 22 reptile species under nine families. Among amphibians, three species were categorized as very common, six common, two uncommon, and only one was rare. Among reptiles, five species were very common, five common, seven uncommon, and four species were rare. The Shannon–Wiener Diversity Index (H) indicated that cultivated lands supported the highest amphibian diversity ($H = 2.48$), while forest patches exhibited the greatest reptile diversity ($H = 2.35$). However, increasing anthropogenic pressures, including infrastructure expansion and pollution, pose significant threats to the persistence of herpetofaunal diversity of Jahangirnagar University campus.

Key words: Amphibian, reptile, diversity, habitats, threats.

INTRODUCTION

Herpetofaunal assessments in Bangladesh are limited, with a few comprehensive studies on species richness, distribution, and abundance, particularly focusing on human-modified landscapes (Mahony *et al.*, 2009; Jaman *et al.*, 2021). The country's diverse climatic and ecological conditions encompass varied forest ecosystems ranging from mangroves to hill forests that support numerous herpetofaunal species (Mukul, 2007; IUCN Bangladesh, 2015). Amphibians and reptiles occupy a wide range of habitats—from natural forests and wetlands to human-dominated urban and rural environments (Hamer & McDonnell, 2008). Despite this diversity,

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the overall national status as well as distributional patterns in central and north western regions of Bangladesh remain poorly explored, leaving significant gaps in baseline data on species distribution and population status (Rabbe *et al.*, 2022). Herpetofauna play vital ecological roles and contribute to essential ecosystem services such as pest and mosquito control, disease regulation, scavenging, and nutrient cycling (Jaman *et al.*, 1999; Mukul, 2007; Islam *et al.*, 2018; Mandal *et al.*, 2021; Rabbe *et al.*, 2022). Amphibians, in particular, are sensitive bioindicators of environmental health owing to their permeable skin and biphasic life cycles (Sumanasekara *et al.*, 2015). Despite their ecological significance, herpetofaunal populations face severe threats from anthropogenic pressures, including habitat loss, pollution, pesticide use, wetland loss, intentional fires, and excessive extraction of natural resources (Eckstein *et al.*, 2021; Rabbe *et al.*, 2022). Land conversion for settlements and agriculture has further intensified habitat fragmentation and increased human–wildlife proximity, exacerbating biodiversity loss (Stuart *et al.*, 2004; Khan, 2015; Rabbe *et al.*, 2022).

Bangladesh currently harbours 216 herpetofaunal species, including 49 amphibians and 167 reptiles, of which approximately 15% are listed as Data Deficient (IUCN Bangladesh, 2015). This highlights the urgent need for updated records and population assessments. Compared to neighbouring countries such as India and Myanmar, herpetofaunal research in Bangladesh is limited (Mahony *et al.*, 2009; Hakim *et al.*, 2020). The paucity of studies from the central and northwestern regions (Howlader *et al.*, 2015a, b; Rahman *et al.*, 2019) including urban landscapes further constrains conservation planning and management actions. Effective management strategies require robust information on species diversity, distribution, and habitat associations (Mace, 2004; Boyd *et al.*, 2008). Furthermore, diversity indices and occupancy models provide valuable insights into herpetofaunal responses to habitat alteration (Russildi *et al.*, 2016).

Jahangirnagar University (JU) campus, situated in central Bangladesh, represents a semi-natural landscape that supports diverse flora and fauna within a matrix of wetlands, forest patches, and cultivated lands. Although urbanization and pollution threaten its ecological integrity, the campus still provides important refuges for herpetofaunal communities (Mahony *et al.*, 2009). Understanding species diversity and abundance within such environments is crucial for urban biodiversity conservation and its future monitoring. This study assessed the diversity and abundance of herpetofauna across different habitat types within JU campus and to

evaluate the conservation significance of herpetofaunal diversity in this human-altered landscape in central Bangladesh.

MATERIAL AND METHODS

Study sites: The present study was conducted at JU campus (23.5325° N, 90.1682° E), located in Savar Upazila of Dhaka District in central Bangladesh (Fig. 1). The campus covers an area of approximately 697.56 acres and encompasses a mosaic of ecological habitats, including wetlands, woodlands, grasslands, croplands, lakes, bushy areas, and human settlements (Khan *et al.*, 2021). This habitat heterogeneity supports rich faunal diversity, with recorded occurrences of mammals, birds, reptiles, and amphibians, making JU an important refuge for wildlife in an otherwise urbanized region (Mohsanin & Khan, 2009; Akter *et al.*, 2013; Sharmin *et al.*, 2019).

The area experiences a tropical monsoon climate characterized by an average annual rainfall of 30.44 mm and relative humidity of 84.26% (Mondol *et al.*, 2019). The mean temperature generally ranges from 26 °C to 32 °C (Mohsanin & Khan, 2009). The landscape is gently undulating, and the soil composition is enriched with iron, aluminium, and calcium, imparting yellowish to reddish coloration typical of the Pleistocene terrace formations (Khan *et al.*, 2021). The study area contains 12 man-made permanent lakes. Two lakes were selected for amphibian surveys—one located near the Transport Office and another adjacent to Muktomoncho. Similarly, two lakes were chosen for reptile surveys—one near Bishwakabi Rabindranath Tagore Hall and another adjacent to Butterfly Park. These lakes support diverse aquatic vegetation, including *Pistia stratiotes*, *Nymphaea lotus*, *Lepidosperma chinense*, *Ipomoea aquatica*, and *Nymphoides indica*, among others. During the monsoon season, numerous ephemeral water bodies form across the campus, providing suitable breeding habitats for amphibians. Two temporary pools were selected for the study—one adjacent to the Biological Faculty Building and another behind the Physics Department. Vegetation in these pools includes grasses and herbs such as *Paspalum distichum*, *Enhydra fluctuans*, *Bonnya antipoda*, and *Alternanthera philoxeroides*.

Several isolated woodland patches, primarily consisting of planted vegetation, occur throughout the campus. Two woodlands were selected for amphibian surveys—one behind Soptom Chayamoncho and another behind the Mathematics and Statistics Building. For reptile surveys, two woodlands were chosen—one beside Mir Mosharaff Hossain Hall and another adjacent to Soptom Chayamoncho (Fig. 1). These woodlands support diverse plant assemblages, including *Shorea robusta*, *Albizia lebbeck*, *Spondias mangifera*, *Phyllanthus emblica*, *Senna siamea*, *Swietenia mahagoni*,

Artocarpus heterophyllus, *Ficus* spp., *Lantana camara*, *Phyllodium pulchellum*, and *Urena lobata*. The campus also contains limited cultivated areas. Croplands were surveyed for amphibians, particularly those located on both sides of the Bangabandhu Sheikh Mujibur Rahman Hall field. These areas are primarily cultivated with paddy (*Oryza sativa*). Human settlements include student dormitories, faculty residences, and administrative buildings. Two sites—Mir Mosharaff Hossain Hall and the Transport Office Building—were selected for reptile surveys within this habitat type (Fig. 1).

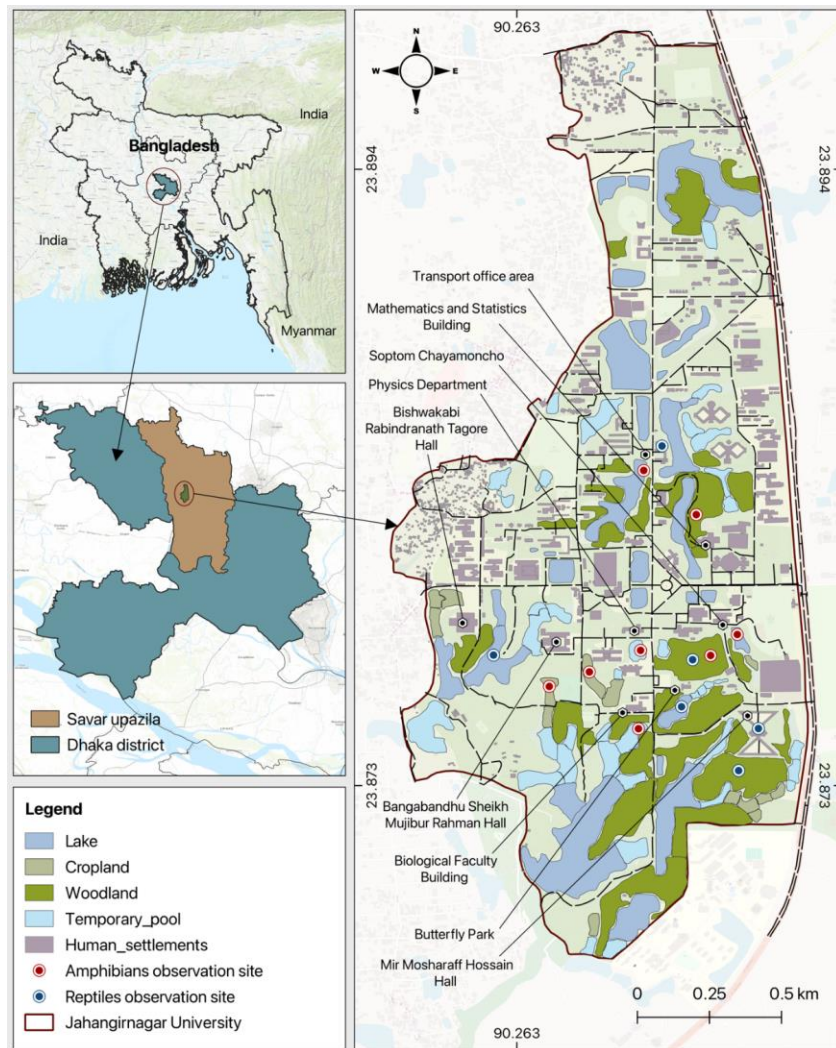


Fig. 1. Location of sample sites for detecting herpetofauna in Jahangirnagar University campus, Bangladesh.

Field surveys: The study was conducted from May to October 2023, coinciding with the peak activity period of amphibians and reptiles (Rahman *et al.*, 2013; Hasan & Feeroz, 2014). Data were collected using a combination of 5 m × 5 m sample plot laid out in each selected site, giving a total of 14 sample plots available for monthly counts. Surveys were carried out twice a month, covering all sample plots. Amphibian and most reptile surveys were conducted at night between 18:30 and 22:30, while diurnal species such as skinks and lizards were surveyed between 11:00 and 13:00 (Rabbe *et al.*, 2022). Four habitat types were covered for amphibians (lakes, temporary pools, croplands, and woodlands), and three for reptiles (lakes, woodlands, and human settlements) observation. Observations were made through visual encounters during active searches using high-intensity torchlights and, when possible, the naked eye. Each individual detected during the survey was photographed. During the searches, logs, grasses, bushes, leaf litter, and similar microhabitats were lifted or turned carefully to locate cryptic herpetofaunal species. Species identification was confirmed using photographic guides and books (Hasan *et al.*, 2014; Khan, 2018).

Data analysis: Herpetofaunal species diversity across habitat types was quantified using the Shannon–Wiener Diversity Index (*H*) (Crane *et al.*, 2018). The aggregated total counts of each species across different sample plots were used to assess species abundance and was visualized using *ggplot2* in the statistical program R version 4.5.0 (R Core Team, 2023). Species status was categorized based on sighting frequency across sample plots: Very Common (detected a species during 76–100% of visits), Common (51–75%), Uncommon (26–50%), and Rare ($\leq 25\%$ or occasional sightings) (Khan, 2008). Maps and figures were prepared in QGIS version 3.40.

RESULTS AND DISCUSSION

Amphibian diversity: A total of 12 species of amphibians belonging to 5 families (Bufonidae, Rhacophoridae, Microhylidae, Ranidae, and Dicroglossidae) were recorded (Table 1). The family Dicroglossidae contained the highest proportion (59%) of the recorded amphibians, followed by the Microhylidae (17%), Rhacophoridae (8%), Ranidae (8%), and Bufonidae (8%). A total of 522 individuals of amphibians were recorded (Fig. 2). The *H. tigerinus* was the most abundant species ($n = 112$), while the *U. globulosus* was the least ($n = 3$). The *H. tigerinus*, *M. teraiensis*, *M. asmati*, *D. melanostictus* were found across all habitat types, whereas *U. globulosus* was found only in the woodlands. Overall, cropland exhibited the greatest

variability and the highest counts of amphibians, whereas lakes consistently supported the lowest numbers. Woodland habitats and temporary pools showed intermediate levels of abundance. These patterns underscore the importance of habitat heterogeneity in sustaining

Table 1. List of amphibian species recorded in the Jahangirnagar University campus with their status

Family Name	Common Name	Scientific Name	Status (This study)	IUCN Bangladesh (2015)
Bufonidae	Asian Common Toad	<i>Duttaphrynus melanostictus</i>	VC	LC
Rhacophoridae	Common Tree Frog	<i>Polypedates leucomystax</i>	C	LC
Ranidae	Yellow Stripped Frog	<i>Hylarana tytleri</i>	UC	LC
Microhylidae	Ornate Microhylid Frog	<i>Microhyla ornata</i>	C	LC
	Indian Balloon Frog	<i>Uperodon globulosus</i>	R	VU
	Skipper Frog	<i>Euphlyctis cyanophlyctis</i>	C	LC
	Green Pond Frog	<i>Euphlyctis hexadactylus</i>	UC	LC
Dicroglossidae	Asmat's Cricket Frog	<i>Minervarya asmati</i>	C	LC
	Pierre's Cricket Frog	<i>Minervarya pierrei</i>	C	LC
	Syhadra Cricket Frog	<i>Minervarya sahyadris</i>	VC	LC
	Terai Cricket Frog	<i>Minervarya teraiensis</i>	C	LC
	Indian Bull Frog	<i>Hoplobatrachus tigerinus</i>	VC	LC

amphibian assemblages within urban landscapes. The 12 species recorded in this study represent approximately one-quarter of the 49 amphibian species previously reported nationally in Bangladesh (IUCN Bangladesh, 2015), emphasizing the conservation value of the university campus as an important habitat patch in central Bangladesh despite ongoing anthropogenic pressures. In contrast, a survey at the University of Dhaka campus documented only five amphibian species, likely reflecting a limited of suitable habitats or habitat diversity (Shome *et al.*, 2021). More recent report indicated that national record of amphibian has risen to 62 species, with central regions characterized by moderate species richness but heightened vulnerability to urban expansion (Rahman *et al.*, 2022). Despite these pressures, JU campus continues to function as a stronghold for amphibians, although it faces several threats, including road mortality, pollution of water bodies by plastic waste, general waste disposal, unplanned infrastructural development, and inadequate lake management (Jahan *et al.*, 2017). The Shannon-Wiener Diversity Index (H) by habitat was the highest in the cropland ($H = 2.48$), followed by temporary pool ($H = 2.17$), woodland ($H = 2.12$), and lake ($H = 1.54$). Among the recorded amphibians, three species were classified as very common, six common, two

uncommon, and only one rare. Our analysis revealed a distribution of individual counts varied notably across the four habitat types (cropland, lake, woodland, and temporary pool). The cropland exhibits the widest range of counts, exceeding 50 individuals, indicating high variability and occasional large

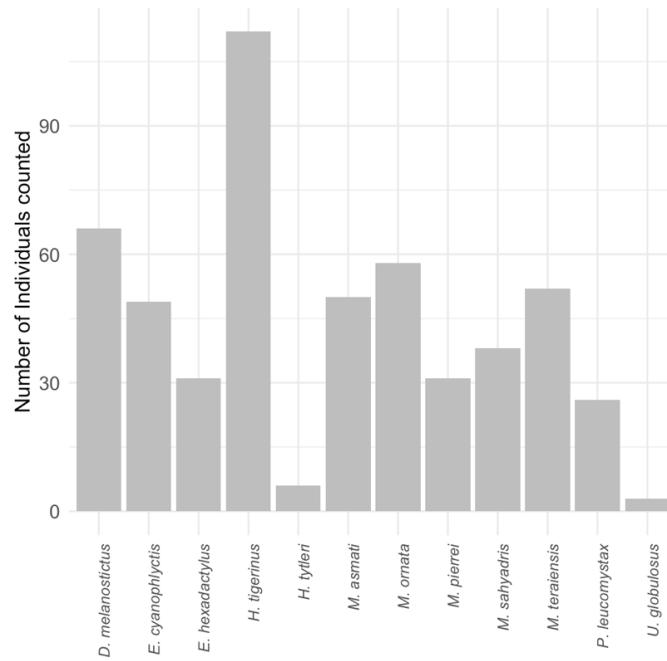


Fig. 2. Abundance of amphibian species across different habitat types of Jahangirnagar University campus.

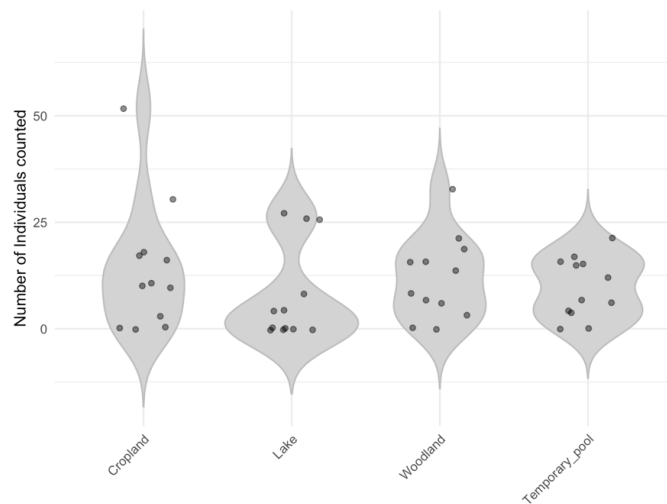
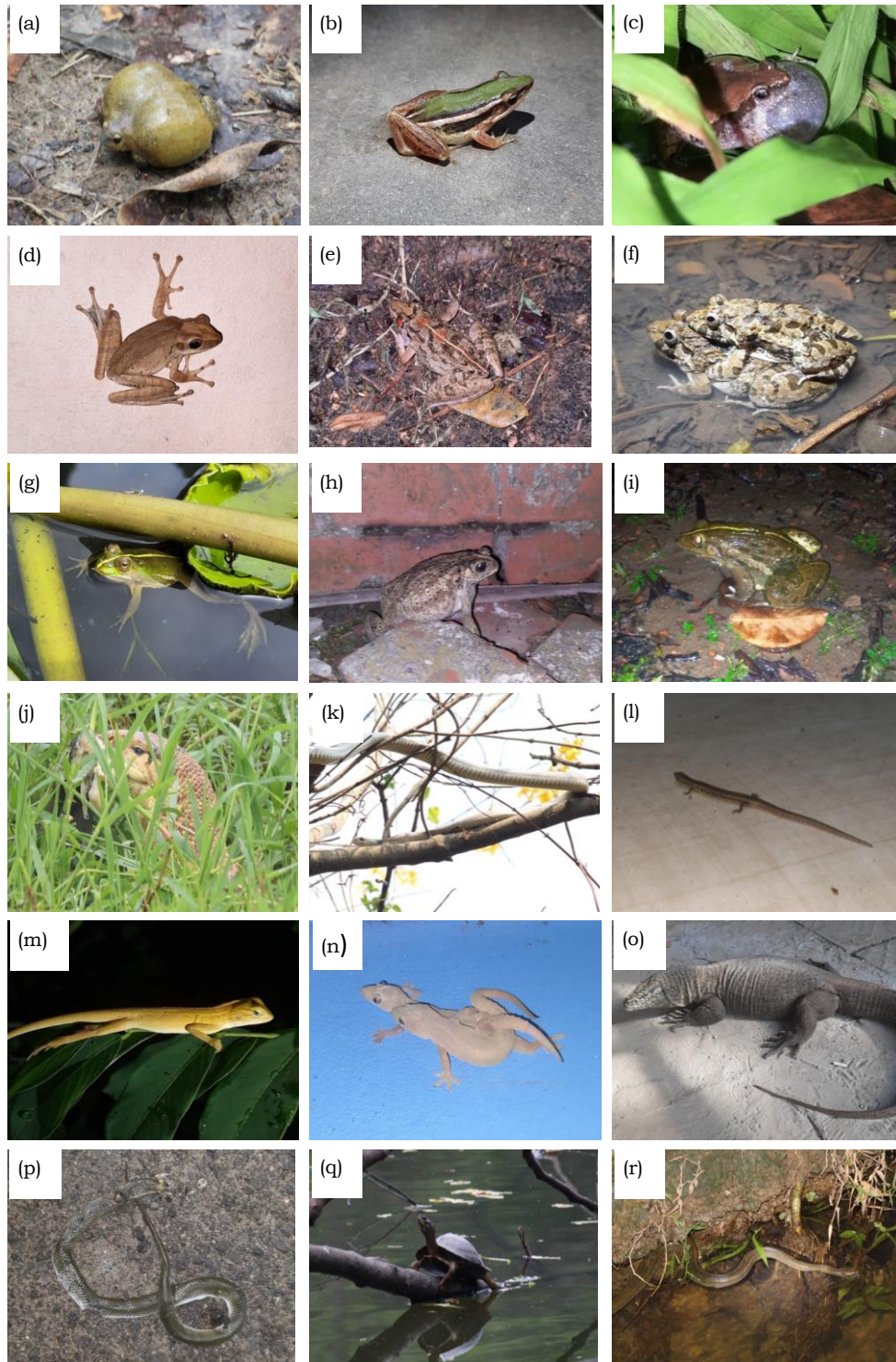


Fig. 3. Distributional patterns of amphibian species across four habitat types in Jahangirnagar University campus.



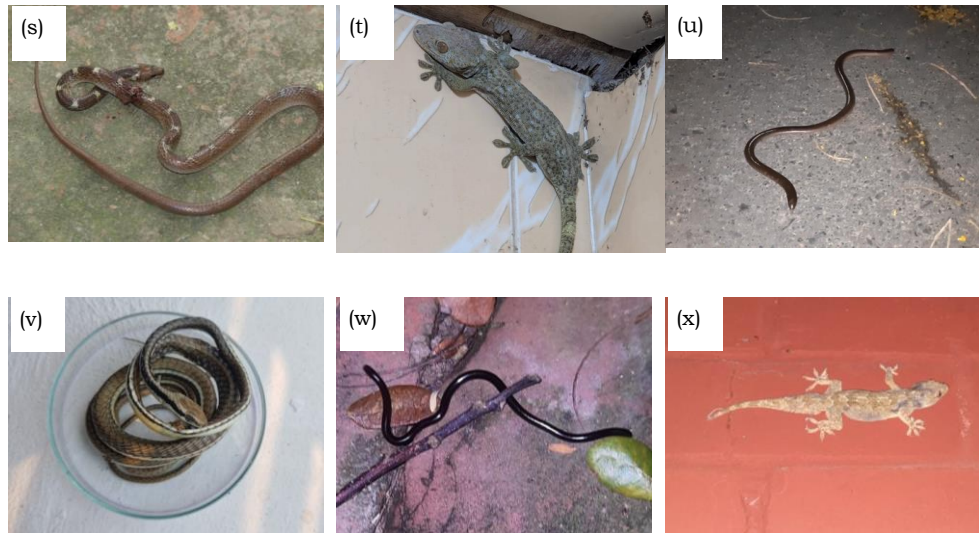


Fig. 4. Recorded herpetofauna in Jahangirnagar University campus during study period: (a) *Uperodon globulosus*, (b) *Hylarana tytleri*, (c) *Microhyla ornata*, (d) *Polypedates leucomystax*, (e) *Minervarya asmata*, (f) *Minervarya teraiensis*, (g) *Euphlyctis hexadactylus*, (h) *Duttaphrynus melanostictus*, (i) *Hoplobatrachus tigerinus*, (j) *Varanus flavescens*, (k) *Ptyas mucosa*, (l) *Subdoluseps bowringii*, (m) *Calotes versicolor*, (n) *Hemidactylus frenatus*, (o) *Varanus bengalensis*, (p) *Lycodon jara*, (q) *Pangshura tecta*, (r) *Enhydryn enhydryn*, (s) *Lycodon capucinus*, (t) *Gekko gecko*, (u) *Argyrophis diardii*, (v) *Dendrelaphis tristis*, (w) *Indotyphlops braminus*, (x) *Hemidactylus flaviviridis*.

aggregations of amphibians. The lakes show lower and more concentrated counts, with most observations of 20–30 individuals. The woodland habitats present a moderate and more uniform distribution while the temporary pools display a moderately variable distribution (Fig. 3).

Previous research has documented a high amphibian richness in agricultural landscapes of northwestern Bangladesh (Rabbe *et al.*, 2022). In contrast, agricultural areas in central Bangladesh support a lower diversity, largely due to insect population declines driven by intensive pesticide use, which directly impacts amphibian communities (Jahan *et al.*, 2017). The comparatively higher diversity observed in the croplands and associated habitats of the JU campus suggests limited pesticide application, thereby supporting richer amphibian assemblages. The moderate diversity recorded in temporary pools and woodlands likely reflects their suitability as breeding and sheltering habitats during the monsoon season, owing to the ecological importance of ephemeral water bodies and vegetative cover. Conversely, the low diversity observed in lake habitats indicates suboptimal conditions, a pattern consistent with other wetland systems in central Bangladesh (Shome & Jaman, 2021).

Table 2. List of reptilian species recorded in Jahangirnagar University campus with their status

Family Name	Common Name	Scientific Name	Status (This study)	IUCN Bangladesh (2015)
Agamidae	Oriental Garden Lizard	<i>Calotes versicolor</i>	VC	LC
	House Gecko	<i>Hemidactylus frenatus</i>	VC	LC
Gekkonidae	Yellow green House Gecko	<i>Hemidactylus flaviviridis</i>	C	LC
	Tokay Gecko	<i>Gekko gekko</i>	UC	LC
	Keeled Grass Skink	<i>Eutropis carinata</i>	UC	LC
Scincidae	Bowring's Supple Skink	<i>Subdoluseps bowringii</i>	R	LC
	Bronze Grass Skink	<i>Eutropis macularia</i>	UC	LC
Varanidae	Bengal Monitor Lizard	<i>Varanus bengalensis</i>	VC	NT
	Yellow Monitor Lizard	<i>Varanus flavescens</i>	R	NT
Bataguridae	Indian Roofed Turtle	<i>Pangshura tecta</i>	C	LC
Trionychidae	Spotted Flapshell Turtle	<i>Lissemys punctata</i>	C	LC
Typhlopidae	Common Blind Snake	<i>Indotyphlops braminus</i>	C	LC
	Diard's Blind Snake	<i>Argyrophis diardii</i>	UC	LC
Elapidae	Spectacled Cobra	<i>Naja naja</i>	R	NT
	Monocled Cobra	<i>Naja kaouthia</i>	UC	NT
	Common Wolf Snake	<i>Lycodon capucinus</i>	C	LC
	Smooth scaled Water Snake	<i>Enhydria enhydria</i>	VC	LC
	Checkered Keelback	<i>Fowlea piscator</i>	VC	LC
Colubridae	Buff striped Keelback	<i>Amphiesma stolatum</i>	UC	LC
	Indian Rat Snake	<i>Ptyas mucosa</i>	UC	LC
	Twin Spotted Wolf Snake	<i>Lycodon jara</i>	R	LC
	Bronze-back Tree Snake	<i>Dendrelaphis tristis</i>	R	LC

Status code: VC - Very Common, C - Common, UC - Uncommon, R - Rare; LC - Least Concern, NT - Near Threatened, VU - Vulnerable

Reptilian diversity: Among the reptiles, a total of 22 species belonging to 9 families (Agamidae, Gekkonidae, Scincidae, Varanidae, Bataguridae, Trionychidae, Typhlopidae, Elapidae, and Colubridae) were recorded (Table 2). The family Colubridae represented the highest number of species (29%), followed by the Gekkonidae (14%), Scincidae (14%), Typhlopidae (10%), Varanidae (10%), Elapidae (10%), Bataguridae (5%), Trionychidae (5%), and Agamidae (5%). A total of 314 individuals were recorded during the study

period, of which the *V. bengalensis* was the most common ($n = 51$) species, while the *L. jara* was the least ($n = 1$). The *F. piscator*, *V. bengalensis*, and *E. carinata* were found across all habitat types (Fig. 5).

The record of 22 reptile species constitutes approximately one-eighth of the total reptilian fauna of Bangladesh (IUCN Bangladesh, 2015), underscoring the significance of the JU campus as an important habitat within an urbanized landscape. Species richness documented here also exceeds that reported from nearby habitats within the Bangladesh Livestock Research Institute (Rahman & Hasan, 2013). By contrast, only 10 species were recorded from the University of Dhaka (Shome *et al.*, 2021), where intense anthropogenic pressures prevail. This comparison suggests that there are some natural habitats in JU campus which may provide comparatively better habitat conditions and resources for reptile assemblages.

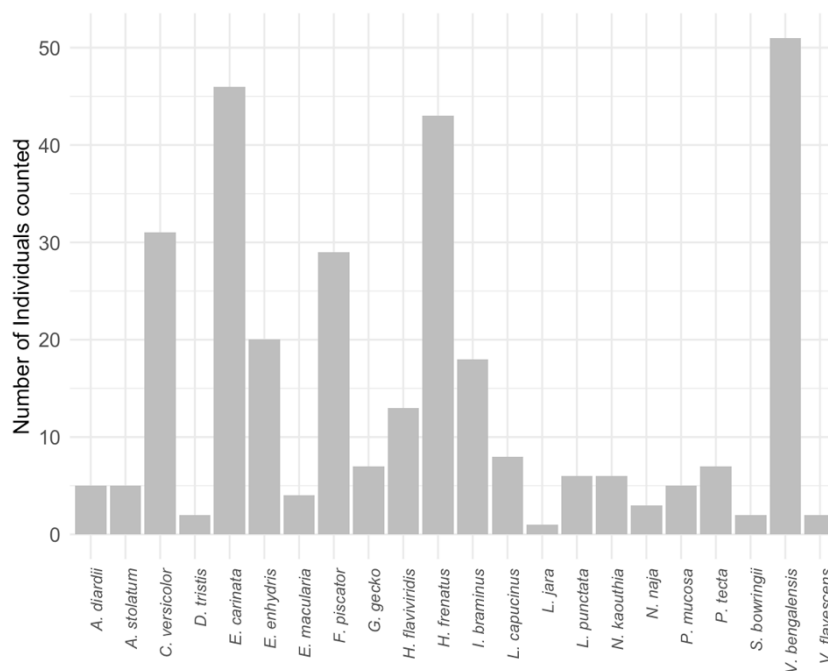


Fig. 5. Abundance of reptilian species recorded across different habitat types of Jahangirnagar University campus.

The Shannon-Wiener Diversity Index (H) analysis showed that woodland has the highest value ($H = 2.35$), followed by human settlements ($H = 2.00$), and lake ($H = 1.87$). Among the recorded reptiles, five species were very

common, five common, seven uncommon, and five species were rare. The individual counts showed fairly skewed distributional patterns, indicating inconsistent densities across habitat (human settlement, $n = 103$; lake, $n = 92$; woodland, $n = 119$) types (Fig. 6).

The H Index was the highest in woodland habitats, consistent with earlier observations of elevated reptile abundance on the JU campus (Reza & Perry, 2015). Woodlands likely offer optimal habitat conditions through structurally diverse tropical vegetation that provides both shelter and foraging opportunities. In contrast, reptilian species diversity was lower around human settlements and lake habitats, reflecting degraded or polluted conditions that reduce habitat suitability.

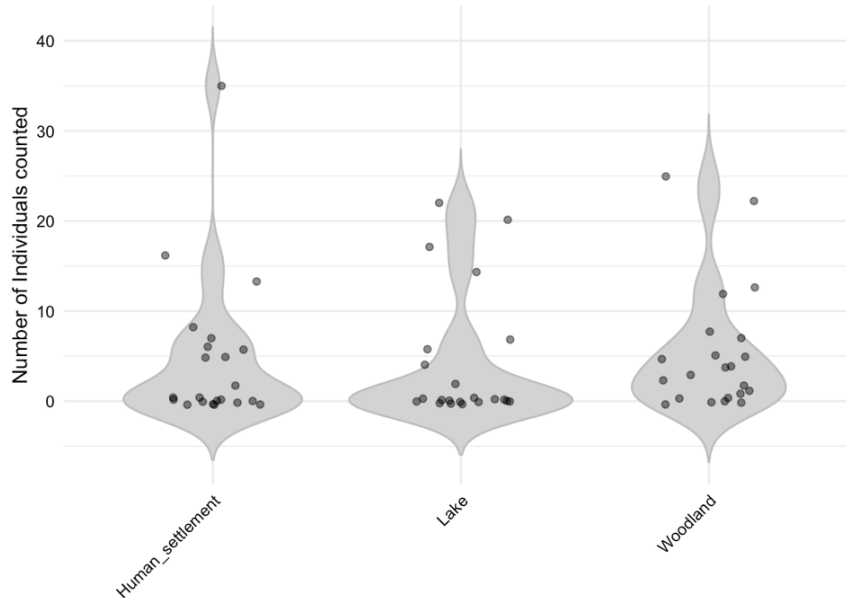


Fig. 6. Distributional patterns of reptilian species across four habitat types in Jahangirnagar University campus.

Management implications: The herpetofaunal habitats in JU campus require urgent conservation attention as it has been undergoing through extensive infrastructural development in recent years, including new dormitories, academic buildings, administrative facilities, and road networks. Priority measures should include restoring degraded habitats, preventing the filling of temporary pools, and enforcing wetland protection to preserve key grasslands, woodlands, and lakes. Strengthening lake management—particularly through pollution control, removal of plastic waste, and routine

monitoring—will further improve habitat quality for amphibians and reptiles. Woodland conservation should emphasize planting native species and limiting additional construction to maintain essential microhabitats. Integrating herpetofaunal conservation into the university's broader biodiversity management framework will also help support national initiatives to safeguard threatened species.

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