

Chapter: III

MATERIALS & METHODS

A) STUDY AREA:

Jarandeshwar Hill shows dry deciduous type of forest in the Satara region of Maharashtra state. It is famous for the medicinal plants in the area. At the top (plateau) of the hill there is temple of lord Maruti (Jarandeshwar). People are visiting to this temple for worship. The devotees and natives harvest right hand side plants for the treatment of diseases while going upward and downwards, because they have strong belief that, each and every plant is medicinal plants (Sanjivini). Therefore it may create threat to the plants. At east and south side of the hill, a cattle grazing is responsible for degradation of biodiversity. It is found that, forest fire has a profound effect on forest biodiversity.

Physical Location:

Jarandeshwar hill is a track of dry deciduous forest. It comprises Ca. 199 ha. area which is located at the border line of Padali Jamb villages of Koregaon Tahsil and Mahuli of Satara Tahsil, which is situated at Latitude N $17^{\circ} 44.013'$ and longitude E $074^{\circ} 06.291'$ and altitude between 825m to 1227m from mean sea level. It is 15 km away from Satara city towards east and 9 km away from Koregaon Tahasi (figure 1). Data of altitude and longitude was determined by using Garmin GPS.

General Climatic Feature:

The climate of Study Area is composed of four seasons namely, the cold, hot, the south west monsoon and the post monsoon season. The cold season starts by about end of November and continues up to middle of February. It is followed by the hot season from middle of February till onset of the monsoon or up to the first or second week of June. The south west monsoon season starts from June to September, October and November are the post monsoon months (Kulkarni, 1997).

Climate data of study area have been obtained from meteorological department of Satara. Monthly means of temperature, highest and lowest humidity and total rainfall per month in the year 2007 are given in table 1 and represented by figure 2.

Temperature:

A wide variation occurs in temperature from season to season. In May and June temperature rises up to 38.2°C . The coldest days are in the month of December-January. In these days temperature falls up to 14.4°C .

Table -1: Monthly meteorological records of study area.

Month	Temperature (°C)		Rainfall		Humidity (%)	
	Max.	Min.	mm	Days in month	Max.	Min.
January	31.5	13.6	0.3	01	89	31
February	32.3	14.5	0.0	00	86	25
March	36.2	18.4	0.0	00	83	29
April	38.2	22.1	32.7	04	81	22
May	36.7	23.2	5.6	03	73	29
June	30.2	22.9	368.2	18	98	50
July	27.4	22.1	329.3	31	98	55
August	26.9	21.7	214.6	27	98	67
September	31.5	13.6	0.3	22	98	59
October	32.9	19.6	0.8	02	89	29
November	32	15.5	1.9	02	91	28
December	31.2	14.4	0.0	00	86	28

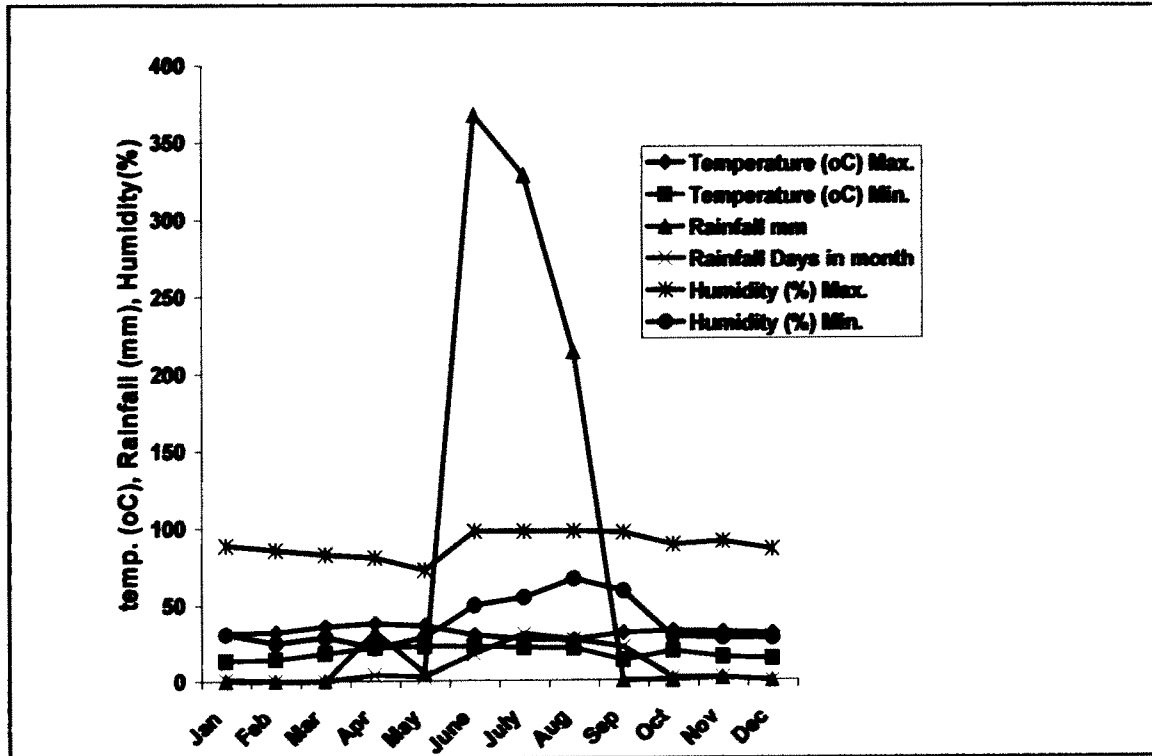


Figure 2 : Monthly meteorological records of study area.

Rainfall:

The monsoon in the area is irregularly distributed. Rainfall in this area ranges between 750-1250mm. Total number of rainy days in 2007 were 110. Minimum rainfall was 0.3 mm in the month of January while maximum rainfall was 368.2 mm in the month of June. However, the area is drought prone and variation in rainfall from year to year is considerable.

Humidity:

Humidity of the study area ranges between 22-98%. Highest humidity found in the month of June to September (98%) and lowest humidity found in the month of April (22%).

Soil Analysis:

Soil analysis of the study area was done in the laboratory with respect to the following parameters represented in table 2 (Subrahmanyam, 1996).

Table -2: Soil analysis from Jarandeshwar hill.

Altitude	Color	pH	Water holding capacity (ml) per 150 gm of soil.	Texture of Soil			
				Coarse sand	Fine Sand	Silt	Clay
Top	Reddish	7.3	13.6	121.6	21.9	4.8	1.8
Middle	Black	7.5	43.5	22.5	66.9	38.2	22.4
Base	Black	7.4	16.3	63.4	34.2	28.7	23.7

Color of the soil is red to black. Soil is alkaline with average pH 7.4. Soil from the middle part of the hill has high water holding capacity (43.5). Top and basal soil samples appear sandy as they show 81.7% and 42.27% coarse sand while middle soil shows higher proportion of fine sand (44.60%).

Water bodies:

There are two ponds and Rain water conservation tank at top of the Jarandeshwar hill.

Status of Forest:

Jarandeshwar hill extends over an area ca. 199.0 ha. West side of hill is private area and remaining part of this hill has been declared as reserve forest.

B) MATERIALS AND METHODS

Jarandeshwar Hill was analyzed with respect to Phytosociological, ethnobotanical and endemic aspect in the year 2007 by arranging field trips. Study area was visited two times in a week. For the convenience of study, study area differentiated into four sides i.e. East (E), West (W), South (S) and North (N).

I. Ecological Studies:

Ecological studies were conducted by transect and quadrat method (Mishra, 1968). The size of quadrat varied with the type of vegetation. For small plants like grasses and herbs with great diversity, 80 quadrats of 2 X 2 m² were taken, while 40 quadrats were for the shrubs and climbers (5 X 5 m²). Tree data was analyzed by using 20 belt transect (500 X 10m²).

Ecological data of major plant forms like herbs, shrubs, climbers and trees:

Ecological data provides the baseline information for conservation and sustainable management of forest ecosystem. We have surveyed and studied the entire Jarandeshwar hill during 2007. Numerical counts of each individual species were recorded for their abundance, density and basal area (for tree species) calculated by using following formulae (Mishra, 1968).

i) Frequency (F): It is determined on the basis of percentage frequency values of individual species.

$$\text{Frequency (F)} = \frac{\text{Number of quadrats in which a species occurred}}{\text{Total number of quadrats sampled}} \times 100$$

ii) Abundance (A): It is determined by obtaining the ratio of total number of individuals of a species in a quadrat to the total number of quadrat in which species occurred.

$$\text{Abundance (A)} = \frac{\text{Total number of individuals of a species in all quadrat}}{\text{Total number of quadrats in which the species occurred}}$$

iii) Density (D): It is the total number of individuals of each species divided by the total number of quadrats studied. It determines numerical strength of species.

$$\text{Density (D)} = \frac{\text{Total number of individuals of a species in all quadrat}}{\text{Total number of quadrats sampled}}$$

iv) Basal Area: It refers to the ground area covered by species.

$$\text{Basal Area} = \pi r^2 \text{ (where } \pi = 3.14 \text{ and } r = \text{radius).}$$

v) Species diversity:

Species diversity is calculated by using BDPRO software.

Species richness (SR): Species richness is simply the number of species found in the community. Species richness is calculated as follows (Menhinick, 1964).

$$\text{Species richness (SR)} = \frac{S}{\sqrt{N}}$$

Where, S = Number of species in a community

N = Number of individuals of all species in a community.

Diversity indices: Diversity is often represented in the form of indices. Diversity indices attempt to incorporate both richness and abundance into a single numerical value. These are therefore referred to as heterogeneity indices. A given value of diversity index can result from different combinations of species richness and abundance evenness. However, it would be difficult to separate the relative importance of species richness and evenness from the given value. Species diversity is calculated by following formulae (Vasudeva, 2006).

a) Shannon Wiever function (H)

Shannon Wiever index of diversity (Shannon, 1963) can be calculated as (H)

$$H = \sum_{i=1}^s (P_i) (\log_2 P_i)$$

Where, $P_i = n_i / N$

n_i = Number of species.

N = Total number of species.

S = Number of species.

b) Simpson Index (DS)

Simpson species diversity index (Simpson, 1949) can be calculated as

$$DS = 1 - \sum_{i=1}^k \left[\frac{n_i(n_i-1)}{N(N-1)} \right]$$

Where, DS = the diversity index.

n_i = the number of individuals belonging to a species.

K = is the total number of species.

N = is the total number of individuals of all species.

c) Species diversity (SD)

Species diversity is calculated in the form

$$SD = 1 - \sum (p_i)^2$$

Where, $P_i = n_i / N$

n_i = number of species

N = total number of species

The low value is indicative of low diversity

d) Species evenness (J)

Species evenness (J) is calculated through index (Magurran, 1988)

$$J = \frac{D}{\log S}$$

Where, S = Total number of species in a community,

D = Shannon- Wiever index

e) Berger - Parker Dominance Index (d)

Berger - Parker Dominance Index (Hill, 1973) is simple, both mathematically and conceptually,

$$d = \frac{N_{\max}}{N_T}$$

Where, N_T = the proportion of the total catch

N_{\max} = dominant species

f) Mcintosh diversity measure (D)

Mcintosh (1967) suggested the Dominance index:

$$D = \frac{N - U}{N - \sqrt{N}}$$

Where, N = is the total number of individuals in the sample

U = is calculated as:

$$U = \sqrt{\sum n_i^2}$$

Where n_i = is the number of individuals belonging to the i^{th} species.

vi) Importance Value Index (IVI):

The Importance Value Index (IVI) is a statistical quantity, which gives an overall picture of the importance of the species in the vegetative community. It considers the relative values of density, frequency and basal area of every species in a study area. It thus incorporates three important parameters, which are measures of diversity and productivity of tree species under study.

IVI = Relative Density + Relative Dominance + Relative Basal Area

Relative Density (RD) is the proportional representation of a species in a sample.

$$RD = \frac{\text{Density of the species}}{\text{Total density of all species}} \times 100$$

Relative frequency (RF) is the proportion of frequency of a species in the sampled area.

$$RF = \frac{\text{Frequency of the species}}{\text{Total frequency of all species}} \times 100$$

Relative Basal Area (RBA) is the proportion of Basal Area of a species in the Total area.

$$RBA = \frac{\text{Basal Area of the species}}{\text{Total Basal area of all species}} \times 100$$

RBA is the area occupied by the base of the species. It is considered as a good indicator of a size, volume or weight of a species. The GBH measures are used to calculate the basal area of tree species.

II. Ethnobotanical study:

For collecting the information about medicinal plants, survey was conducted in four villages around the study area i.e. Jamb, Mahuli, Bhivadi and Khavali. For knowing the medicinal uses of plants by following local hakims (Vaidus) were interviewed by using the questioner. 1) Maruti Gaikawad, 2) Kondiba Nikam, 3) Mahavir Shelar and 4) Dada Nikam 5) Sudama Jadhav. Collected information was analysed by referring literature (Maheshwari *et al.*, 1993; Das and Pandey 2007). The information concerned with religious plants was collected from 'Date Panchang' and information about timber, non-timber forest products; fodder plants were collected by referring literature (Singh *et al.*, 2000, Das and Pandey, 2007).

III. Endemic plants:

Endemic plants are listed out from study area by using Flora of Maharashtra state (Singh *et al.*, 2000).

IV. Ornamental Plants: These were listed on the basis of ornamental characters and general appearance of the plants.

V. Herbaria preparation:

Flowering twigs of plants from the study area were collected and identified by using floras, Flora of Presidency of Bombay-Vol-I to III (Cook, 1967), Flora of Mahabaleshwar and adjoining regions Vol I & II (Deshapande *et al.* 1993), Flora of Kolhapur District, (Yadav & Saradesai 2002), and Flora of Maharashtra State (Sharma *et al.*, 1996; Singh and Karthikeyan, 2000 and Singh *et al.*.2001).

Herbarium of collected plant species was prepared by using the method of Subrahmanyam (1996) and deposited in the Department of Botany, YCIS, Satara. Floristic data obtained during study was the outcome of phytosociological studies.