# CHAPTER: III

# METHODOLOGY

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Present dissertation covers several aspects viz. enumeration of floral species, subsistence and commercial uses of various species, understanding the ecological significance of different floristic elements and socio-ecological linkage for better management of this forest area etc.

For the entire work vegetation sampling is the first step and linking the vegetation and its elements with the socio-economy of the dependent people is the last. The entire methodology has been framed keeping in mind these factors.

## 3.1. SAMPLING OF VEGETATION

Following steps have been followed to obtain relevant vegetation estimates across the different plot areas studied.

**3.1.1. Plot Selection:** Sample plots were selected at random covering the entire study area, which is the core area of Buxa Tiger Reserve

**3.1.2. Plot layout:** Three concentric circles with radial of 10 meters (for canopy), 3 meters (for under-storey) and 1 meter (for ground cover) were laid (Sarkar *et al*, 2009; Fig. 3.1). Tree-trunks were numerically marked for future recognition of a plot. Diameter at breast height (DBH), height, and crown cover for the trees (over 10 cm in diameter) along with the occurrence of epiphytes on trees occurring within the largest circle were recorded. In the under-storey, along with the list-count data height, collar diameter (CD) and crown diameter were also recorded for the plants with stem diameter 2.5 – 10.

For ground cover sample (smallest circle), list-count and cover for all plants with less than 2.5 cm in diameter were recorded. Details of herbs and seedlings observed in the smallest circle were also noted. Random sampling plot survey has been done in consecutive three seasons (Wertime *et al*, 1999; Chakrabarti *et al*, 2002; Biswas *et al*, 2012; Tag *et al*, 2012).

**3.1.3. Physical attributes:** A structured questionnaire used to record some important physical status parameters of each plot under study and includes altitude, aspect and slope. The method suggested by Ruhe and Walker (1968) had been followed to measure the slope.

**3.1.4. Soil sampling:** Soil samples were collected by digging a hole of at least 25 cm deep from the smallest circle to measure the soil moisture and chemical properties like organic Carbon, other organic matters, Nitrogen, Phosphorus, Potassium and Sulphur (Pennock, 2008). Samples were stored as per procedure prescribed by Sheppard and Addison (2008). Soil Phosphorus was measured following Schoenau and O'Halloran (2008). Assessment of Potassium has been done following the method of Ziadi and Tran (2008). Methodology of Maynard *et al* (2008) followed to measure soil Nitrogen. In addition, pH and moisture content of soil were also measured.

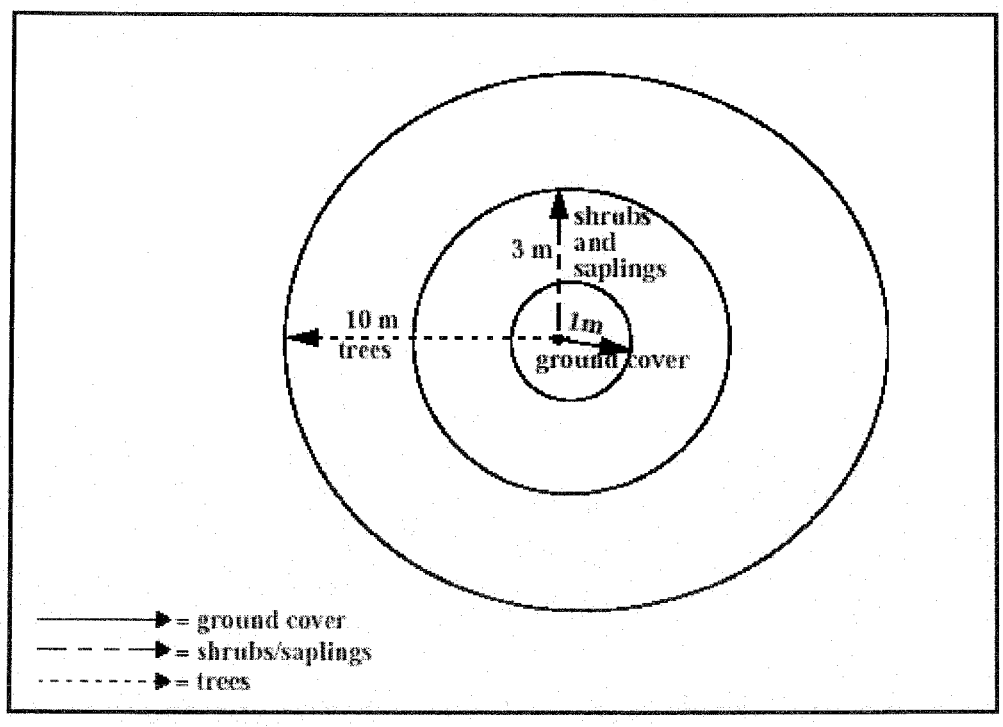


**Fig. 3.1.** Concentric Circles for Vegetation Study of a Forest Plot

3.1.5. **Qualitative observation:** Careful qualitative observation on active soil erosion, plants damaged by insects, evidence of livestock intervention, tree fall, jungle trail, location of the plot (whether near a river/stream/road), presence of insects etc were also noted;

3.1.6. **Recognition through vernacular names:** Forest department people and the local inhabitants are quite familiar with the vernacular names of the plants of their surrounding areas. These names were also recorded with a view to use those for feedback.

3.1.7. **Processing of Specimens:** Specimens were basically processed at the field camp. After proper cleaning, pruning etc. specimens were inserted in blotters in a Herbarium Press. After drying, specimens were poisoned and mounted on standard Herbarium mounts. Labelled properly and temporarily stored in steel cabinet in the laboratory (Jain and Rao, 1977).

3.1.8 **Identification of plants:** Most of the specimens were identified in the Taxonomy and Environmental Biology Laboratory, of the Department of Botany. Identification of mounted specimens were done by conventional techniques (Jain & Rao, 1977) with the use of local floras, monographs, etc and confirmed by matching basically at NBU and then at CAL Herbaria. After the works are over, main set of the specimens will be deposited at the NBU-Herbarium and the duplicates at the CAL.

## 3.2. SAMPLING OF SOCIO-ECONOMIC ASPECTS

A Socio-Economic survey was simultaneously carried out to collect required information from the villagers. Following steps were followed:

1. An initial discussion with the members of the local village *Panchayat* and other important individuals like a teacher, each from the nearest high school and the local primary school helped us to understand the general socio-economic features of the people residing in the area under present study.

As a second step, a complete list of the households has been prepared and following data has been collected—

- Settlement history
- Demographic structure
- Occupation of highest earning member
- Annual income of the family and
- Collection of fuel wood from the forest.

2. 40 representative households have been selected from the list using random sampling technique and a cross check have undertaken to reveal that the population parameters and sample parameters like—
   a. Occupation status;
   b. Annual family income and
   c. Collection of NTFP from the forest.
3. A structured questionnaire was canvassed among the selected households to elicit information about socio-economic status of each of them and their dependence on forest products.
4. In addition informal discussions with villagers at local market teashops and school also carried out to gather information.

### 3.2.1. Analysis of socio-economic information

The socio-economic data helped us to document—

- History of the settlement;
- Demographic features of the population;
- Major income sources;
- Man-forest relationship with particular reference to ethnobotanical practices and
- Quantitative information about forest produces harvested.

Socio-economic information has been accumulated using IFRI techniques (Wertime *et al*, 1999). Voucher specimens of different NTFPs are collected with the help of the respondents during household survey. Local uses viz. subsistence, commercial or ethnobotanical – have been documented during survey. Methodology of Jain (1981, 1987, 1991); Rai *et al* (1998); Rai & Bhujel (1999), Rai (2006); Ghosh & Das (2011); Devi *et al* (2011); Sarkar & Das (2012) are followed for this purpose.

## 3.3. PHYTOSOCIOLOGICAL ANALYSIS

Using the list-count data recorded from the circular sample plots were used to calculate frequency, density, abundance, basal area etc to determine the Importance Value Index (IVI). IVI is the sum of the relatives of frequency, density and dominance (Phillips, 1959; Misra, 1969; Shimwell, 1971; Das & Lahiri, 1997; Kadir, 2001; Rai, 2006 and Ghosh, 2006). Calculation of IVI for shrubs and herbs were done – considering abundance – following the methodology of Samanta and Das (1996).

### 3.3.1. Frequency

Frequency (F) and Relative Frequency (RF) of a species is determined using the formulae:

**Frequency (F%)** = (Number plots in which species occurred / Total number of plots studied) x 100.

**Relative Frequency (RF)** = (Frequency of a species/ Ó of the frequencies of all species) x 100.

### 3.3.2. Density

Density (D) and Relative Density (RD) of a species is determined using the formulae:

**Density** (D) = $\frac{\text{Total number of individuals of a species in all studied plots}}{\text{Total number of plots studied}}$

**Relative density (RD)** = $\frac{\text{Number of individual of a species}}{\text{Number of individual of all species}}$ X 100

### 3.3.3. Dominance

Dominance (Dm) and Relative Dominance (RDm) of a species is determined using the formulae:

**Dominance (Dm)**= Value of individual basal cover.

**Relative Dominance (RDm)**= $\frac{\text{Total basal area of the species}}{\text{Total basal area of all the species}}$ X 100

### 3.3.4. Importance Value Index (IVI)

IVI is calculated using the following formula –

**IVI**= RF+RD+RDm

### 3.3.5. Shannon – Weaver Index of Diversity (SWID) [Shannon-Weaver, 1963]

The formula for calculating the Shannon diversity index is

**H' = – Ó *pi* ln *pi***

Where, H' = Shannon index of diversity

*pi* = the proportion of important value of the ith species ( *pi* =

*ni* / N, *ni* is the stem count of ith species and N is the stem count of all the species).

### 3.3.6. Simpson's Dominance Index (SDI) [Simpson, 1949]

SDI is calculated by the following way –

**SDI**= n*(n-1)/N*(N-1)

### 3.3.7. Species Richness [Menhinick, 1964]

Species richness of floral community has been calculated in the following way:

**D** = S/"N

S = Total number of species observed.

N = Total number of individual observed.