

Herpetofaunal Diversity in Nagarjun Forest

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Abstract

The composition of amphibians and reptiles diversity in the Nagarjun forest of Shivapuri Nagarjun National Park was studied. Purposive transect and opportunistic survey methods were adopted to estimate species diversity. The species caught during survey were identified on the spot using field guide and released *in-situ*. Transects were distributed across six distinct micro-watersheds in the forest. In total, 134 individuals belonging to 11 species were observed. The spatial distribution patterns of the species were also mapped. The condition and potential threat of the habitat is also assessed during this study.

Key words: amphibians, diversity, transect survey, reptiles

Introduction

Herpetofauna (amphibians and reptiles) are correspondingly defenseless against the global threats of deforestation, draining of wetlands, and pollution from agricultural runoff (Gibbons *et al.* 2000). Amphibian populations have suffered widespread declines and extinctions in recent decades (Kiesecker *et al.* 2001). Amphibians are frequently characterized as having limited dispersal abilities, strong site fidelity and spatially disjunctive breeding habitat (Smith & Green 2005). Limited dispersal ability may further increase the vulnerability of amphibians and reptiles to changes in climate. Slight changes in water level in breeding ponds can trigger reproductive failure and, in a single year, cause a severe drop in the population size of short-lived species; persistent changes can lead to extinctions of species (Arau Jo *et*

al. 2006). Although, the amphibian decline problem is a serious threat, reptiles appear to be in even greater danger of extinction worldwide (Gibbons *et al.* 2000). So, the assessments of amphibian and reptile diversity require exploration of previously unvisited areas, comprehensive surveys of poorly known areas, and revisiting of localities that have not been assessed in the last decade (Parra *et al.* 2007).

South Asia has a rich diversity of amphibian and reptilian fauna including several unique and endemic species (Shah & Tiwari 2004). Ecological research efforts and suitable protection of species naturally depend on the knowledge of species occurrences in a particular area. This information in readily accessible form is lack-ing for several taxonomic groups and regions in Southeast Asia (Sodhi & Brook 2006). It

appears that only about 50% of the biodiversity of amphibians in South Asia has been discovered. However, there is increasing habitat loss and fragmentation, which are rapidly depleting amphibian populations. Very few species have been described from disturbed habitats, indicating a diminished species composition when compared with the original habitat (Molur 2008).

Fourteen species of herpetofauna are endemic to Nepal. A total of 17 herpetofaunal species are enlisted as threatened in Nepal, of which six species are globally threatened (Bhujju *et al.* 2007). As herpetofauna is one of the poorly studied faunal group in the country, their present status is also poorly known (CEPF 2005). A publication “Amphibians and Reptiles of Nepal” edited by Schleich and Catstle (2002) provides an account of 50 amphibians and 123 reptiles. The herpetofauna in Nepal is relatively richer compared to other South Asian countries well over 206 species and sub-species, including 59 amphibian species of which 15 are listed as globally threatened. Amphibians and reptiles of Nepal face severe threat of extinction. Nepal has a reduced species composition compared with the 2001 checklists (Molur 2008).

Biodiversity resource profile indicates the current checklists of Shivapuri National Park include 3 herpetofauna species. But, this is sought to be the gap in study of herpetofauna in the park. This gap has created a situation of ‘No names, no conservation’ for herpetofauna since no systematic exploration works are ongoing. The park has different habitat conditions owing to topographical and microclimatic variations. The study is carried out with the aim to generate the current status of herpetofauna in the area and to sensitize the conservation efforts. Further, it is expected to minimize the gap in herpetological studies in Nepal. This paper has revealed the status of amphibians and reptiles diversity of Nagarjuna forest at different habitat.

Study area

The study area, Nagarjun forest, is inside the Shivapuri Nagarjun National Park. The area covers 16 km² in the western part of the national park. The study area extends from base of Nagarjun forest (around 1350 m a.s.l.) to top of Nagarjun hill (2100m a.s.l.). The study area is one of the important natural areas along the Kathmandu valley rim.

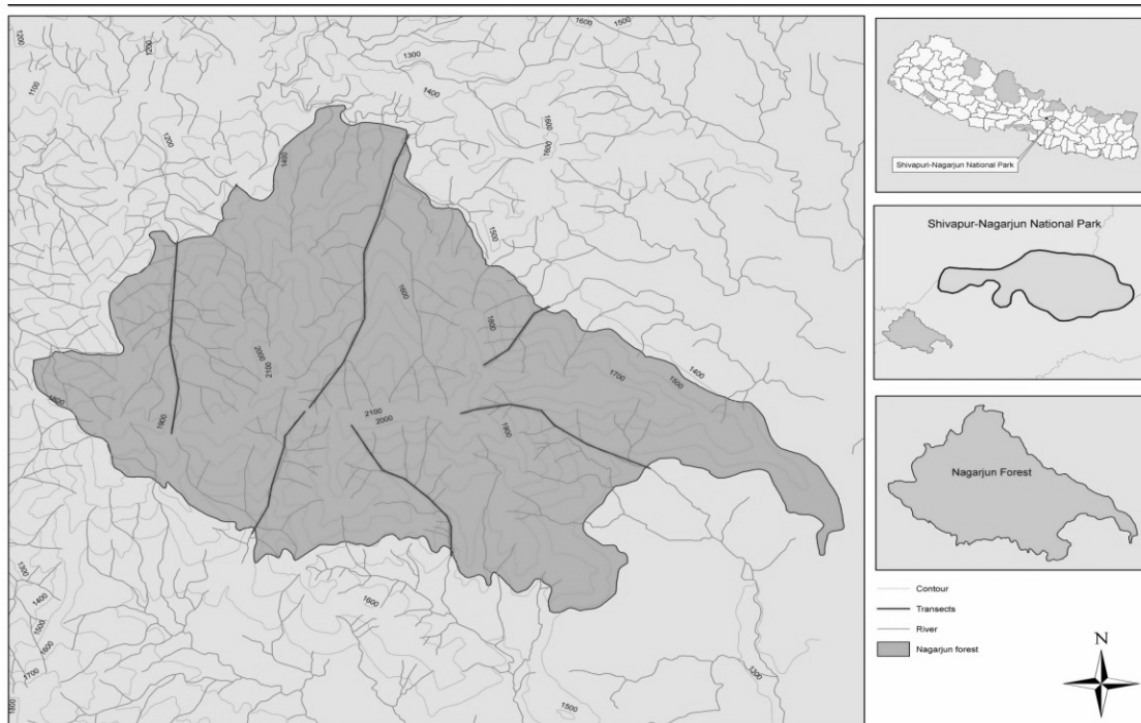


Fig.1. Depicts location of the study area

Nagarjun forest area is a typical Mahabharat hill and bears mostly sub-tropical type of climate and partly temperate climate (Chaudhary 1998). The southern side is sunny and is evidently much drier than the northern forested side. The climatic data of the Nagarjun area is not available. According to the climatic data of nearest meteorological stations i.e. Dhunibesi and Kakani, average relative humidity of the area ranges from 54.7 % (April) at Dhunibesi to 94.29% (July) at Kakani. Similarly, the average monthly rainfall ranges from 5.15 mm (December) to 548.73mm (July).

Methodology

The field methods involved the approaches for the basic exploration of the herpetofauna in the Nagarjun forest area. Purposeive transect method was adopted in order to sampling in the area for intensive study (Fig.2). Diurnal transect walks were carried to locate the amphibians and reptiles. Hand picking (using equipments for handling the reptiles and amphibians) method was used in all the sites. The species caught during survey were spot identified using field guide of Shah and Tiwari (2004) and released *in-situ*.

Opportunistic surveys were also carried out in other parts from sample transects based on Gardner and Fitzherbert (2007).

Field surveys were carried out during June-August, 2009 for 20 days covering 6 watersheds in Nagarjuna forest. In each transect (along the forest trails and streams) four persons walked covering the distance of 10 m on both sides. During walking along the transects, species were searched by overturning the logs, looking on the trunk and hollows of trees and rocks, overturning of stones along the water way, etc. Geographical position of species encounter location was recorded by GPS.

The nearby residents were contacted and information was obtained through interviews. The color photographs of the potential amphibians and reptiles were shown to people and asked to explain the features. Whenever more than one individual in more than two instances could explain the features, the species were noted and later consulted with the herpetologists to confirm the occurrences.

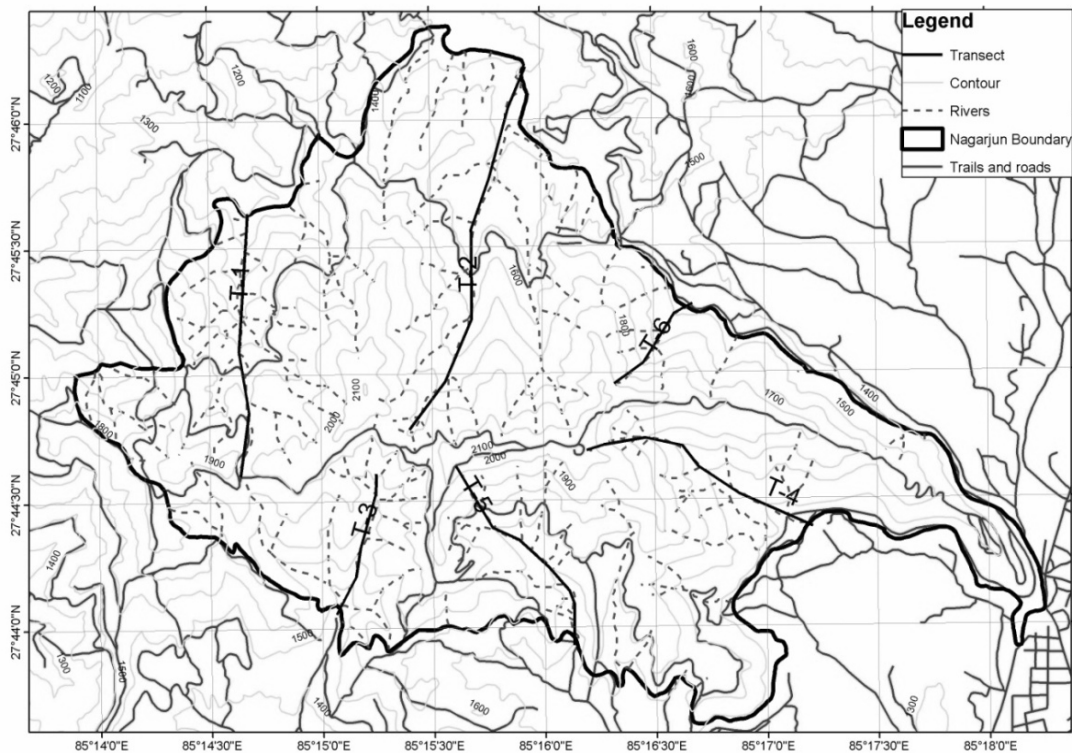


Fig.2. Map showing sampling transects

Results and Discussion

Species diversity

Altogether, 134 individuals belonging to 11 species of herpetofauna (three amphibians and eight reptiles) were recorded from the area. *Naja kaouthia* was encountered only once. The other species with less encounter (<10) were *Bufo melanostictus*, *Trachischium leave*, *Mabuya carinata*, *Amphiesma platyceps* and *Japalura variegata*. Five species

namely, *Japalura variegata*, *Trachischium tenuiceps*, *Asymblepharus sikimmensis*, *Calotes versicolor versicolor*, *Megophrys parva* and *Limnonectes syhadrensis* were observed commonly i.e. >10 individuals. *Megophrys parva* was the most commonly observed species among all (and amphibians) whereas *Calotes versicolor versicolor* was the most common among reptiles.

Table 1. Species encountered in Nagarjun during the forest survey (June-August)

SN	Species	Family	No. of Individuals	Abundance
1	<i>Naja kaouthia</i>	Elapidae	1	R
2	<i>Bufo melanostictus</i>	Bufonidae	3	O
3	<i>Trachischium leave</i>	Colubridae	3	O
4	<i>Mabuya carinata</i>	Scincidae	5	C
5	<i>Amphiesma platyceps</i>	Colubridae	7	C
6	<i>Limnonectes syhadrensis</i>	Ranidae	13	C
7	<i>Trachischium tenuiceps</i>	Colubridae	14	C
8	<i>Asymblepharus sikimmensis</i>	Scincidae	22	C
9	<i>Calotes versicolor versicolor</i>	Agamidae	24	C
10	<i>Megophrys parva</i>	Megophryidae	35	C
11	<i>Japalura variegata</i>	Agamidae	7	C
Total Individuals			134	

* R = Rare; O = Occasional; C = Common

Some of the species records were made through the local information. The following five species (1 amphibian and 4 reptiles) records were made through the secondary sources.

Table 2. Species information from secondary sources

SN	Species	Common Name	Source
1	<i>Ophiophagus hannah</i>	King cobra	NHM*
2	<i>Varanus bengalensis</i>	Common monitor	Local Residents
3	<i>Paa leigibii</i>	Liebig's Paa frog	Local Residents
4	<i>Trimeresurus albolabris</i>	White lipped pit viper	Local Residents
5	<i>Ptyas mucosa mucosa</i>	Asiatic rat snake	Local Residents

* Natural History Museum, Kathmandu

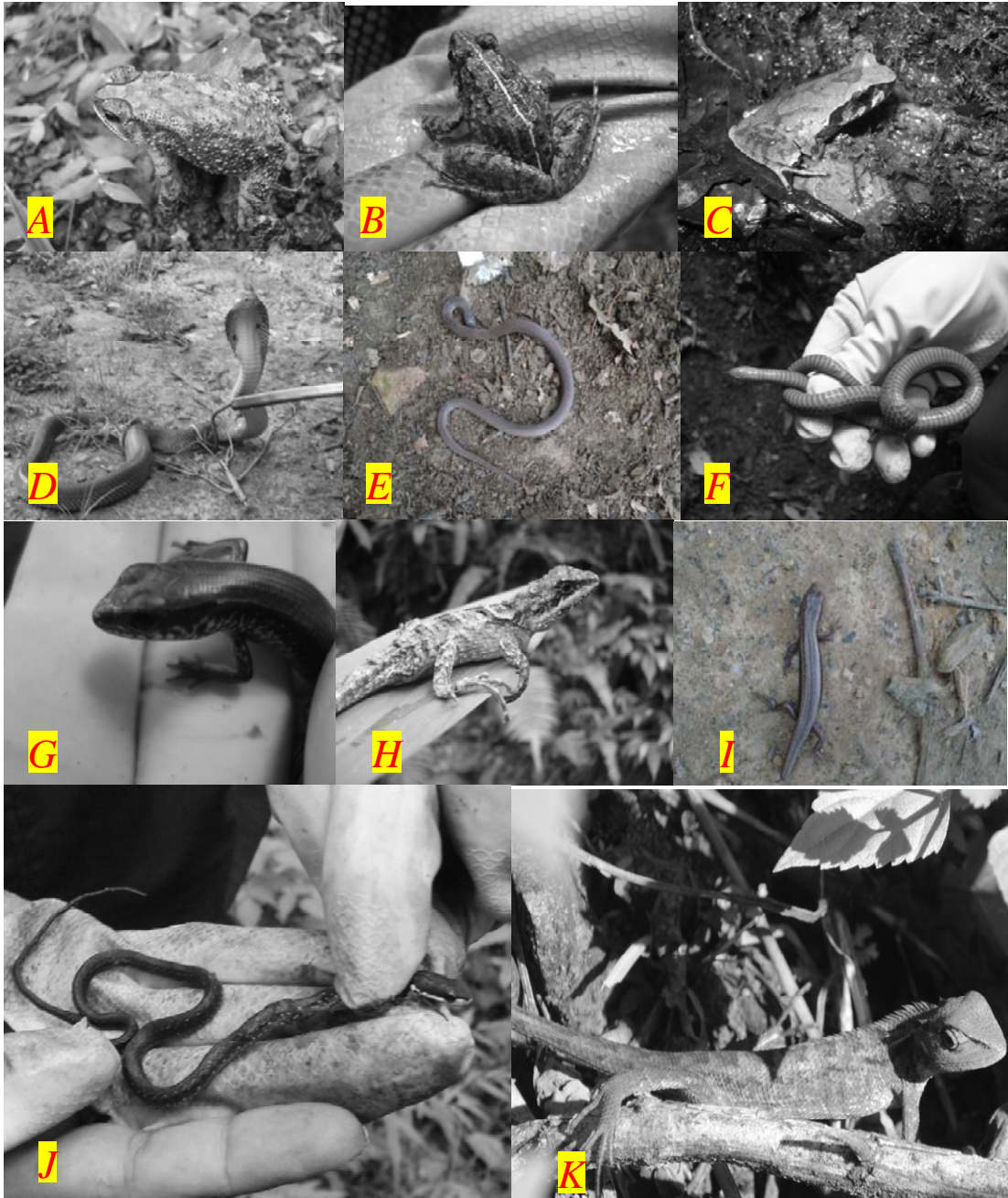


Fig. 3. Amphibians and reptiles encountered in the Nagarjun forest: (A) *Bufo melanostictus*; (B) *Limnonectes syhadrensis*; (C) *Megophrys parva*; (D) *Naja kaouthia*; (E) *Trachischium leave*; (F) *Trachischium tenuiceps*; (G) *Astylepharus sikimensis*; (H) *Japalura variegata*; (I) *Mabuya carinata*; (J) *Amphiesma platyceps*; (K) *Calotes versicolor*.

Distribution of Herpetofauna

The habitat comprises of shrub area, slight to moderately dense forests along with some springs making a combination of aquatic habitats at places. The good forest growths and springs make diverse habitat conditions for herpetofauna in Nagarjun forest. The slope landscape, caves and varied microclimatic conditions harbour diverse

herpetofaunal species. Surveys were carried out in and around water bodies (streams). None of the species encountered during the entire field survey in the water bodies. Using the GPS points of the site observations, the distribution of herpetofauna was mapped (Fig.4) in Arc GIS 9.2.

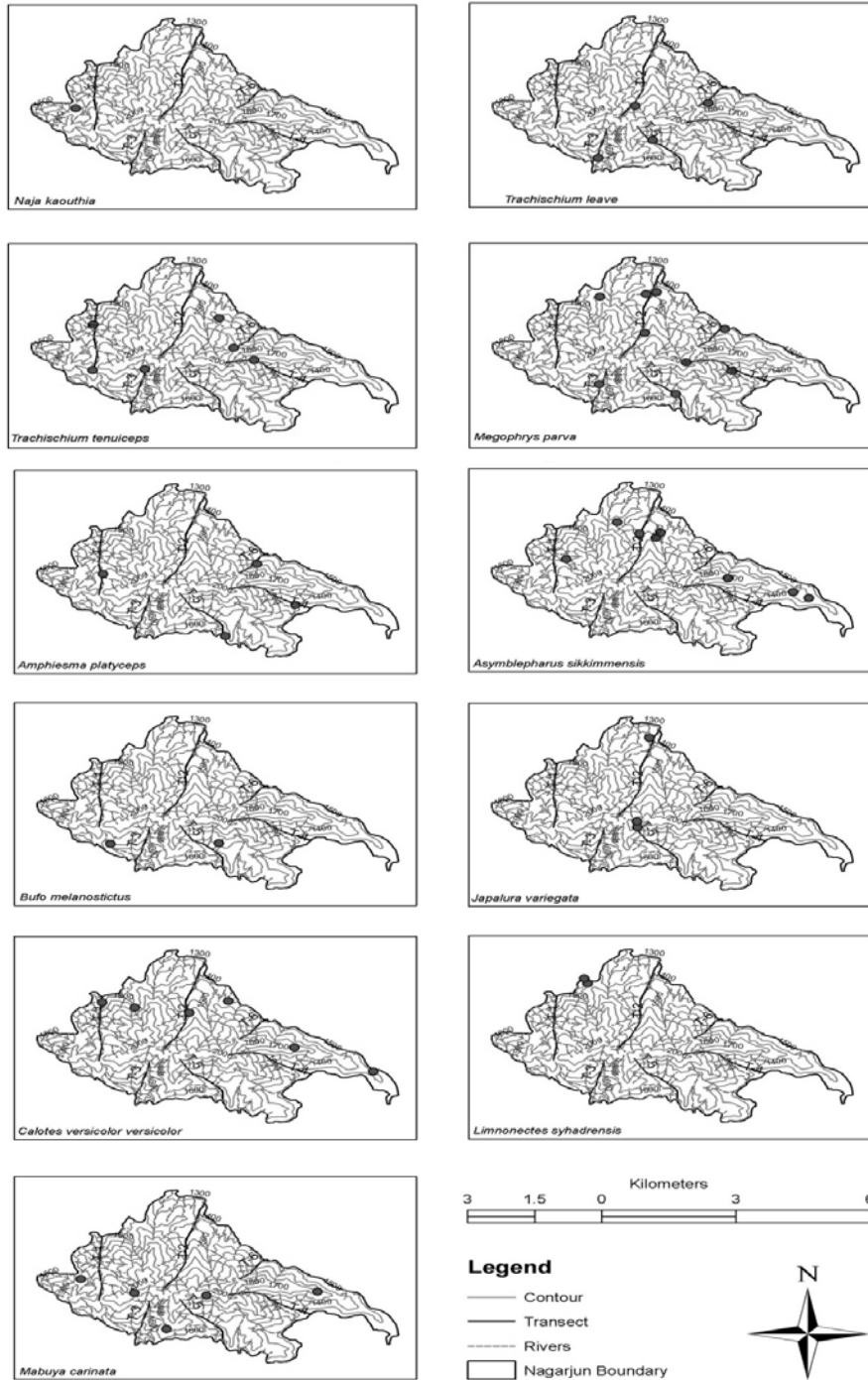


Fig.4. Species distribution map in Nagarjuna forest

All the species of snakes (Elapidae and Colubridae) and frogs (Bufonidae, Megophryidae, Ranidae) observed during the survey were within a distance of 50m from water bodies. On the other hand the species of Agamidae (Lizards) and Scincidae (Skinks) were encountered independent of the distance of water bodies.

Conservation Issues

Nagarjuna forest is away from grazing problems. However, other human activities were not uncommon. Road networks linking villages to Kathmandu were major disturbance factors. Accidental killings of herps along the road were observed. And annual clearings of road edges were also noticed. The forest is protected but clearings of forest floor by security (Nepal Army) also disturbed the habitat of herps. It was also observed that illegal entry of hikers/trekkers/picnickers inside the forest also disturbed the herpetofaunal species. Illegal fishing in the stream was also seen as a disturbance factors to the herptofauna. Local practices of fuel wood and fodder collection were frequent in the area; particularly near the settlements which also degrade the habitat.

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