



## Ecological Impact of Urbanization on Anuran Fauna And Need for Conservation Measures: a Study in Barak Valley, Assam.

### KEYWORDS

urbanization, anuran, habitat degradation, pollution, conservation.

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### ABSTRACT

Urbanization has negative influence on biodiversity. It leads to alteration of habitat structure and quality influencing distribution and survival of fauna. Barak Valley region of Assam abounds in wetlands, streams, pools, and marshes; paddy fields and low hills. Twenty species of anurans were recorded in the area belonging to 6 families and 10 genera. Agriculture and tea cultivation are important economic activities in the region. Urbanisation is accompanied by earth cutting, reclamation of ponds, pollution of water bodies and increase of vehicular traffic accompanied by road kill of amphibians and reptiles. Conversion of agricultural land into brick kilns is a recent development. Anurans inhabit diverse habitats and are influenced by water availability, moisture condition and vegetation. The paper analyses the impact of urbanization and related anthropogenic activities and puts forward suggestions which would help design conservation strategies for this lesser studied group of vertebrates.

### Introduction:

Urbanisation is a global phenomenon and major concern for the health of ecosystems and environment. Urbanization is a powerful agent of ecological change and has a detrimental effect on the landscape as well as species richness of various taxa (McKinney, 2002). Urbanisation brings with it exposure to contaminants, eutrophication, changes in hydroperiod, changes in geomorphology and also leads to habitat degradation and loss. The northeast region of India is gifted with greenery, heavy rainfall, varied topography including river valley plains, hills, flood plain lakes, wetlands etc. The region is one of the 35 global biodiversity hotspots and home to unique fauna like the Sanghai deer of Manipur, Hoolock Gibbon, Hornbill, and Pigmy deer. Among the lesser studied vertebrates the region provides habitat for variety of amphibians and reptiles. However, habitat degradation, fragmentation and loss are the major threats faced by the herpetofauna. The Barak Valley districts of South Assam comprises three districts viz. Cachar, Hailakandi and Karimganj (24° 8' N and 25° 8' N latitudes and 92° 15' E and 93° 15' E longitudes). The region has myriad freshwater ecosystems along with thick tropical vegetation which offer excellent habitats for anurans.

Amphibians are considered environment health indicators and they need both land and water for their survival and propagation. Habitat loss is generally considered the most important cause of amphibian population decline (Cushman, 2006). Urbanization and other developmental activities have led to habitat fragmentation, degradation and loss along with pollution of natural habitats creating unsuitable conditions for the survival of anurans. During a survey conducted in this region twenty species of anurans belonging to ten genera and six families were recorded (Dey, 2011). Another study recorded 23 species of anurans from the Borail Wildlife Sanctuary which borders the Barak Valley region in the north (Das et al. 2009).

### Material and Methods:

Tadpoles and aquatic adults were collected by dip net. For more terrestrial species the area was actively searched and visual inspection of various habitats was carried out during the day and night. Adults were caught by hand and flashlights were used during the nocturnal survey (Inger and Dutta, 1986). During breeding season the call of the male anurans helped in tracing out frogs/toads. The locality, date, time, microhabitat of each individual was recorded. Adults were collected from paddy fields, marshy land, grassy meadows, heterogeneous areas having human habitations, wet and wastelands. Some of the specimens collected were deposited at the Zoological Survey of India, Kolkata for identification and for preservation as voucher specimens. The more rare ones were caught, identified, photographed and released back into their habitat. Acoustic searching was also done, species were photographed using NIKON P-100 and Nikon D3100 camera and due to lack of sound/video recorder the same camera was used for video and sound recording where ever possible. During field survey the following equipments were used: Polythene bags, plastic bottles, snake catching stick, frog catching net, field notebook, leech-guard, high power charging light, torch light, etc.

### Results and Discussion

The inventory of anuran species of Barak Valley (Fig.1) recorded during field survey is presented in Table 1. Twenty species of anurans belonging to 10 genera and 6 families were recorded, belonging to Bufonidae, Megophryidae, Microhylidae, Dicroglossidae, Ranidae and Rhacophoridae. *Microhyala berdmorei*, *Fejervarya teraiensis*, *F. pierrei*, *F. nepalensis*, *F. syhadrensis*, *Clinotarsus alticola*, *Humarana humeralis*, *Philautus sp.* and *Chiromantis vittatus* were recorded for the first time during the present study (2010-2011) and is an addition to the earlier list (Dey and Gupta, 1999).

**Table 1: Status of anurans (Class:Amphibia) in N.E India and Barak Valley.**

Sl. No	Species name	Family	Status		
			Northeast India		Barak Valley
			Indian WLP 1972	Status	
1	<i>Duttaphrynus melanostictus</i>	Bufonidae	None	LC	Common
2	<i>Leptobranchium smithi</i>	Megophryidae	None	LC	Common

3	<i>Kaloula pulchra</i>	Microhylidae	None	LC	Rare
4	<i>Microhyla ornata</i>		None	LC	Common
5	<i>M. berdmorei</i>		---	---	Rare
6	<i>Euphlyctis cyanophlyctis</i>	Dicroglossidae	Schedule IV	LC	Abundant
7	<i>F. teraiensis</i>		---	---	Abundant
8	<i>F. pierrei</i>		Schedule IV	LC	Common
9	<i>Fejervarya nepalensis</i>		---	LC	Abundant
10	<i>F. sahydransis</i>		--	--	Abundant
11	<i>Hoplobatrachus tigerinus</i>		Schedule IV	LC	Common
12	<i>Hylarana taipehensis</i>	Ranidae	Schedule IV	LC	Rare
13	<i>Hylarana erythraea</i> (Tadpoles identified and reared to adult)		-	-	-
14	<i>Sylvirana leptoglossa</i>		Schedule IV	LC	Common
15	<i>Clinotarsus alticola</i>		-	-	-
16	<i>Humarana humaralis</i>		-	-	-
17	<i>Rana sp</i>		-	-	-
18	<i>Polypedates teraiensis</i>	Rhacophoridae	None	LC	Common
19	<i>Philautus sp</i>		-	-	-
20	<i>Chiromantis vittatus</i>		-	-	-

LC- Least Concerned, Common-C, Abundant-A, Rare-R, - not evaluated

Table 2 shows the breeding season of anurans found in urban locality of Silchar. All the *Fejarvarya species* (i.e *Fejarvarya peirrie*, *F. teraiensis*, *Fejervarya nepalensis*, *F. sahydransis*), *Euphlyctis cyanophlyctis*, *Duttaphrynus melanostictus*, *Hoplobatrachus tigerinus*, *Polypedatus leucomystax* and *Kaloula pulchra* are hardy and found frequently in urban areas while species like *Clinotarsus alticola*, *Sylvirana leptoglossa*, *Microhyla berdmorei*, *Philautus sp.*, *Humarana humeralis*, *Chiromantis vittatus*, *Leptobranchium smithi* are

only encountered in rural, forest and undisturbed areas. *Microhyla ornata* is found both in urban and rural areas. *Hylarana taipehensis* was found in Silchar in marshy area among water hyacinth (*Eichornia crassipes*) but since 1999 it has not been seen in this area, where rapid residential growth has taken place. Impact of urbanization on amphibians and reptiles has been studied in Guwahati, Assam where 14 anuran species belonging to 6 families were found in urban area (Purkayastha et al, 2011).

**Table 2. Habitat and breeding season of anuran species of Barak Valley from urban area.**

S.No	Name of species	Habitat	Breeding season
1	<i>Duttaphrynus melanostictus</i>	Nocturnal, terrestrial, found near horticultural gardens, hillocks, near human dwelling	November – April
2	<i>Euphlyctis cyanophlyctis</i>	Diurnal and nocturnal, all types of water bodies	April – May
3	<i>Fejarvarya sp</i> (four species in Barak Valley)	Nocturnal, moist terrestrial areas, near ponds and in water logged paddy fields	March – August
4	<i>Microhyla ornata</i>	Nocturnal, terrestrial habitat, on shrubs and small trees	April – May, August, December
5	<i>Hoplobatrachus tigerinus</i>	Nocturnal, permanent pond	March-April
6	<i>Polypedatus teraiensis</i>	On trees, especially banana trees, near human settlements, marshy thick vegetated area, dense forest	April – May
7	<i>Kaloula pulchra</i>	Nocturnal, found in ponds and tanks and can climb walls and trees.	Not detected
8	<i>Hylarana taipehensis</i>	Nocturnal, Marshy area, flooded area with thick aquatic vegetation	Not detected

Loss of Habitat: Some sites were selected for the study in 1998 and a comparison has been made between their present status and at the beginning of the study ie in 1998 (Table 3).

**Table 3. Location, type of locality, nature of habitats and present status at different study sites (1998-2012) in and around Silchar town.**

Location/ Site number	Type of locality	Type of habitat	Size	Area	Depth	Present status 2012
1	Urban	Permanent	30x35m	1050m <sup>2</sup>	2.0m	Present , provides water for human activity
2	"	"	31x35m	1085m <sup>2</sup>	2.0m	Degraded
3	"	"	30x33m	990m <sup>2</sup>	1.5m	Being filled up slowly
4	"	"	33x35m	1155m <sup>2</sup>	3m	Degraded due to setting up of servicing station
5	"	Temporary	1x1m	1m <sup>2</sup>	1m	Lost due to construction
6	"	"	1x1m	1m <sup>2</sup>	1m	Lost due to construction
7	"	"	1x1m	1m <sup>2</sup>	1m	Lost due to construction
8	"	"	1x1m	1m <sup>2</sup>	1m	Lost due to construction
9	"	"	0.5x0.0m	0.25m <sup>2</sup>	20cm	Lost due to construction
10	"	"	0.5x2m	1m <sup>2</sup>	9to10cm	Lost due to construction
11	Suburban	Permanent	40x45m	1800m <sup>2</sup>	2m	Lost due to construction
12	"	"	5x6m	30m <sup>2</sup>	0.5m	Lost, filled up.
13	"	"	5x6m	30m <sup>2</sup>	0.5m shallow 1 m deep end	Degraded due to waste disposal
14	"	"	0.5x100m	50m <sup>2</sup> to 200m <sup>2</sup>	10cm to 0.5m	Present within agriculture field
15	Rural	Temporary	1x1m	1m <sup>2</sup>	1m	Lost due to construction
16	"	"	2.75x1.5	4.13m <sup>2</sup>	12cm	Lost due to construction
17	"	Permanent	3x5m	-	Shallow	Lost due to construction
18	"	"	3x5m	-	"	Lost due to construction

Site 1-10 were located in Das Colony-Panchayet Road area in Silchar, a very busy, thickly populated area. Sites 1-4 are permanent ponds and contained water throughout the year and were used for fish culture and domestic purposes. Sites 5 – 8 were manmade holes at a construction site, retaining water during the monsoon but drying up during the winter months. The holes had soft muddy bottom with decomposing vegetation. Sites 9-10 were rain water puddles. Both these sites had soft muddy bottom with decomposing vegetation. The marginal vegetation around these systems comprised *Cynodon dactylon*, *Commelina benghalensis*, *Cyperus* spp., *Enhydra fluctans*, *Monochoria hastata* and *Eclipta prostrata*. *Salvinia* sp., a water fern was present in Site 3, a permanent pond. Sites 11-14 were located at Kabiura, Meherpur, Silchar which is also very thickly populated now. Site 11 is a large permanent pond was used for fish culture and domestic chores. It has been filled up and houses constructed. Sites 12 and 13 were both permanent ponds; Site No. 12 a permanent pond surrounded by a dense growth of bamboo used for building houses. Site number 13 was used for dumping domestic and agricultural wastes, as well as decomposing carcasses and is in extremely degraded condition now. Site 14 was a slow flowing channel in the paddy field measuring  $\approx$  0.5 m to 2 m in width and 10 cm to 0.5 m. in depth. The marginal vegetation was dominated by *Cynodon dactylon* and is now maintained as in the earlier state. Sites 15 and 16 were located in campus area of Assam University at Dargakona, about 20 km south of Silchar. The former a semi-permanent freshwater body with soft muddy bottom is lost due to construction work. Site 16 was a temporary system inside a partially undisturbed forest in the Assam University Campus with soft muddy bottom and clear water. However, both are now lost. Sites 17 and 18 were slow flowing streams inside the forest at Assam University Campus. They had thick riparian vegetation and soft muddy bottom but are now lost. The above sites were visited at fortnightly intervals from November 1996 to December 2000 and again in 2011-12. These systems have degraded due to various anthropogenic activities related to fast population growth, increased waste disposal, construction of residential complex/house etc. Freshwater habitats both

lotic and lentic are disturbed by urbanization not only in this region but has been reported around the world (Baron et al, 2002, Paul and Meyer, 2001). Such changes occur at low level of urbanization also through changes in water quality, discharge of polluting materials etc. Habitat change and degradation has been identified as the major cause of decline of biodiversity globally (Sala, et al, 2000), which also includes the amphibians. Urbanization is a major cause of amphibian decline globally and broad-scale landscape fragmentation is an important factor underlying the anuran community structure (Pillsbury, 2008).

**Developmental activities:** Urbanisation and development work in the form of construction of buildings, roads, bridges etc go hand in hand and affect the distribution of anurans. Adult anurans choose agricultural land and adjoining ponds and ephemeral pools for breeding as well as foraging. Anurans in general lay eggs in ponds- both permanent and temporary, ditches and ephemeral pools and loss of aquatic bodies disturb their life cycle. Tadpoles are detected from variety of aquatic habitats which emphasizes the need of sufficient aquatic habitats Human activities are widely responsible for disturbing and destroying a habitat in this region. Several of the habitats in the present study have been lost due to vehicular service station discharge, washing of vehicles, disposal of domestic waste and finally degradation.

**Reclamation of aquatic habitats:** Ponds were a natural feature in every house which provided water and also served as a habitat for different organisms including the anurans. Due to rapid urbanization, reclamation of ponds and wetlands is taking place at a fast rate. Filling up these habitats for building of residential complexes is leading to loss of breeding grounds. Expansion of urban area and reclamation of low lying land, wetlands, agricultural fields are observed. Malini Beel in Silchar town, a large wetland which helped storage of excess rainwater during monsoon has been lost. Land filling of ponds to construct multistoried buildings has led to decline of breeding sites of the anurans.

**Earth cutting and deforestation** are part of urbanization. Earth cutting is done for road construction, earth filling of lowlying area and for setting up of small and medium industries. The construction of six lane MahaSadhak i.e. Silchar- Hailong road and the conversion of meter gauge railway line to broad gauge line between Silchar and Lumding will both have impact on the biodiversity. Both the projects run through and near the Borail Range which is very rich in biodiversity including anurans. Deforestation and fragmentation commonly causes losses from tropical forests and the Western Ghat amphibians are facing habitat loss induced by deforestation and fragmentation (Daniels, 1999; Molur and Walker, 1998). Therefore, afforestation programs have to be initiated to repair the damage done by deforestation.

**Vehicular Kill:** Urban development is accompanied by increase in road communication and vehicular traffic. The anurans are killed on the road by speeding vehicles as these are relatively small in size and slow in movement. The intensity is more in the breeding and post breeding season. *Duttaphrynus melanostictus* both adults and juveniles are killed most frequently by the vehicular traffic. A study on a busy road in the university campus revealed that this species was killed in maximum number (118 out of 149 killed i.e. 88%).

**Change in landscape and land use:** In recent years the setting up of several brick kilns in agricultural fields has led to degradation of large landscape and loss of habitat. The change in landscape pattern due to brick kilns is also affecting anuran distribution. The heat from firing of bricks also may be causing habitat degradation. Habitat is also degraded due to waste disposal from various anthropogenic sources which has become very common and affect the anuran population.

#### Conclusion:

Urbanization and development have become a necessity but has negative impact on biodiversity. Species are affected by changes in the landscape and by changes within site in urban areas. Any disturbance can affect the ecosystem and particularly affects sensitive species, more resilient species survive and are able to tolerate the changes. Anurans have biphasic lifestyle and occupy important position in food chain. Urbanization converts natural habitats into human-modified ecosystems and reduces the diversity and abundance of indigenous plant and animal communities. Urbanization may lead to the extinction of indigenous species or facilitate the establishment of non-indigenous communities in cities and towns. To conserve herpetofauna in urban areas we need to maintain structural complexity in remnant habitat patches, and implement strategic policies and management actions that protect habitat remnants and habitat corridors. Within urban areas maintenance of

aquatic habitat like ponds and lakes must be made compulsory which will not only provide suitable habitat but will also act as water storage systems. Massive afforestation programs have to be undertaken and it will also make up for the damage caused by deforestation. Awareness about the role of anurans in pest control and position in ecological food chain must be spread in the general public. School students should be made aware of ecosystem benefit and service obtained which will help in conservation of this lesser studied group of animals.

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Fig.1 Map of study area-Barak Valley

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