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VV Bala Subramanyam

Department of Zoology, Sri
Krishnadevaraya University,
Ananthapuram, Andhra
Pradesh, India

YD Imran Khan

Department of Zoology, Jnana
Bharathi Campus, Bangalore
University, Bengaluru,
Karnataka, India

A Krishna Kumari

Professor, GIS and Remote
sensing wing, Department of
Geography, Sri Krishnadevaraya
University, Anantapuram,
Andhra Pradesh, India

Status of herpatofaunal diversity of Ramagiri east and west reserve forests of Ananthapuramu district, Andhra Pradesh

VV Bala Subramanyam, YD Imran Khan and A Krishna Kumari

Abstract

Ministry of Environment and Forests, Government of India, recommended an impact assessment study in view of the potential adverse impacts of windmill projects on terrestrial species of wildlife resulting from alternation and damage to habitats. In accordance with the broad terms of reference set by the Ministry, the present Herpatofaunal study was carried out in the proposed area of Windmill project and subsequently listed 30 reptile species belonging to 11 families. *Varanus bengalensis* and *Python molurus* Linnaeus, 1758 are the two reptile fauna belonging to SCHEDULE-I species of INDIAN WILDLIFE (PROTECTION) ACT, 1972. Totally one year were spent in assessing the distribution of herpetofauna. Visual Encounter Survey Method was followed for the collection of data. IUCN status of Recorded Herpatofauna are mostly Lower Risk least Concern least concern (LR-lc). In this study only the density of identified species was specified and calculated based on the average percentage of sightings representing abundant (70 to 100%), common (50 to 70%), frequent (20 to 50%) and rare (0 to 20%). Anthropogenic activities like Forest fires, killing, hunting, and biotic stress like grazing and browsing are the major threats to the proposed wind power project in the Reserve forest area (East and West) of Anantapur district, Andhra Pradesh.

Keywords: Herpatofauna, Anantapur district, Windmill, Reptiles, Anthropogenic activities.

1. Introduction

Herpatofaunal studies serve as a model for promotion of effective management actions, with a special focus on areas characterized by a strong anthropogenic pressure^[1]. The presence or absence of diversity can be a reliable indicator of environmental health and ecosystem stress. Herpatofauna have been declining more rapidly than birds and mammals^[2]. Ramagiri, once known for its rich Gold resources, the second in Andhra Pradesh, is now known for Wind Electricity generation. Non-Conventional Energy Development Corporation (NEDCAP) is interested in tapping the full potential of wind energy as part of meeting the ever-growing demand for power. It is difficult to ascertain whether the establishment of windmills in the wildlife habitat areas of Reserve forests can affect adversely the flora and fauna of the surrounding areas, without conducting any herpatofaunal survey. Further, the literature on herpatofauna does not indicate at any major alterations in the habitat fragmentation resulting in the loss of wildlife, especially herpatofaunal diversity, which can be ascertained as an indicator of the negative effects of habitat loss/fragmentation^[3-6]. In view of the studies carried out by BNHS &WII on impact of windmill establishment on wildlife, Forest advisor Committee of Ministry of Environment (FAC), Forests & Climate change, Government of India recommended comprehensive studies to be carried out to assess the potential impact of windmills on the terrestrial species of wildlife. Accordingly, the user agency approached the Department of Zoology, Sri Krishnadevaraya University, with a proposal that it take up a study (as per the terms of references suggested in its letter vide F.No.8-47/2008-FC dt16th March, 2008) across the reserve forests of Ramagiri East and west for assessing the potential impact of Windmills on terrestrial species. The present study was intended to come up with a report on the herpatofaunal distribution, densities, and diversity. Subsequently, the study also conducted on land use and land cover analysis with a view of providing precise information on their occurrence and habitat utilization pattern for proper management and conservation of biodiversity. The study also focused on anthropogenic threats associated with the ecological degradation of the study area and offering recommendations for the conservation of natural habitats.

Correspondence

VV Bala Subramanyam

Department of Zoology, Sri
Krishnadevaraya University,
Ananthapuram, Andhra
Pradesh, India

Recent population studies indicate that there are 6347 amphibian and 8863 reptile species worldwide [7-8] of which 32.5% of all the known amphibians and 22% of reptiles are endangered, while 122 amphibians and 22 reptile species have become extinct [9]. In India, 311 amphibian species belonging to the existing orders, namely, Caudata, Anura and Gymnophiona have been reported [10]. India harbors 10% of the world's flora and fauna across only 2.4% of the landmass of the world [11]. A regional study on herpetofauna in Rayalaseema zone conducted by Srinivasulu and Das in Nallamalla hills of A.P has reported 20 spp. of amphibians and 64 spp. of reptiles; a similar work done by them in Seshachalam Biosphere Reserve, Andhra Pradesh has reported eight spp. of amphibians and 34 spp. of reptiles [12]. Both Nallamalla hills and Seshachalam Biosphere Reserves are located 150 kms off from the area of windmill establishments. Amphibian related studies carried out in the state of Andhra Pradesh and other parts of India [13-20] are comprehensive in that they explore the amphibian diversity in terms of population and distribution mostly across Nallamalla Hills and Nagarjunasagar-Srisailem Tiger Reserve [21-24]. Further, some of the authors have presented herpetofaunal and amphibian studies with respect to the Eastern Ghats region of Central Telangana [23]. The present study has made an attempt to

provide additional information on herpetofauna of Rayalaseema region.

2. Materials and Methods

2.1 Study area: Ramagiri (E&W) RFs located in Ramagiri mandal of Ananthapuram District lie between latitude 14.420435 N to 14.295066 N and Longitude 77.587573 E to 77.466489 E. The maximum elevation of Ramagiri (E) RF is 702Mts above MSL while that of Ramagiri (W) RF is 694Mts above MSL. A broken chain of rugged hills characterizes the area (Figure. 1). East Ramagiri RF (Figure 1) spreads over 1405.45 Ha, West region of Ramagiri over 832.58, encompassing forestland (9.25%), agriculture land (72.15%), scrub land (16.43%), and water bodies (1.75%) (Figure. 2 & Table. 1). This region experiences extremes of weather conditions with a maximum temperature ranging from 39-43°C. The geographical location of Ananthapuram District is such that it does not get the full benefit of either of the monsoons. The district is located in the rain shadow area with a normal rainfall of 553 mm. Dry land farming (arid agro ecosystem) is the major agricultural practice noticed in the surrounding landscapes of the study area. Bengal gram, groundnut and paddy are the major crops grown.

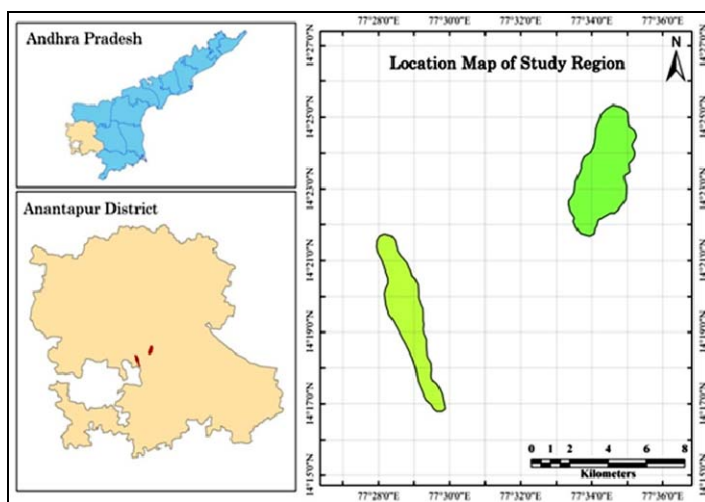


Fig 1: Location Map of the Study region

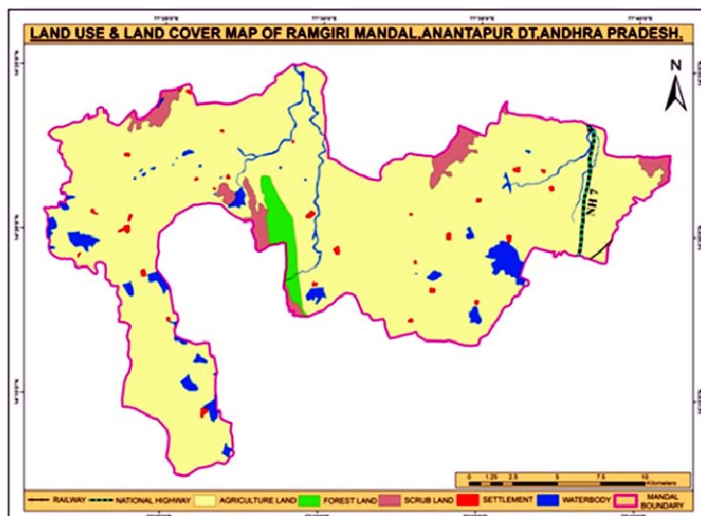


Fig 2: Land use and land cover across Ramagiri mandal

Table 1: A Comparative statement of Land use and Land cover (LULC) over the period from 1995-2016.

LULC classes	1995		2016		Area change (ha)
	Area (ha)	Area (%)	Area (ha)	Area (%)	
Agriculture	6758	26.94	9012	35.93	2254
Open land	3959	15.78	3391	13.52	-568
Forest	14042	55.98	12280	48.95	-1762
Settlement	48	0.19	146	0.58	98
Water	63	0.25	59	0.24	-4
River	215	0.86	197	0.79	-18
Total	25085	100.00	25085	100.00	

2.2 Vegetation of study area

H.G. Champion and Seth, have classified these forests as 6A/C1 Southern Tropical Thorn Forests [25]. The top canopy comprises species like *Albizzi aamara*, *Chloroxylon szweitenia*, *Feronialimonia*, *Canthiumdidynium*, *Wrightia tinctoria* etc., Middle canopy comprises *Cassia fistula*, *Bauhinia rasimosa*, *Acacia Arabica*, *Acacia sundra*, *Dichrosta chiscinerea*, *Dolichendronflacata*, *Cassia carandusetc.*, *Shrubs comprises Randia dumetorum*, *Gymnosporiamontana*, *Gmelinaasiatica*, *Zizyphus numularia*, *Ixora arborea*, *Cadaba fruticosa*, *Cassia auriculata*, *Euphorbia antiquorum*, *Acacia ferruginea*, *Acacia planifrons*, *Acacia torta*, *Acacia horrida*, *Ziziphus glabrata*, *Scutiamyrtina*, *Rhus mysurensis*, *Canthium coromandelianum*, *Capparissp.*, *Senna alexandrina*. Grasses represent *Sympopogan collaratus*, *Heteropogancontortus*, *Panicum repens*, *Cynodon dactylone* etc.

2.3 Methodology: A survey was carried out between August 2015 to August 2016 three times a week during the rainy

season and once a week during the end of season, for a total of one year. After the identification of the main habitat types, we have adopted standard methodology which was suggested by [26, 27]. Line transects method were chosen for conducting this study. In each part, six line transects of 1 km length each were laid. Such transects were subsequently investigated through an active search over a 24hour period. The geographical coordinates of transects and the path were noted with the aid of a Garmin Etrex 10 GPS (Figure. 3). Animals were located by lifting stones, under rocks, fallen leaves, trees and peeling barks of trees during the early hours, afternoon and evening during the day time and before midnight during night time. Photographs of herpetofauna were taken with Canon 450D SLR camera. ERDAS 9.3 and Arc GIS 10.2 software were used for generating LULC maps [28]. Materials used in this study included Lands at images [Lands at 5 TM for 1995 Lands at 8OLI/TIRS] for 2016 over the period 1995 -2016.

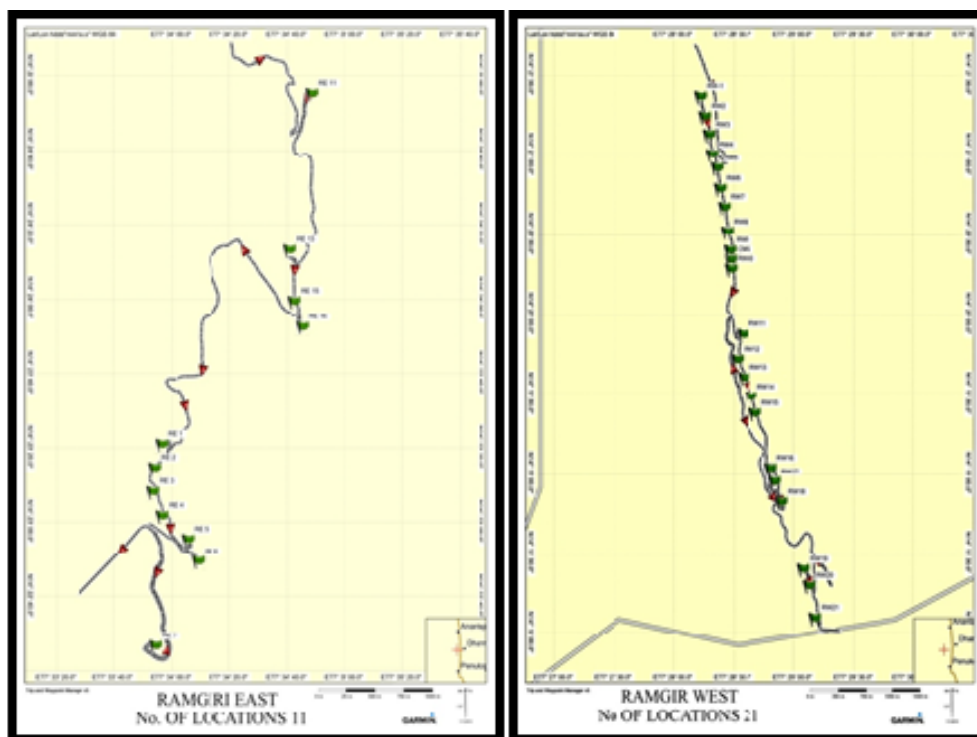


Fig 3: GPS location of Windmill establishments at Ramagiri East and West

3. Result and Discussion

Herpatofaunal diversity in the proposed windmill establishment area is represented by 9 species of amphibians belonging to 7 different genera distributed among 4 families

Bufoinae (2), Ranidae (6), Microhylidae (1), and Rhacophoridae (1) family-wise distribution of amphibian fauna shows the presence of 24 Reptilian species (12 species of Snakes, 9species of lizards, and 1 species of pond terrapin)

belonging to 20 genera distributed among 13 families, while a family wise distribution of serpent species in a descending order is as follows: Colubridae (8 species), Agamidae (03), Boidae (2 Species), Elaphidae (2species), Viperidae (2 species), Typhlopidae (1 species) and Pythonidae (1species)

of the Lizard members belonging to 9 families, Gekkonidae accounts for a high number of 03 species, followed by Agamidae (2 species), Typhlopidae (1 species), Pythonidae (1 species) and Varanidae (1 species) (Table. 2 & 3 and Figure 4)..

Table 2: Amphibians recorded in Ramagiri Reserve forest (East and West)

S. No.	Common name	Scientific Name	Family	IUCN Status	Density
1	Common toad	<i>Duttaphrynusmelanostictus</i>	Bufoinae	LR-lc	A
2	Ferguson's Toad	<i>Duttaphrynusscaber</i>	Bufoinae	LR-lc	A
3	Indian narrow-mouthed frog	<i>Microhylarubra</i>	Microhylidae	LR-lc	A
4	Indian bull frog	<i>Hoplobatrachustigerinus</i>	Ranidae	LR-lc	A
5	Skittering frog	<i>Euphylyctiscyanophlyctis</i>	Ranidae	LR-lc	A
6	Cricket frog	<i>Fejervaryacaperrata</i>	Ranidae	LR-lc	F
7	Indian Pond Frog	<i>Euphylyctisshexadactylus</i>	Ranidae	LR-lc	A
8	Indian Burrowing Frog	<i>Sphaerothecarolandae</i>	Ranidae	LR-lc	R
10	Jerdon's bull frog	<i>Hoplobatrachucrassus</i>	Ranidae	LR-lc	A
9	Common Indian tree frog	<i>Polypedatesmaculatus</i>	Rhacophoridae	LR-lc	R

Table 3: Reptiles (Snakes and Lizards) recorded at Ramagiri Reserve forest

S. No.	Common name	Scientific Name	Family	IUCN Status	Density
1	Peninsular rock agama	<i>Psammophilusdorsalis</i>	Agamidae	LR-lc	A
2	Forest lizard	<i>Calotes spp.</i>	Agamidae	LR-lc	C
3	Red sand boa	<i>Eryxjohnii</i>	Boidae	LR-nt	F
4	Checkered keel back	<i>Xenochropispiscator</i>	Boidae	LR-lc	C
5	Indian rat snake	<i>Ptyas mucosa</i>	Colubridae	LR-nt	C
6	Indian garden lizard	<i>Calotesversicolor</i>	Colubridae	LR-lc	C
7	Green vine snake	<i>Ahaetullanastua</i>	Colubridae	LR-lc	C
8	Common sand boa	<i>Gongylophisconicus</i>	Colubridae	LR-nt	C
9	Common cat snake	<i>Boigatrigonata</i>	Colubridae	LR-lc	C
10	Brook's gecko	<i>Hemidactylusbrooki</i>	Colubridae	LR-lc	C
11	Bronze back tree snake	<i>Dendrelaphistristis</i>	Colubridae	LR-lc	A
12	Bark gecko	<i>Hemidactylusleschenaultia</i>	Colubridae	LR-lc	C
13	Spectacled cobra	<i>Najanaja</i>	Elapidae	LR-nt	C
14	Common Krait	<i>Bungaruscaeruleus</i>	Elapidae	LR-nt	C
15	Termite hill gecko	<i>Hemidactylus triedrus</i>	Gekkonidae	LR-lc	A
16	Reticulated ground gecko	<i>Hemidactylus reticulates</i>	Gekkonidae	LR-lc	C
17	Bhrahminy skink	<i>Eutropis carinata</i>	Gekkonidae	LR-nt	A
18	Indian pond terrapin	<i>Melanochely strijuga</i>	Geomydidae	LR-lc	R
19	Snake eyed lizard	<i>Ophisops spp.</i>	Lacertidae	LR-nt	R
20	Indian rock python	<i>Python molurus</i>	Pythonidae	LR-lc	R
21	Common worm snake	<i>Typhlopsbraminus</i>	Typhlopidae	VU	C
22	Monitor lizard	<i>Varanusbengalensis</i>	Varanidae	LR-nt	C
23	Saw scaled viper	<i>Echiscarinatus</i>	Viperidae	LR-nt	F
24	Russel's viper	<i>Daboiarusselli</i>	Viperidae	LR-nt	C

LR-nt = Lower Risk near Threatened; LR-lc = Lower Risk least Concern; VU = Vulnerable;

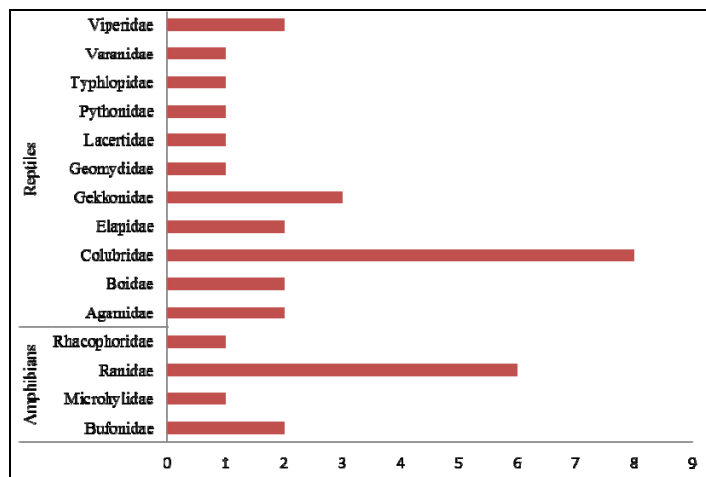


Fig 4: Number of herpatofaunal species (Family wise) observed in the study area

However, the study area is completely devoid of the presence of lizards belonging to Chamaeleonidae and Trionychidae families. There is only one representative from the family Geomydidae. All Amphibians listed from the study area are at a lower risk and come under the least concern category as referred in 2012 IUCN Red List. Of the total listed Herpatofauna, 09 species of amphibian population occupy

20% and the remaining 80% are reptiles and among reptiles, serpents represent 33% and lizards 46%. Identified reptilian herpatofauna come under Lower risk and Least concern group (58%) followed by 29% under Lower risk near threatened and 8% under both Least concern and Vulnerable categories (Table. 4).

Table 4: Densities of Herpatofauna from Study area.

Family	No. of identified Species	Percentage (%) of identified species	Average percentage(%) sightings	Densities of identified species			
				Abundant	Common	Rare	Frequent
Amphibians							
Bufo	2	20	80	2	X	X	X
Microhylidae	1	10	70	1	X	X	X
Ranidae	6	60	90	5	X	X	1
Rhacophoridae	1	10	70	1	X	X	X
Reptiles							
Pythonidae	1	4.34	5	X	X	1	X
Gekkonidae	2	8.69	70	1	1	X	X
Elapidae	2	8.69	80	X	2	X	X
Lacertidae	1	4.34	10	X	X	1	X
Viperidae	2	8.69	70	X	1	X	1
Boidae	2	8.69	40	X	X	X	1
Agamidae	2	8.69	70	1	1	X	X
Varanidae	1	4.34	80	X	1	X	X
Geomydidae	1	4.34	10	X	X	1	X
Colubridae	8	34	80	1	7	X	X
Typhlopidae	1	4.34	60	X	1	X	X

Density of identified species were calculated on the average percentage of sightings which is represented as abundant (70 to 100%), common (50 to 70%), frequent (20 to 50%) and rare (0 to 20%).

Among herpatofauna, 80% of the population is dominated by reptiles that survive under extremes of weather conditions in the semiarid region of the study area, mainly because of their ability to radiate into drier habitats as compared to amphibians because of amniote egg with a leathery or hard shell, and a relatively impermeable skin with scales. Embryos develop directly into small adults at hatching; a few adaptive radiations like nocturnal activity, burrowing ability, and the presence of a thin skin with little insulation, and inefficiency to produce much heat internally to fuel their metabolism and adaptations to regulate body temperatures enable their survival. Amphibians represent only 20% of the total recorded herpatofauna due to their biphasic lifestyle, while population densities fluctuates the seasonal changes in the ecosystem habitat. They are highly philopatric and exist according to relatively stable populations due to these attributes, as it makes them more tractable and reliable indicators of potential alterations in habitat structure and their relative abundance can be a useful indicator of habitat condition [29]. Dominant Ranidae families of this study area are the tremendous members with a substantial ecological significance as indicator species. In other words, their presence or absence in a particular ecosystem may be used in determining the health of the ecosystem [30]. Seven out of every ten amphibian species are threatened due to habitat loss [31]. This habitat loss primarily is caused by expanding agriculture, road laying, dam construction and housing developments, soil erosion and global climate change [32, 33]. They are a cryptic component of an ecosystem and can thus serve as excellent bio-indicators of stressed ecosystems [34]. This report on Herpato fauna signifies their rich distribution, abundance and their existence in a stable population in the study areas. Generally, herpatofauna are highly philopatric to specific microhabitats

[35]. Amphibian dependencies on water and habitat specialization of many reptiles' make them good candidates for being indicator species [36]. Their relative abundance can be a useful indicator of the ecological condition of an ecosystem [29].

4. Conclusion

Present study result concluding that, the composition of herpetofauna assemblages reflects the degree of habitat degradation and destruction. The present investigation into herpatofauna and listing of species along with their composition may be useful to an impact assessment of wildlife and may assist in the conservation and management of habitats in post windmill establishments. Proper conservation strategies or measures should be taken for managing the adverse impacts on biodiversity [37]. Frequent periodical assessment has to be done to assess the state of herpatofauna.

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