

CHAPTER III

MATERIALS AND METHODS

Study area:-

Amchang Wildlife Sanctuary is situated on the eastern part of the capital city Guwahati; district Kamrup, Assam (Fig 3.1). The area of the sanctuary is about 78.64sq.km. It is located at the lower foothills of Shillong plateau which is the adjoined part of Raja Mayang hill Reserve Forest and Pabitora Wildlife Sanctuary. Amchang is declared as a Wildlife Sanctuary on 19th June 2004 by the Government of Assam. It comprises of three reserve forests Amchang, South Amchang and Khanapara. The central coordinates of Amchang Hill is 91°45'00" East and 26° 6'20" North. The altitude of this area is ranging from 50m-569m. The Khamranga beel, which is the lowest area and the Parahopa peak, is the highest point of the area. The northern part of the study area is guarded by the mighty Brahmaputra River, the southern part is bordered by the 37 National Highway, the western side is bounded by Guwahati Metro City and the eastern part is attached to Digaru of Morigaon district. The atmospheric temperature of the study area has been recorded as 32°C ± 2°C during the month of July and minimum 12°C ± 2°C during the month of January. The maximum average rainfall has been recorded as 377mm in the month of July whereas the minimum average rainfall recorded as 8mm in the month of December. The maximum relative humidity during the month of July recorded 94% and minimum in the month of January 70%.

Location Map



Fig. 3.1

Study site I (Ghagua)

Dense forest area and canopy coverage and some agricultural land with ferns and streams giving moist habitat with sufficient light infiltration to support a diversity of herbs and shrubs. This site is located on the North eastern vicinity area of the Amchang Wildlife Sanctuary. It is located at 26°20'96" E longitude and 92°27'81" N latitude.

Plate 1 Study sectors of Ghagua



Sector I

Sector II



Sector III

Sector IV

Study site II (South Amchang)

This represents moderately disturbed site of the sanctuary with sparse forest patches. Human habitation along with industrial installations like cement factory, coke factory are found to be present. Further, tea gardens are also found to cover a major area of this site. The study site lies between 26°13'E - 26°09'E and 91°50'N- 91°59'N and is situated on the southern part of Amchang Wildlife Sanctuary. The area is a foothill of lower part of Amchang Wildlife Sanctuary and gradually merging into low lying flat plain on the southern side. Tropical moist deciduous, tropical semi-evergreen and wet alluvial grasslands characterize the vegetation of South Amchang. The trees on the alluvial grassland habitat have formed the characteristic tropical scattered forest. The major rainy season is from May to September. It rains often even in March, April and October, but rarely in November, December and January. The winter months of January and December are comparatively dry. January is the coldest month when the minimum temperature often drops to 8°C and the maximum stays between 25°C to 32°C. The summer from May to September that is also the rainy season, when the maximum temperature prevails.

Plate-2 Study sectors of South Amchang



Sector I

Sector II



Sector III

Sector IV

Study site III (Bonda)

This is the most disturbed area affected with the expansion of the city area of Guwahati. The natural vegetation is severely inflicted with human habitation and other developmental works. Sparse trees and scrubs jungles dominate the area with teak plantation in some area of the site.

The study area is a foothill of lower part of Amchang Wildlife Sanctuary and undulating in the northern boundary and then gradually merging into low lying flat plain. The climate of study area can be characterized by high humidity and copious rainfall.

Plate- 3 Study sectors of Bonda



Sector I

Sector II



Sector III

Sector IV

3.2 Study design

The study was conducted during 2014 and 2015 in three sites span across different seasons as suggested by Borthakur, 1986 :-

Monsoon(June-August)

Retreating monsoon (September-November)

Winter (December-February)

Pre-monsoon (March-May)

All surveys and sampling were limited to sunny days and in clear weather. The following hours of the day were selected for field survey for collection of data:- 9.00–10.00Hrs, 10.30–11.30 Hrs, 12.00–13.00 Hrs, 13.30–14.30Hrs, 15.00–16.00Hrs and 16.30 –17.30 Hrs.

3.3. Data collection methods

Primary data collection and the survey were carried out in the parts of Ghagua, South Amchang and Bonda study sites of Amchang Wildlife Sanctuary. To study the magnitude of diversity, the three sites were painstakingly surveyed. Each site was separated into four sectors of 500m x 500m plots. Each sector was further divided into four quadrat of 250m x 250 m dimension. Weekly butterfly survey was carried out at four randomly chosen quadrat one each from every sector. Random selection of the quadrat was made to minimize the sampling bias. Butterflies were collected, identified, photographed, counted and released. On the walking transects, all butterflies– roosting and flying were recorded; walking on the trail was made at a standard speed without stopping. The survey was carried out by steadily walking along the transect and recording butterflies observed within a 20 m (10m on the each side of the line) width along the line transect (Pollard and Yates, 1993). Further 16 transects (250m long) were laid at random of each study site. The random points were selected and marked through GPS. Environmental data like maximum and minimum temperature and relative humidity were recorded during the collection of data on butterfly using thermohygrometer.

3.4 Butterfly species identification

The butterflies were identified by observing their morphology. Wingspan was measured with the help of vernier calliper and diagnostic characters were also noted. Identification of butterfly had been carried out following books Bingham(1905), Evens(1932), Talbot(1947), Winter-Blyth(1957), Mani(1986), Haribal(1992) Varshney(1994), Kunte(2000) and Kehimkar(2014). Further, unidentified specimens were compared with voucher specimens of Zoological Survey of India (Eastern Regional Station, Shillong).

3.5. Statistical indices and analyses

The data collected were analysed using the following diversity indices and population measures. The statistical analyses were computed based on the recommendations of Michael (1986), Ludwig and Reynolds (1988) and Southwood and Henderson (2000).

Frequency= (Nos of sampling units in which the species occurred) X 100/Total nos of sampling units studied. On the basis of % of frequency occurrence, all species were categorized into five different classes i.e very common (80%-100%), common (60%-80%), occasional (40%-60%), rare (20%-40%) and very rare (0-20%).

Abundance = this is the numbers of individuals of the species per sampling units of occurrence. This was calculated by the following method:-

Abundance = (Total numbers of individuals of the species of all sampling units)/Numbers of sampling units in which the species has occurred.

Density: - It is represented as the numerical strength of the species in the community. It is calculated by the following formula

Density = (Total nos of individuals of the species of all the sampling units)/Total area of all sampling units. Density is expressed in as numbers of individuals per unit area.

Richness index:- The richness index R (Margalef's index) was calculated relating to number of species and total number of individuals using the following formula:-

$R_1 = (S-1)/\text{Log}_e(n)$ Where **S** is the total number of species and **n** the total number of individuals.

Diversity indices:-The Simpson's (λ) and Shannon-Weiner (H') indices of diversity were calculated relating to the number of families of butterflies and the total number of species collected using the following formulae

$$\text{Simpson's index}(\lambda) = \frac{1}{\sum_{i=1}^S p_i^2}$$

Where $p_i = n_i/N$, $i = 1, 2, 3 \dots S$ i.e., the proportional abundance of the i th species and N is the known total number for all S species

$$\text{Shannon-Weiner index} (H') = - \sum_{j=1}^S (p_j \ln p_j)$$

Where p_i is the proportion of individuals in the i th species. S is the total number of species and \ln is the log with base e logarithms

Hill's diversity index: - The number of abundant species (N) = $e^{H'}$ Where H' is the Shannon-Weiner index.

Evenness index: - The evenness index was calculated using the formula

$$E = (1/\lambda) / e^{H'}$$
 Where H' is the Shannon-Weiner index

Similarity index: - Bray-Curtis (B) index. This is a measure of dissimilarity; hence (1-B) is taken by measure of similarity. $B = \sum (\quad) (\quad)$

Where

X_{ij} = Nos of individuals of i th species in sample or habitat or community in j ,

X_{jk} = Nos of individuals of i th species of sample or habitat or community in k .

Correlation coefficient and regression analyses

Correlation coefficient and regression analyses were computed using standard formulae:-

$$\text{Correlation coefficient (r)} = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2} \sqrt{\Sigma(y - \bar{y})^2}}$$

$$\text{Regression coefficient (b)} = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\Sigma(x - \bar{x})^2}$$

$$\text{Intercept y (a)} = \bar{y} - b\bar{x}$$

Regression line fitments were computed based on scattered diagram mode using the following equation.

$$y = a + bx$$

The statistical treatments were given to analyse the interaction between different abiotic factors (temperature, humidity) and the abundance of butterfly. The analyses made between monthly butterfly population in the three sites studied and the role of abiotic factors on the population richness were analysed for the entire period of the research.