

IMPACTS OF CLIMATE CHANGE ON FAUNAL DIVERSITY WITH SPECIAL REFERENCE TO MAMMALIAN FAUNA IN CHURU DISTRICT OF RAJASTHAN, INDIA

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ABSTRACT

There is utmost need to conserve and utilize natural resources in a sustainable manner since they are the very basic components of human development but in the race of industrialization, urbanization and globalization all the natural resources along with forest and faunal diversity are adversely influencing. As a result forest cover has been shrinking rapidly and many of plant as well as animal species are on way of decline. The excess exploitation of nature is creating many problems and changing the weather pattern. The increasing concentration of green house gases and deforestation has lead to global warming which disrupts the weather, wind pattern and upper circulation of the atmosphere. India is a unique country with a great diversity flora and fauna, associated with all kinds of climates. It contains a great wealth of biological diversity in its forests, wetlands, Thar Desert and in marine areas but the thrust for economic development has put more pressure on the natural resources, particularly the forest resources and lives.

Churu region located in north-eastern of Rajasthan and covers 6616 hectares (0.46%) area of district under forest. Climatic condition of the Churu district is both extreme – very hot summer and very cool winters. The area lies in semi-arid zone with low floral and faunal diversity due to scanty and irregular rainfall. Wind velocity in the area is quite high during the summer and sand storms are common feature of the area. Sand dunes are dominant in the entire region. Churu district is part of Indian Thar Desert exhibit little mammalian diversity. During last three decades numbers of large mammals (except Black buck that is conserved in Tal Chhapar sanctuary) has been drastically decreased in the study area due to inference of people in natural habitats of mammals for their beneficiary activities. The mammalian diversity of Churu is represented by 40 species of mammals belonging to 20 families and 31 genera. The area covers near about 9 % mammalian diversity of India and 55 % of Thar. During survey of mammalian species both direct methods like line transect method and indirect methods by identification of sign were used. The conversion of desert land into irrigated agriculture is also affecting the biodiversity scenario in the region. Mammals that are adapted to desert environment is rapidly vanishing due to destructive activities and interference of man.

Key words: climate, mammal, desert, carnivorous, sanctuary, transact, diversity, sand dune, drastic, environment.

INTRODUCTION

The total forest cover in India is 7, 12, 249 sq km which is 21.67% of the geographical area of the country and 2% of the globe. Rajasthan has about 32,737 sq km area under forest that is 9.57% of state's geographical area and about 4.28% India's forest area. Thar desert in Rajasthan has only 6% area of the total area of the country. Within a small area, with hostile climatic conditions, about 15.8% (68 out of 428) mammalian species are surviving. Earlier workers (Blanford, 1898; Agarwal, 1967; Bates *et al.* 1994a, c; Joshi, 1984; Prakash, 1959, 1964, 1994, 1995; Rahmani, 1991; Rana, 1980; Rice, 1991; Sankaran, 1992; Sankhala, 1979; Saxena, 1975; Tehsin, 1980, 1987; Tripathi *et al.*, 1985; Singh, 1995; Baqri and Kankane, 2001; Subhasini *et al.*, 2003) have done a faunistic survey and made significant contribution towards study of mammals in Rajasthan. Wilson and Reeder (1993) listed the mammalian species of the world. On basis of his report Agarwal (1998) reported 13 orders, 42 families, 180 Genera and 390 species of mammals in India. Of these, 8 orders, 23 families, 45 Genera and 66 species have been recorded from Thar desert of Rajasthan (Chakraborty *et al.*, 2005). Alfred and Agarwal (1995) reported 68 species belonging to 9 orders dwelling in the Thar Desert.

The ecosystem of Thar is under the process of ecological transformation. This transformation has been largely changes brought about by the mighty Indira Gandhi Canal in Ganganagar, Hanumangarh, Churu, Bikaner Jaisalmer, Barmer district and partly through global climate changes. The water of Indira Gandhi Canal in the Churu district is mainly used for drinking purpose. Shadow effects on flora had been observed due to this Canal irrigation and 40 plant species of irrigated area have expanded their distribution to non-irrigated area. Uncontrolled mining in small hillocks in Sujangarh Tehsil of the study area are also affecting the faunal diversity. Changing floral composition will definitely affect the faunal composition of the area. Many mesic species of small mammals are expanding their distribution towards the Thar (Prakash, 1995), many aquatic birds have recently invaded the Thar (Soni, 1994; Idris *et al.* 2009). The present inventory of mammals in the district will help in monitoring the population, threats and suggest measures for their future.

Churu region is not so rich in carnivores and large mammals' diversity. The main reasons for the poor diversity of these animals in the district is - high population density of human, rapidly destructing of natural habitats, increasing wood industries, illegal mining, irrigation, shrinking forest covers and poaching etc. Only protected area in the district is Tal Chhapar Blackbuck sanctuary, is a small fenced area of about 7.19 sq km. It is vast grassland with sporadic trees here and there. The mammalian species Black buck is chiefly conserved there. In addition to Blackbucks, Gazelle, some snakes, lizards, harriers and some other predator avian species are found in the sanctuary. Important mammals found in the study area are Desert fox, Blackbuck, Gazelle, Blue bull, Desert hare, Desert cat, Mongoose, Hedgehog, Musk shrew, Desert gerbil, Indian gerbil and eight chiropteran species. Sometimes hyena, jackal and panther also reported in the district but they are not permanent resident of the area. No significant work on vertebrate diversity of Churu district has been carried out, except the systematic of small mammalian study of CAZRI team (Prakash, *et al.*, 1971).

MATERIALS AND METHODS

Churu district is one of the thirteen districts of Rajasthan state and is part of the Thar desert located in the north-east part of Rajasthan. It lies in between 27° 5' to 29° 0' N latitude and 73° 40' to 75° 41' E longitude, at a height of about 320 meters from sea level. The district covers an area of 13,85,898 hectares that is about 4.92% area of the state. The area is bordered by Hanumangarh district in north, Hissar and Bhiwani districts of Haryana in north-east, Jhunjhunu in north and Sikar in south and with Nagaur- Bikaner district in west. (Fig. 1).

Not much work has been carried out on survey of existing mammalian species in Churu region of Thar desert. Though, Chakraborty *et al.* (2005) made a district-wise survey on mammalian diversity of Thar desert. Present study is largely based on our observations in the field during last five years from Sep 2014 to June 2019. The Mammals of the region were monitored all the year round, during all the seasons. During study period minimum one site was visited per month to record the mammals and their related parameters. Total 76 sites were visited in the study area. During field survey of mammalian species both direct and indirect methods were used. Following methods were applied:

Line transects method (Rodger, 1988, 1991; Rodger and Panwar 1998): In this method, line transect of 1 square km. were used in different locations of study area and observation were made by walking along the road side both on foot and by vehicle. The observations mostly were taken in morning and evening hours. The presences of different mammalian species in the particular habitats were noted. Large mammals like *Semnopithecus entellus*, *Macaca mulata*, *Boselaphus tragocamelus*, *Antelope cervicapra*, *Gazella gazelle* etc. that can tolerate the humans presence and allow the observations to be made from close quarters by necked eyes in open field, dense forest or in hilly part of the region. 8x40 Olympus binoculars were also used for observing mammals. Photographs were taken by using Cannon Supershot and hp 945 digital Camera.

Water source method was also applied for observation of mammals during the noon and sometime at night in the summer because this time temperature reached on peak and water crisis begins and mammals comes near water body in search of water.

During field visit in the area for identifications of mammalian species some indirect methods were also used. Animal signs such as pellets, scats, quills, kill and burrows which are indicate the presence of an animal in the area, were carefully observed and photographs were taken.

Rural people also helped in identification by presence or absence of mammals by providing them photographs and pictorial guides for identification that are likely to be found in the area. Confusing and difficult group of mammals were confirmed by sending the photographs to wildlife experts.

RESULTS

A total of 40 species of mammals are found in the study area. They belong to 8 orders, 20 families, and 31 genera. Out of 110 species of order Chiroptera present in India, 18 have been reported in Thar desert of Rajasthan and only eight are present in Churu region. Pholidota and Lagomorpha are smallest orders in the region with only one species each. In the study area order Chiroptera has maximum number of six families; while order rodentia, with 14 species is largest one constituting 35% of the total mammals (Table 2 and figure 1).

Some species of small and large mammals like chinkara, mongoose and hares were predominantly found in the desertic crop area of north-west part of study region, where as panther and jackal (rarely seen), fox, jungle cats, etc. were predominantly observed in the community lands, hilly areas and near water bodies. Blue bull, desert cat and many small rodents were well distributed in all kinds of ecological settings. Interestingly two primate species were also seen near the pious Hindu Temple “Bala Ji” in Salasar village of Sujangarh tehsil (Table 1). Out of 40 mammalian species found in this study area, six species are in Schedule I and one species is in schedule III, of five species listed in Schedule II and six species in schedule IV and thirteen species are in Schedule V of Wildlife (protection) act, 1972 and the status of remaining species is not mentioned.

Three species *Gazella bennetti*, *Antelope cervicapra* and *Boselaphus tragocamelus* belong to the large mammal category and rest to small mammals. Blackbuck and Chinkara are common in Thar ecosystem and are more or less restricted in protected areas or in and around villages, owing mostly to water scarcity and poaching pressure. *Boselaphus tragocamelus* *Gazella bennetti* and *Antelope cervicapra* have been seen in all tehsils of Churu district. At Tal Chhapar wildlife Sanctuary (Churu) and around it, all these species are quite abundant. Most of the observed species of Rodents are found in all tehsils of Churu region. Three species of Mongoose are found in the field and also near houses where dirt of *Ziziphus* and thorny plants are collected as fire wood.

DISCUSSION & CONCLUSIONS

Churu district is not unaffected from the impact of the climate change. Changing level of minimum and maximum temperature, shifting rainfall pattern, changing of crop pattern and duration of seasons, low rainfall, frequent drought, increasing temperature are some common effect of climate change here. It is true that man has encroached in all natural resources for his/her greed, without taking into consideration its negative impact.

The current conservation status of the mammals of Threatened Species is enhancing day by day. As per IUCN Red list (2012), out of the 428 mammal species, 44 species are endemic and 4 species are extinct from India. There is no doubt that biodiversity of the Thar is changing with adding few new species in or around the irrigated areas but this increase is at the cost of desert-dwelling species. Uncontrolled use of pesticides in agricultural fields, transportation, and deforestation were found causing highest impact to the forest ecosystem and mammalian fauna as well.

If we not wake up for saving wild fauna and flora, the desert-adapted species like desert fox, jackal, desert cat, Desert hare etc. will become extinct from this fragile but unique ecosystem. Use of pesticides in agricultural practices by the farmers of the region may have direct impact on herbivores and finally on carnivores. The rapidly increasing pattern of urbanization and colonization may also be responsible for loss mammalian habitat.

Road accident cases is also major threats to wild mammals, during the present study accidents of palm striped Squirrel, small Indian Mongoose, Jungle cat, Indian Fox, Pale Hedgehog, Neel gai and Black buck has been recorded. The study indicates that natural habitats of the study area should be protected for conservation of mammalian fauna.

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Table 1. Checklist of Mammals of the Shekhawati region

A	B	C	D	E	F
Order – Insectivora					
Family – Erinaceidae					
1.	Indian Hedgehog	<i>Paraechinus micrurus</i>	–	C	O
Family – Soricidae					
2.	Grey Musk Shrew	<i>Suncus murinus</i>	–	VC	O
Order – Chiroptera					
Family - Pteropodidae					
3.	Flying Fox	<i>Pteropus giganteus</i>	V	C	F
Family – Megadermatidae					
4.	Greater False Vambire Bat	<i>Megaderma lyra</i>	–	VR	C
Family – Rhinolophidae					
5.	Blyth's Horse shoe Bat	<i>Rhinolophus lepidus</i>	–	R	I
Family – Rhinopomatidae					
6.	Greater mouse-tailed Bat	<i>Rhinopoma microphyllum</i>	–	C	I
7.	Lesser mouse-tailed Bat	<i>Rhinopoma hardwickei</i>	–	C	I
Family – Emballonuridae					
8.	Egyptian tomb bat	<i>Taphozous perforatus</i>	–	R	I
Family – Vespertilionidae					
9.	Common Pipistrellus	<i>Pipistrellus pipistrellus</i>	–	C	I
10.	Asiatic Yellow House Bat	<i>Scotophilus heathi</i>	–	C	I
Order – Primates					
Family - Cercopithecidae					
11.	Hanuman Langur	<i>Semnopithecus entellus</i>	II	R	H
12.	Rhesus Macaque	<i>Macaca mulata</i>	II	R	H
Order – Carnivora					
Family – Canidae					
13.	Jackal	<i>Canis aureus</i>	II	R	C
14.	Desert Fox	<i>Vulpes vulpes</i>	I	C	C
Family – Viverridae					
15.	Small Indian Civet	<i>Viverricula indica</i>	II	VR	O
Family – Herpestidae					

16.	Small Indian Mongoose	<i>Herpestes javanicus</i>	IV	R	C
17.	Grey Indian Mongoose	<i>H. edwardsi</i>	IV	C	C
18.	Ruddy Mongoose	<i>H. smithi</i>	IV	R	C
Family – Felidae					
19.	Desert Cat	<i>Felis silvestris</i>	I	R	C
20.	Jungle Cat	<i>F. chaus</i>	II	VR	C
Family – Ursidae					
21.	Sloth Bear	<i>Melursus ursinus</i>	I	–	O
Order – Artiodactyla					
Family – Bovidae					
22.	Nilgai	<i>Boselaphus tragocamelus</i>	III	VC	H
23.	Black buck	<i>Antelope cervicapra</i>	I	C	H
24.	Indian Gazelle	<i>Gazella gazella</i>	I	C	H
Order – Pholidota					
Family – Manidae					
25.	Indian Pangolin	<i>Manis crassicaudata</i>	I	VR	I
Order – Logomorpha					
Family – Leporidae					
26.	Desert Hare	<i>Lepus nigricollis</i>	IV	R	H
Order – Rodentia					
Family – Sciuridae					
27.	Five Striped Palm Squirrel	<i>Funambulus pennanti</i>	IV	VC	H,G
Family – Muridae					
38.	House Rat	<i>Rattus rattus</i>	V	VC	O
29.	Kutch Rat	<i>Cremnomys cutchicus</i>	V	C	O
30.	House Mouse	<i>Mus musculus</i>	V	VC	O
31.	Phillips' mouse	<i>Mus phillipsi</i>	V	R	O
32.	Flat-haired Mouse	<i>Mus platythrix</i>	V	R	O
33.	Sadhu Mouse	<i>Mus saxicola</i>	V	R	O
34.	Bush Rat	<i>Golunda ellioti</i>	V	C	O
35.	Metad	<i>Millardia meltada</i>	V	R	O
36.	Indian desert Gerbil	<i>Meriones hurrianae</i>	V	VC	O
37.	Indian Gerbil	<i>Tatera indica</i>	V	VC	O

38.	Hairy-footed Gerbil	<i>Gerbillus leadowi</i>	V	R	O
39.	Baluchistan Gerbil	<i>Gerbillus nanus</i>	V	R	O
Family – Hystricidae					
40.	Indian Porcupine	<i>Hystrix indica</i>	IV	R	O

Abbreviations used in Table 10.4

A = S. No., B = Common name, C = Scientific name, D = Wildlife status, E = Abundance status or conservation status, F = Foraging status

Wildlife status: I = Schedule I; IV = Schedule IV; V = Schedule V; NLA = Not listed in act; 0 = Information not available

Abundance status or conservation status: R = Rare, VC = Very common, C = Common, VR = Very Rare,

Foraging status: O = Omnivores, H = Herbivores, C = Carnivores, I = Insectivores, G = Grainivores, S = Scavenger, N = Nectivore, F = Frugivores

Table 2. Order and Family-wise distribution of genera and species of mammals in the Churu district.

S.No.	Orders	Family	Genera	No. of species	% of the Species
1.	Insectivora	2	2	2	5
2.	Chiroptera	6	6	8	20
3.	Primates	1	2	2	5
4.	Pholidota	1	1	1	2.5
5.	Carnivora	5	6	9	22.5
6.	Artiodactyla	1	3	3	7.5
7.	Lagomorpha	1	1	1	2.5
8.	Rodentia	3	10	14	35
Total	8	20	31	40	100

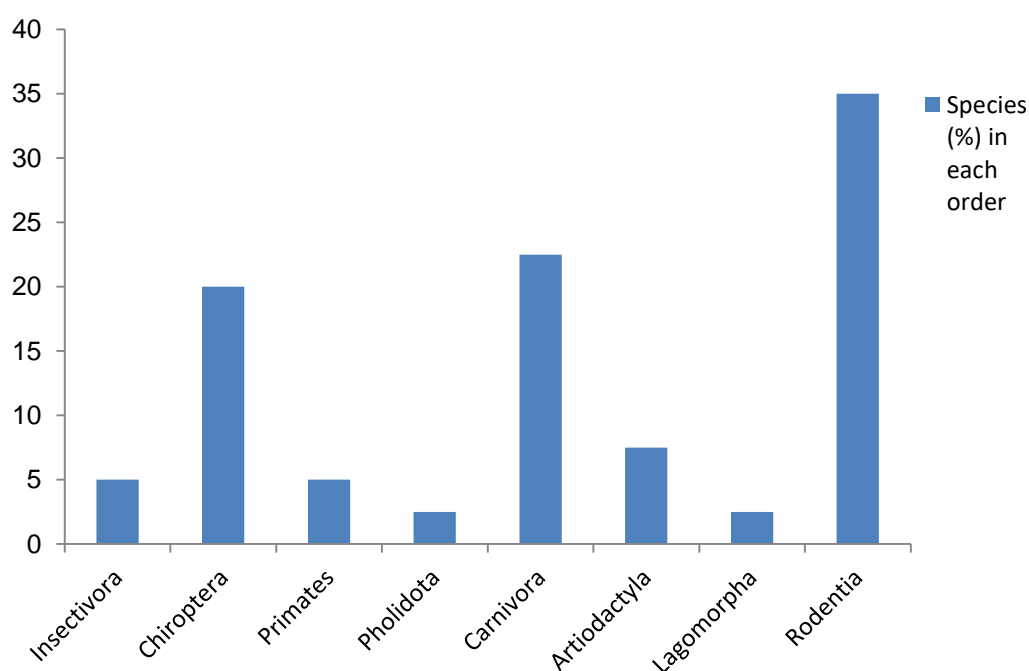


Figure 1. Species number (in percentage) in each mammalian order

Map 1. Churu region

LOCATION MAP OF THE STUDY AREA