ROOSTING AND HABITAT PREFERENCE OF INDIAN FLYING FOX, *PTEROPUS GIGANTEUS* (BRUNNICH, 1782) AT CENTRAL DRY ZONE MYANMAR

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Abstract

In Myanmar the Indian flying fox, (*Pteropus giganteus*) is found in forested habitats and near the urban areas. We have learned roosting and habitat preference of the Indian flying fox at central dry zone Myanmar. Conserving a species depends on an understanding of its habitats requirements. Studied were made on (Site I) for a period of five months extending from October 2015 to February 2016 and (Site II) from October 2016 to February 2017. Direct roost count method was counted to estimate the population size of the colony. At the study Sites I total number of 146 trees (above 5 m) were observed. Among them, numbers of 13 trees were rested roost site by the flying Fox. Out of 13 trees, four trees of Tamarind (*Tamarindus india*) and one tree of Rain tree (*Samanea saman*) were rested the study period. The highest number of flying foxes were recorded in October 2015 (854 bats) and the lowest numbers were in February 2016 (716 bats). In the vicinity of the study site (Site II) had 25 trees (above 5 m). At the study Site II, there were six trees of *Bombox ceiba* (kapok). The highest numbers of bats were observed in February 2017(976 individuals) and the lowest numbers were in November 2016 (261 individuals).Thus, *P.giganteus* preferred to roost on tall and large tree, close to paddy fields and stream. Seasonal shifting pattern from one roost tree to another increase and decrease in bats were observed in study area. Habitat destruction and diverse threats to species in the sites were recorded in these areas.

Keywords: Roosting and Habitat Preference, Fruit Bats, Indian flying Fox, *Pteropus giganteus*, microclimate

Introduction

In Myanmar the Indian flying fox, (*Pteropus giganteus*) is found in forested habitats and near the urban areas. Bats fly mainly at night and spend the day in roosts which provide shelter from extremes of temperature, other climatic variables and predators (Furey and Racey, 2016). All bats comprise the Order Chiroptera (neuweiler, 2000), meaning 'hand-wing' in Greek (Tun Yin, world, Chiroptera is the second largest order of mammals. The Order Chiroptera can be divided into two suborders; Megachiroptera (the Old world fruit bats) and Microchiroptera (Insectivorous bats). The mircobats comprise 17 families but the Megachiroptera include only one family that is Pteropoidae (Corbet and Hill, 1992). Megachiroptera are very different with Microchiropera (Tun Yin, 1967). Old World fruit bats do not emit the echolocation (with the exception of *Rousettus*) but rely on olfaction and vision when foraging (Kunz and Fenton, 2003).

Roosting habitats of bats are often partitioned by roost type. Bats spend over half of their life time inside their roost environments. Bats roosts provide sites for mating, hibernation and rearing young, they promote social interactions and the digestion of food, and they offer protection from adverse weather and predators (Kunz, 1982)., Kunz also stated that the roosting habits of bats may be influenced by roost abundance and availability, risk of predation, the distribution and abundance of food resources, social organization and an energy economy imposed by body size and the physical environment. Disturbance and destruction of day roost sites is a fundamental factor for decline of bat population (Kunz, 1982).

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Bats are found in all areas of the world especially throughout the temperate and tropical regions (Corbet and Hill, 1992) except in Arctic and Antarctic, in certain remote oceanic islands in eastern pacific (Tun Yin, 1967).At present there are more than 1300 species of bats distributed throughout the world (Voigt and Kingston, 2016). The distribution of bats is largely dependent on the spatial and temporal variation of their abundance of the food (Mickleburg et al., 1992).

Bats are ecologically and economically important animals. They are the only true flying mammals, and they occupy a wide arrange of ecological, niches. Bats shelter in tree cavities, crevices, caves and buildings and the rest exposed on trees (Fenton, 1983). Flying foxes are relatively large, their body weights ranging from 100g to 1000 g and wingspan up to 1.7 m (Neuweiler, 2000). Bats are threatened by human's activities and natural factors (Mickleburg et al.,1992). *P.giganteus* is assumed to be locally threatened by cutting down of roosting trees, hunting or other purposes (IUCN, 2008).

The present study was conducted to learn the roost site and habitat preference of *Pteropus giganteus* and to record the fluctuation of the bat population in the study area.

Materials and Methods

Study area

The roosting site of Indian Flying Fox, *Pteropus giganteus* was in Shwe Sedi Pagoda Precinct, Hpayar Pyan Village, Wetlet Township, Sagaing Region. (Site I). It is located at 22° 15' N and 95°43' 52' E. The elevation of this study site is approximately 90 m (Figure 1).

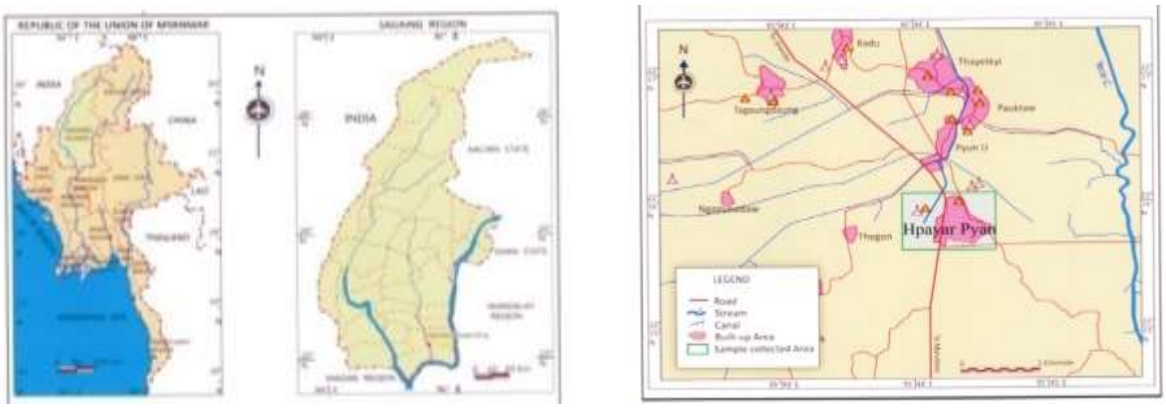
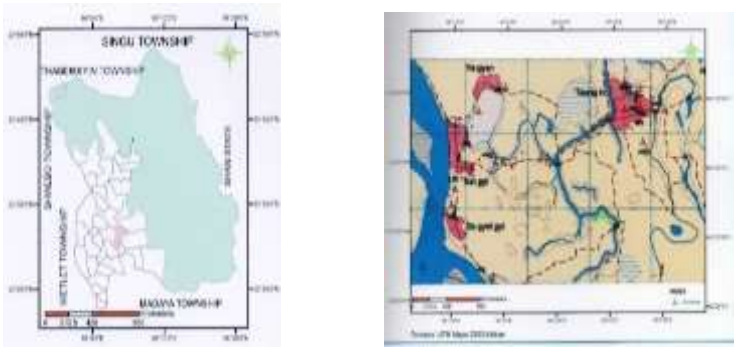


Figure 1 Location map of Hpayar Pyan Village, Wetlet Township, (Sagaing Region)

The roosting site of Indian Flying Fox, *Pteropus giganteus* was in Taunginn village, Mandalay Region (Site II).It is located at 22° 25' N and 96°02' E. The elevation of this study site is approximately 76 m (Figure 2).



(**Source:** Geography Department of MU)

Figure 2 Location map of Taunginn village in Sintgu Township (MandalayRegion)

Study period

The survey was carried out of for five months from October 2015 to February 2016 (Site I) and from October 2016 to February 2017 (Site II).

Data collection

Monthly field surveys were carried out twice a month; the second week and last week of each month. The trees which have over 5 m height were focused.

Identification of species

Identification of Indian Flying Fox, *Pteroopus giganteus* was followed after by Corbet and Hill (1992) and Bates and Harrison (1997). The nomenclature of the trees was based according to Kress et al. (2003).

The measurement of roost trees

The diameter of the trunk as well as the height of each roost trees were measured by the aid of clinometers (Suunto MC2, Pro-Compass) and measuring tape. The height of tree was calculated by using the following equation (Bower *et al*., 1988) (Fig. 3).

$$H = (d \times \tan\theta) + h$$

where, H = the height of a tree

h = the height of eye above ground

d = distance, $\tan\theta$ = the angle of elevation

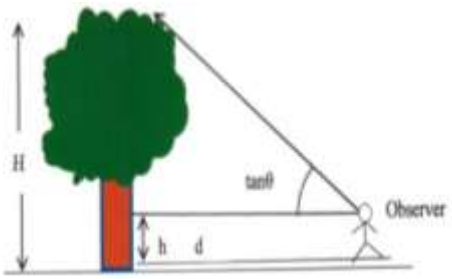


Figure 3 Measuring of the height of the tree

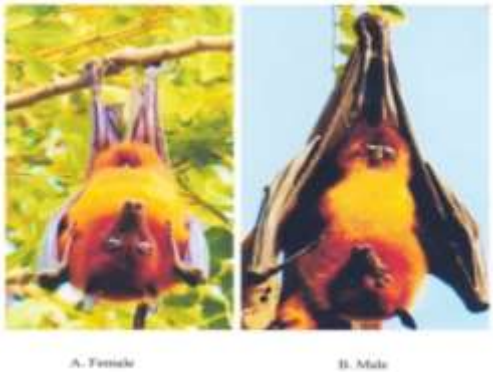


Figure 4 *Pteropus giganteus*

Results

Systematic position of Indian Flying Fox

Kingdom	-	Animalia
Phylum	-	Chordata
Class	-	Mammalia
Order	-	Chiroptera
Suborder	-	Megachiroptera
Family	-	Pteropodidae
Genus	-	*Pteropus*
Species	-	*P. giganteus* (Brunnich, 1782)

Morphological Structure -*P. giganteus* is a very large fruit bat. The snout is long and the ears are tall and pointed. The wings are massive. The first digit has a large claw. The crown of the head was a chestnut brown colour and the baculum is large and semicircular. (Fig 4)

Global distribution - This species is distributed extending from Pakistan, India, Nepal, China and Maldives through to Myanmar, Bangladesh, Bhutan, Sri Lanka, source; Corbet and Hill,1992 and Bates and Harrison, 1997.

The selection of roost site

In the study site, the total numbers of 146 trees (above 5 m height) were observed at Site I. These trees belong to eight species, eight genera and seven families. Among them 13 trees were observed as the roosting trees for Indian flying fox (Table 1). These were six trees of Tamarind (Magyi) *Tamarindus indica* and Palm (Htan) *Borassus flabellifer* and one tree of Rain tree (Kokko) *Samanea saman*.(Table 1).The total numbers of 25 trees (above 5 m height) were observed. These trees belong to seven species, seven genera and seven families at Site II (Table 5). Although there were six trees of *Bombax ceiba* (Kapok), the roosting trees for Indian flying fox used five threes as roosts (Table 6). All roosts were located beside the Nut-min Stream, near the Tasaintpay In. The heights and diameters of *Bombax ceiba* were roosted.

Site I flying foxes were collected the highest number in October 2015 (854 bats) and the lowest numbers were in February 2016 (716 bats) (Table 4). Site II the highest numbers of bats were observed in February 2017 (976 individuals) and the lowest number was in November 2016 (261 individuals) (Table 8). The temperature and humidity of the roost site was almost stable without much variation at site I the ambient temperature ranged from 20°C to 23°C and humidity ranged from 64% to 71% (Table 3). Site II at the ambient temperature ranged from 20.1˚C to 25.9˚C and the humidity ranged from 52.6% to 61%. (Table 7)

Table 1 Number of different trees species from October 2015 to February 2016 at (Site I - Hpayar Pyan Village)

Sr No	Family	Scientific Name	Common Name	No	Root Tree
1	Casealpiniac	*Tamirindus inidca*	Tramarind tree	59	6
2	Arecaceae	*Borassus flabellifer*	Palm tree	72	6
3	Anacardiacea	*Magnifera indica*	Mango tree	3	0
4	Fabaceae	*Sammanea saman*	Rain tree	2	1
5	Meliaceae	*Azadirachta indica*	Neem tree	3	0
6	Arecaceae	*Coco snucifera*	Coconut tree	4	0
7	Rosaceae	*Prunus domestica*	Plum	2	0
8	Minosocea	*Acacia leucophliea*	White barked acacia	1	0
		Total		**146**	**13**

Table 2 Height and diameter of roost trees (Site I - Hpayar Pyan Village)

Roost tree species	No. of roost tree	Height (m)	Diameter (m)
Tamarindus indica	6	24.6m	1.97m
Borassus flabelifer	6	23.33m	1.43m
Samanea saman	1	31m	3.38m

Table 3 Monthly populations of *P. giganteus* in relation to temperature and humidity from October 2015 to February 2016 (Site I)

Monthly/year	Population	Temperature	Humidity (%)
Oct-2015	854	23.2	66.3
Nov-2015	785	22	64
Dec-2015	779	20.2	71
Jan-2016	762	23	664
Feb-2016	716	22.7	65

Table 4 Monthly populations of *P.giganteus* on different roosted trees Site I

Sr no	Roost tree species	Roost tree Number	Oct	Nov	Dec	Jan	Feb
1	*Tamarindus indica*	T1	69	61	23	20	-
2	*Tamarindus indica*	T2	350	334	311	328	319
3	*Tamarindus indica*	T3	101	84	76	122	89
4	*Tamarindus indica*	T4	16	13	9	20	12
5	*Tamarindus indica*	T5	36	30	15	13	-
6	*Tamarindus indica*	T6	10	17	5	22	17
7	*Borassus flabelifer*	P1	10	4	-	-	-
8	*Borassus flabelifer*	P2	9	5	-	-	-
9	*Borassus flabelifer*	P3	2	2	-	-	-
10	*Borassus flabelifer*	P4	2	-	-	-	-
11	*Borassus flabelifer*	P5	4	-	-	-	-
12	*Borassus flabelifer*	P6	4	-	-	-	-
13	*Samanea saman*	R1	241	235	340	237	279
Total			**845**	**785**	**779**	**762**	**716**

Table 5 Number of different tree species at study site during October 2016 to February 2017 (Site II -Taunginn Village)

Sr no	Family	Scientific name	Common name	Local name	No.of tree
1.	Ameacardiacea	*Magifera indica* (L.)	Mango	Thayet	7
2.	Rhamnaceae	*Ziziphus jujuba*	Jujube	Zi	2
3.	Bombacaceae	*Bombax ceib* L.	Kapok	Letpan	6
4.	Rubiaceae	*Naucle aorientalis*	Bur Tree	Ma-u	5
5	Mimosaceae	*Albizia lebbek*	Lebbek Tree	Kokko	1
6.	Boraginaceae	*Cordia dichotoma* Forst..	Bird Lime	Thanat	3
7.	Fabaceae	*Butea frondosa* Roxb.	Palas Tree	Pauk	1
Total					**25**

Table 6 Height and diameter of roosted trees (*Bombox ceiba*) Site II

Sr no.	Roost tree	Height (m)	Diameter	Roost
1	I	25.34	7.2	+
2	II	17.13	5	+
3	III	17.5	4.3	+
4	IV	11.12	1.5	-
5	V	15.91	3.5	+
6	VI	21.5	6	+

+ Presence, - Absence

Table 7 Monthly populations of *P.giganteus* in relation to temperature and humidity from October 2016 to February 2017 Site II.

Month/year	Population	Temperature (°C)	Humidity (%)
Oct-2016	272	25	61
Nov-2016	261	24.5	56
Dec-2016	481	20.1	58
Jan-2017	475	21.5	52.6
Feb-2017	976	25.9	56

Table 8 Monthly populations of *P.giganteus* on different roost trees (*Bombox ceiba*) Site II

Srno	Roost tree	Oct	Nov	Dec	Jan	Feb
1	I	93	97	-	69	581
2	II	84	79	59	20	180
3	III	95	85	186	45	215
4	IV	-	-	-	-	-
5	V	-	-	78	-	-
6	VI	-	-	158	341	-
	Total	**272**	**261**	**481**	**475**	**976**

Plate I. Roosting of Indian flying foxes at the study sites

Discussion

The present study was carried out in Shwe Sedi Pagoda Precinct as Site I from October 2015 to February 2016. In this study, *P. giganteus* roosted on 13 trees, comprising three species of trees and the population decreased month by month throughout the study period. However, in the same study site, Moe Moe Aung (2005) recorded that bats used 20 trees as roosting site, including five tree species and the populations of bats increased within her study period (from 2003 to 2005).

During the present investigation, *P.giganteus* was found to root in larger trees. The heights of all roost tree ranged from 23.33m (*Borassus flabellifer*) to 31 m (*Samanea saman*), while the diameters ranged from 1.43 m (*Borassus flabellifer*) to 3.38 m (*Tamarindus indica)* respectively. The ambient temperature ranged from 20.2˚C to 23.2˚C and the humidity ranged from 64% to 71%. The maximum roost of bats was found in *Tamarindus indica* T_2 (319 individuals). The minimum roost of bats was found in (*Borassus flabellifer)* P_3 (2 individuals). Flying foxes were collected the highest number in October 2015 (854 bats) and the lowest numbers were in February

2016 (716 bats). In study site I, the maximum number of roosts was recorded on the tamarind trees in October and minimum number in February.

According to the present results, the populations were assumed to decrease in the present study period. These study months were cold season. The days are shorter in cold season. Since the sunset time is earlier, the emergence time is earlier in the cold season. Similarly, it was assumed that the food production was lower in the cold season thus the bats may need to travel longer distances to search food. Therefore, the population of *P.giganteus* clearly decreased throughout the entire study period from October 2015 to February 2016. Moe Moe Aung (2005) also recorded that the numbers of bats decreased from September through December in Shwe Sedi Pagoda. Moe Moe Aung (2005); Sein Sein Win (2006) and May Myo Nyunt (2007) also stated that bats emerged earlier from the roosts site during the cold season compared to the wet and the hot seasons. The present finding also agrees with the statement of previous local workers.

The present study was also carried out in Taunginn village, Mandalay Region as Site II from October 2016 to February 2017. The flying fox (*P.giganteus*) from the same study site was previously observed by Sein Sein Win (2006).

During the short period of five months study, In the vicinity of the study site has 25 trees (above 5 m) belonging to seven species, seven genera, and seven families. At the study site, there were six trees of *Bombox ceiba* (kapok). Among them, *P.giganteus* roosted on five trees of this species. The highest numbers of bats were observed in February 2017 (976 individuals) and the lowest numbers were in November 2016 (261 individuals). The maximum roost of bats was in RT I (581 individuals) with highest 25.34 m and diameter 7.2 m. The minimum roost of bats was in RT II (20 individuals) with height 17.13 m and diameter 5 m. No bat was observed in RT IV with height 11.12 m and diameter 1.5 m. The ambient temperature was ranged from 20.1˚C to 25.9˚C and the humidity was ranged from 52.6% to 61%. All root trees located along side of Nut-min Stream and surrounded by paddy field. Similarly, Sein Sein Win (2006) recorded that the population of bats was decreased in November, December and February, 2005. It was assumed that the decrease of the bat populations may be due to the lower food availability.

Kunz and Fenton, 2003 stated that bats have evolved specialized thumbs and feet for roosting. It was assumed that they are shrouded by their wings, giving them the appearance of dead leaves so they may reduce the detecting by predators. Similarly, IUCN, 2008 stated that *P.giganteus* roots on larger trees, close to cultivated fields and ponds. Elangovan and Kumar (2015) reported that *P.giganteus* live in large diurnal roost and usually located on the branches of larger trees. Gulraiz et al., 2015 recorded that seasonal shifting pattern from one roost tree to another increase and/or decrease in bats were observed at both sites.

This finding was agreed with Moe Moe Aung (2005), Sein Sein Win (2006) and May Myo Nyunt (2007), who stated that the roost trees occupied by the flying foxes in general are quite large and high.

From this result, all of the roost trees occupied by *P.giganteus* were tall and large in size, thus it may be recorded that *P.giganteus* could prefer to roost on large and tall trees. At the study site, from this result, we were assumed in the field human impacts and climate change are found. We were learned the comparison two study sites, Site I data collected throughout decreased at roost the study period. Site I area environment is closed near the pagoda, village and human impacts. Site II data collected throughout increased at roost the study period. Site II area environment is situated near the river, paddy field and not human impact. Habitat destruction and diverse threats to species in the sites were observed in these areas.

Conclusion

Seasonal shifting pattern from one roost tree to another increase and decrease in bats were observed in the study area. Conserving a species depends on an under-standing of its habitats requirements. So, the long term conservation of the species, need to protect their habitat in this area as well as the other parts of Myanmar.

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