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Status and distribution of Indian flying fox (*Pteropus giganteus*) in district Chitrakoot, Uttar Pradesh, India

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Abstract
Present work dealt the ecological status census and various ecological parameters of Indian flying fox (*Pteropus giganteus)* from March, 2015 to February 2017 at the various roosting sites in Chitrakoot district discussed. Five roosting sites have been recognized on the basis of ecological condition and fruit bats abundance. This major survey was conducted during summer winter and monsoon seasons during March 2015 and Feb 2017. In present investigations it was also recorded that they are frugivorous or nectarivorous, i.e., they feed on fruits or lick nectar from flower while ingesting fruits, these bats expel waste that pollinates and disperse seeds and lives in tropical forest, fruits gardens and swamps, near bodies of water. Climate of Chitrakoot play an important role to flourish the population and species so the investigation envisaged the future demand of the specific species. This work will establish the study area as an important habitat for the conservation of Chiropterans.

Keywords: roosting, abundance, chiropterans, electrocution, threats, swamps

1. Introduction
Bats are the second largest mammal's species in numbers, they constitute 20% of all existing mammals. There are around 1,200 species of bats worldwide. Bats are the mammals of the order Chiroptera, there are two suborders megachiroptera and microchirptera. There are around 120 species of chiroptera found in India. *Pteropus giganteus* (Fruit-bat) is commonly known as Indian flying fox due to its similarity to a fox. It is one of the largest bat of the world, belongs to family pteropodidae of order megachiroptera. Family pteropodidae consists of 43 Genera and about 165 species which are distributed throughout the world. The flying foxes play a key ecological role in temperate rain forests, therefore their distribution and habitat requirements are important to understanding and sustaining ecosystems. Major threats which have been observed in the study area are electrocution, loss of their habitats and hunting for commercial purposes such as oil, leather and specimens for biological institutes.

There are about 14 species fruit bats, belonging to 8 genera, found in Indian subcontinent (Bates et.al). Thus a study has been planned to find out distribution and population status of chiropteran of Uttar Pradesh with special reference to their habitat, behaviour, distribution and population The Indian flying fox *Pteropus giganteus* lives in colonies and hangs from the branches of trees such as banyan, mango and tamarind.

The study reflects the status of this fruit bat species in 5 roosting sites. The work will also establish the study area as an important habitat for the conservation of this chiropteran's species.

2. Material and Methods
Study Area
On the basis of present state of knowledge, it is evident that no systematic study has been done on bats at Chitrakoot district UP. District Chitrakoot lies between Lat. $24^0$48'54" to $25^0$12'34"N and Long. $80^0$58'26" to $81^0$34'17"E. Distance covered by district from east to west is 62 Km and North to South is 57.5Km. It is bounded in the north by Kaushambi, in the south by Satna (MP) & Rewa (MP), in the east by Allahabad and in west by Banda. Total geographical area of District is about 345291Sq. Km. The general topography is hilly and undulating cut off by numerous reveres and rivulets. Mandakini, Valmiki, Gunta, Gedua,Chakara and Jhuri rivers drain the region. Chitrakoot means the 'Hill of many wonders'. Chitrakoot falls in the northern Vindhya Range of mountains spread over the states of Uttar Pradesh and Madhya Pradesh.

The study was carried out for a period of two years (March 2015 – Feb 2017) in various places of chitrakoot districts of Uttar Pradesh such as Mau1(25º15'27"N;81º22'58"E), Chakawa(25º13'5"N; 81º17'33"E), Barachhi(25º10'56"N; 81º10'13E), Karwi1(DM office) (25º12'52"N;80º54'25"E), Karwi2(DFO) (25º12'53"N; 80º55'25"E). The survey was conducted. This study was investigated the colony location, number of roost sites, population abundance behavior, social structure and garden composition were recorded precisely. In each roosting site we measured the relative humidity (Hygrometer), temperature and elevation.

To identify the roosting site of bat in Chitrkoot, different methods were used. First of all map of study area was collected from Chitrakoot forest range of U.P. and with the help of map then applied pilot survey method(as per Wild Life

Institute Protocol).
The climate has distinct wet dry seasons which extend from March to June, rainy seasons which extend from July to October, winter seasons which extend from November to February.

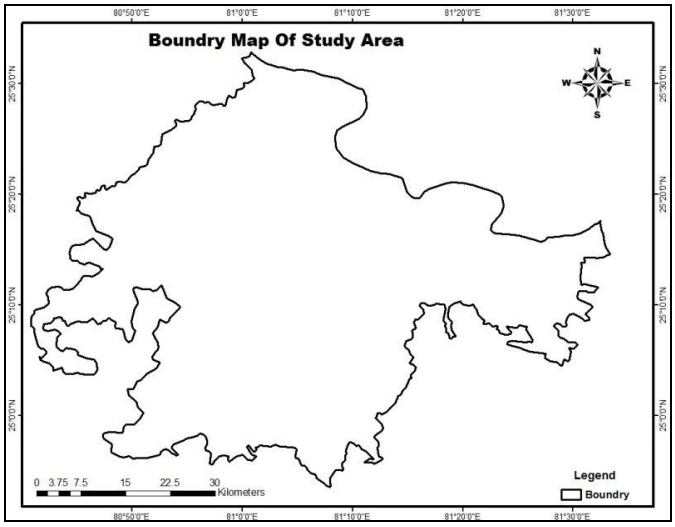

Fig 1

3. Result and Discussion

District Chitrakoot has dense forest area including the forests under the Forest Department and a number of private orchards. Various types of tree species such as Mango (*Mangifera indica*), Teak (*Tectona grandis*), Sal (*Shorea robusta*), Semal (*Bombax ceiba*), Gular (*Ficus glomerata*), Pepal (*Ficus religiosa*), Banana (*Musa paradisiacal)*, Guava (*Psidium guajava*), Jambolana (*Syzygium cumini*), Banyan *(Ficus bengalensis*) etc. are found in the forests as well as orchards.
They are *Pteropus giganteus* (Indian flying fox), The seasonal abundance of all the megachiroptera was calculated for 2015 and 2016 at all the three seasons summer, mansoon and winter. Megachiroptera average census with season wise diversity is given belowssss.

Fig 2: Indian Flying Fox (*Pteropus giganteus*) at various habitats in Chitrakoot

Table 1: Showing Chiroptera census average of various habitats in 2015

S. No	Study Sites	Abundance (2015)						S.D.(Standard deviation)
		Summer		Mansoon		Winter		
		Freq	%	Freq	%	Freq	%	
1.	Mau1	13	14.13	53	57.61	26	28.26	16.66
2.	Chakawa	71	20.52	163	47.11	112	32.37	37.63
3.	Barachhi	89	25.07	153	43.10	113	31.83	26.4
4.	Karwi 1	149	22.68	295	44.90	213	32.42	59.75
5.	Karwi 2	46	22.22	98	47.34	63	30.43	21.4
Average percentage			20.92		48.01		31.06	

The data in Table 1 shows that the majority (48.01 %) of flying foxes Abundance had Mansoon season followed by 31.06 per cent had winter and 20.92 per cent were in the summer season. Thus, it can be concluded that abundance of fruit bats belonged to mansoon season.
In 2015 at 1st site Mau1 the abundance of flying foxes at summer was 14.13%, at monsoon 57.61%, at winter was 28.26%, Chakawa at summer was 20.52%, at monsoon 47.11% and at winter was 32.37%, Barachhi at summer was 25.07%, at monsoon was 43.10% and at winter 31.83%, Karwi1(DM Office) at summer was 22.68%, at monsoon was 44.90% and at winter was 32.42%, Karwi2(DFO) at summer was 22.22%, at monsoon was 47.34% and at winter was 30.43%.

Table 2: Showing Chiroptera census average of various habitats in 2016.

S. No	Study Sites	Abundance (2016)						S.D.(Standard deviation
		Summer		Mansoon		Winter		
		Freq	%	Freq	%	Freq	%	
1.	Mau1	9	10.11	57	64.04	23	25.84	20.15
2.	Chakawa	91	25.85	186	52.84	75	21.30	48.99

3.	Barachhi	94	22.16	185	43.63	145	34.19	37.24
4.	Karwi 1	139	19.41	311	43.43	266	37.15	74.05
5.	Karwi 2	37	15.48	117	48.95	85	35.56	32.88
Average percentage			18.60		50.57		30.80	

The data in Table 2 shows that the majority (50.57 %) of flying foxes Abundance had Mansoon season followed by 30.80% had winter and 18.60% were in the summer season. Thus, it can be concluded that abundance of fruit bats belonged to mansoon season.

In 2016 at 1st site Mau1 the abundance of flying foxes at summer was 10.11%, at monsoon 64.04%, at winter was 25.84%, Chakawa at summer was 25.85%, at monsoon 52.84% and at winter was 21.30%, Barachhi at summer was 22.16%, at monsoon was 43.63% and at winter 34.19%, Karwi1(DM Office) at summer was 19.41%, at monsoon was 43.43% and at winter was 37.15%, Karwi2(DFO) at summer was 15.48%, at monsoon was 48.95% and at winter was 35.56%.

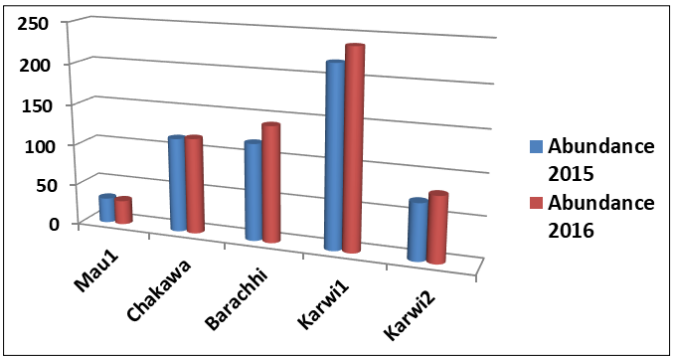

Fig 2: Bar Diagram showing the percentage of mean census of roosting sites according to year

Table 3: Detailed account on the roosting sites of Indian flying fox *Pteropus giganteus* Brünnich, 1782 in District Chitrakoot, U.P.

S. No	Location of the Roost	GPS coordinates	Elevation (m. asl)	Type of the Roost	Roost Tree Species	Method Used to Count Bats	Protection Information
1.	Mau1	25º15'27"N; 81º22'58"E	45m	Roadside	Pepal (*Ficus religiosa*), Banyan (Ficus bengalensis)	Visual Count	Not Protected
2.	Chakawa	25º13'5"N; 81º17'33"E	49 m	Private Orchard	Big Mango Orchard Neem (*Azadirachta indica*)	Visual Count	Protected by local community
3.	Barachhi	25º10'56"N; 81º10'13E	71 m	Roadside	Banyan (Ficus bengalensis), Sal (*Shorea robusta*)	Visual Count	Protected by local community
4.	Karwi 1	25º12'52"N; 80º54'25"E	131 m	Private Orchard	Gular (Ficus glomerata) Neem (*Azadirachta indica*), Guava (*Psidium guajava*), Teak (Tectona grandis)	Tree Estimation	Protected
5.	Karwi 2	25º12'53"N; 80º55'25"E	126 m	Private Orchard	Jambolana (Syzygium cumini), Neem (*Azadirachta indica*), Teak (*Tectona grandis*)	Visual Count	Protected

Five different locations were taken on the basis of ecological condition and bats abundance. This survey conducted during summer, winter and mansoon season. The data were collected with the help of censusing methods. The collected data were analyzed in frequency and percentage. The study has shown that Chiroptera habitats of bats were found useful in enhancing the adoption of season in various aspects.

4. Conclusion

District Chitrakoot is rich in biodiversity of flora and fauna. There were a huge population of bats found in this region during past years, but the population of bats is in continuous danger day by day mostly due to clearance of their habitats, hunting and human interference and electrocution accidents. Comprehensive study is continuing to explore the bat species and their population. The study strongly recommends reviewing the legal status in provincial wildlife legislation in order to provide appropriate protection for bats. Ecological studies should be strongly recommended for better understanding of the status and economic value of species as conservation status of bats. Habitat management includes not only conserving roosting areas such as private orchards but also in conserving their all habitats. Study and documentation of pollination and seed dispersal by bats in different ecosystems, would help to improve the image of the bat species among the local people. Measures for preventing deforestation should be taken to protect the major source of their food. Lastly, the study area provides a suitable habitat for the conservation of this species and such regions should be declared as 'Bat Zones' or 'Bat Hubs'.

5. References

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