STUDY AREA AND METHODOLOGY

The study area, the Gir National Park and the Sanctuary, is one of the better protected and hence, wooded land mass of Gujarat. Together the Gir Sanctuary and the National Park form the Gir Protected Area (Gir P.A.). Gir P.A. is located in southern region of the Saurashtra peninsula of Gujarat state in the Western India. Geographically the Gir P.A. is situated between 20° 40' N to 21° 50'N and 70° 50'E to 71° 15'E longitude respectively (Figure ii). The Gir P.A. encompasses a total of 1412.12 sq. km area, which includes National Park area of 258.7 sq. km and Sanctuary area of 1153.42 sq. km. The study area for administrative reason is divided into three management units *viz.* Sanctuary West (690.69 sq. km), National Park (258.7 sq. km) and Sanctuary East (462.73 sq. km).

GEOLOGICAL FEATURES

The land configuration is mainly undulating with moderate hills, valleys and plateau. It is rugged and hilly with height of hills ranging from 150.3 to 530.7m above MSL. The hills are of volcanic origin. The main geological formation is Deccan trap and main rock types are dolomites and basalt. The volcanic rock have given rise to the black cotton soil however, sand stones and lime stones have given rise to reddish brown sandy loam soil (Patel, 1992).

CLIMATE

The Gir P.A. has tropical monsoon climate, which gets very hot during summer. Three seasons i.e. summer, winter and monsoon are distinct. Summer is a dry warm period, commences from February/March to May/June. Temperature variation is very wide in Gir P.A. During the span of the study we observed a maximum temperature of 41°C - 43°C in the peak summer. The mercury however, dropped as low as 12°C - 10°C during winter season (Table I).

Rainfall in Gir P.A. is erratic and uneven. Rains begin with the onset of southwest monsoon in the month of July and lasts up to September. Due to irregularity in monsoon and unequal distribution of rainfall drought years are not uncommon. This

is evident from the fact that two out of the three years of current study received less than average rain fall (Table II).

Relative humidity during monsoon is generally over 80%. In summer and earlier part of winter, it is around 30-40%. This general pattern of relative humidity remained unchanged during current tenure of study (Table III)

WATER RESOURCES

The Gir P.A. forms the catchments of seven perennial rivers. There are four reservoirs in Gir P.A. Kamleshwar is located in Gir west, Singhoda in Gir National Park, and Macchundri and Raval in Gir East. These perennial rivers and the reservoirs form a reliable source of water during summer months and hence, play a major role in supporting and sustaining the flora and fauna of Gir P.A.

HUMAN SETTLEMENT AND TOURISM

Maldharies, a pastoral community, are an integral part of the Gir ecosystem. They have been living in Gir for the past 130 years. They live in small hutment called "Nesses" in the forest area. Following an effective relocation programme by Gujarat Forest Department, spanning 1972 – 1986, out of 845 Maldhari families, 580 families have been resettled. There are no Maldhari Nesses in the National Park today. However; there are 54 Nesses in the sanctuary area. Gir P.A is revered for its uniqueness of the co- existence of human being and manned big cat (Singh, 2001).

There are three major pilgrimage sites in Gir, which attracts thousands of visitors throughout the year. Pilgrimage is an activity, which has turned out to be the major cause of concern for the management.

VEGETATION

Gir P.A forms a part of Semi-Arid-Gujarat Rajputana (4B) biogeographic province (Rodger, 1989). Gir P.A has diverse and rich vegetation. The major forest types of Gir P.A. are teak forest, non-teak forest and riverine forest. The vegetation in Gir P.A. has been systematically studied and documented (Chavan, 1993). Champion and Seth (1968) have classified Gir P.A under the type 5A/Cia i.e. very dry teak forest. However, geographical variation in vegetation type is very vivid. The Gir west, Gir N.P and Gir east in particular exhibit characteristic vegetation type. This variation vegetation pattern could be due to the difference in climatic and edaphic factors that exist in these three parts of the Gir P.A.

METHODOLOGY

The entire stretch of Gir P.A was traced through an espionage survey to select the suitable sampling sites. The selection of sites was based on general and specific criteria. Such as type of forest, proximity to water body and/or road, relative distance/nearness from human settlement ("nesses"), major floral species and niche specification. Based on these characteristics three main study sites were selected (Figure iii). Gir West was considered as site – I with six sub sites (Figure iv – ix), Gir N.P was considered as site – II with five sub sites (Figure x – xv) and Gir East as site-III with five sub sites (Figure xvi - xxi). In order to have precise repeatability geographical position of each sub sites were located using a Geographical Positioning System (Garmin, GPS 12XL). GPS reading for each site is presented in the form of a table (Table IV).

Regular visits were made twice in a month to each of the sub sites. Samples were sighted and representatives of each group were collected and narcotized and well preserved, and were brought to the working station for further identification. Identification was done by using standard reference books and published articles. The specimens identified were confirmed by comparing with the authentic specimens of Zoological Survey of India, Kolkotta, Jodhpur and at BNHS.

Biological Sampling

In addition to visual sighting and photo documentation following standard methods/ techniques were employed to collect sample specimens from the study area.

1. Manual collection: Sweep net was used for capturing flying insects and also insects found on vegetation. A total of five sweeps were made on each vegetation type. Beating cloth or beating umbrella method was used to collect fauna on the vegetation. Arthropods thus collected were then processed for further investigation.

2. Litter Sifting: Large litter and soil Arthropods were gathered delimiting1.0sq.m sample area. Soil and litter were sequentially removed to a desired depth of 6cm. The soil was processed through a series of sieves. Large Arthropods were then hand picked from the sieves and the soil residue was extracted for smaller Arthropods and Insects using Berlese funnel (Besuchet *et al.*, 1987).

3. Pitfall trap: Small plastic cups were buried up to the rim in the ground so that passing insects may fall. This method was used to sample surface-active Arthropod fauna.

4. Bark Scraping: Barks of trees were scraped so as to expose underneath Arthropods. Once sighted, they were collected by soft brush dipped in 70% alcohol. This method was more useful for borers, mites, peudoscorpions, scorpions etc.

5. Strainers: Aquatic Insects were collected by using strainers and were then preserved.

Preservation

Soft-bodied Arthropods were preserved in Hoods solution and the preservative was changed at regular intervals. Insects collected were transferred to killing jars containing sodium cyanide. Insects were removed relaxed and spread on spreading boards so as to pin them at appropriate standard positions according to the order they belong to. Spreading boards were than exposed to light bulbs for rapid drying. Insects were then transferred to insect boxes. Specimens once identified were labeled with date and collection site.

Quantitative and Morphometric Analysis for Coleoptera

Three fixed with transects (10m x 10m) were laid at each sub sites. The area for transects were selected at random as described in Krebs, (1989). Coleoptera species were collected through various methods as described earlier and computed to get number of species per area using appropriate formula. A minimum of five adult members from each species were measured for total length and mid abdominal width using a calibrated Vernier Calipers. Smaller species however, were measured under a Leica Stereo Microscope MZ16 A, fitted with micrometer graticule.

Data Analysis

All the three sampling from each sub site were analyzed separately and then the data were pooled to get the seasonal data of the site. Data was quantitatively analyzed using standard analytical and statistical methods with computer software packages viz. Excel, SPSS, Species Diversity and Richness Index etc. The following formulae were used for the analysis.

Abundance

Abundance is the number of individuals of species per sampling unit of occurrence. Abundance gives absolute number of species present in a given area.

Similarity Index

Similarity of species composition between the sites was analyzed through Jaccard's similarity index.

Diversity Index

Shannon – Wiener Diversity Index (H') = $-\Sigma Pi \log Pi$

Where:

Pi= ni/N

Ni= Number of the individuals of the i^{th} species

N= Total number of individuals of all the species in the habitat.

Evenness/Equitability Index

$$J = \frac{H'}{\log S}$$

Where,

H'= Shannon Wiener Index

S=total number of species in the habitat

TABLE I: Mean seasonal maximum and minimum Temperature (in°C) recorded during 2000-2001

Year	Season	Maximum	Minimum
2000	Monsoon	31.5	24.95
	Winter	33.6	16.45
	Summer	36.3	22.27
2001	Monsoon	32.45	25.1
	Winter	35.12	16
	Summer	41.52	17.45
2002	Monsoon	37.57	25.32
	Winter	34.17	17.3
	Summer	41.8	19.52

TABLE II: Average Rainfall (in mm) at study area

Year	Gir West	Gir N.P	Gir East
2000	533	404	422
2001	868	743	808
2002	441.6	383	602.3

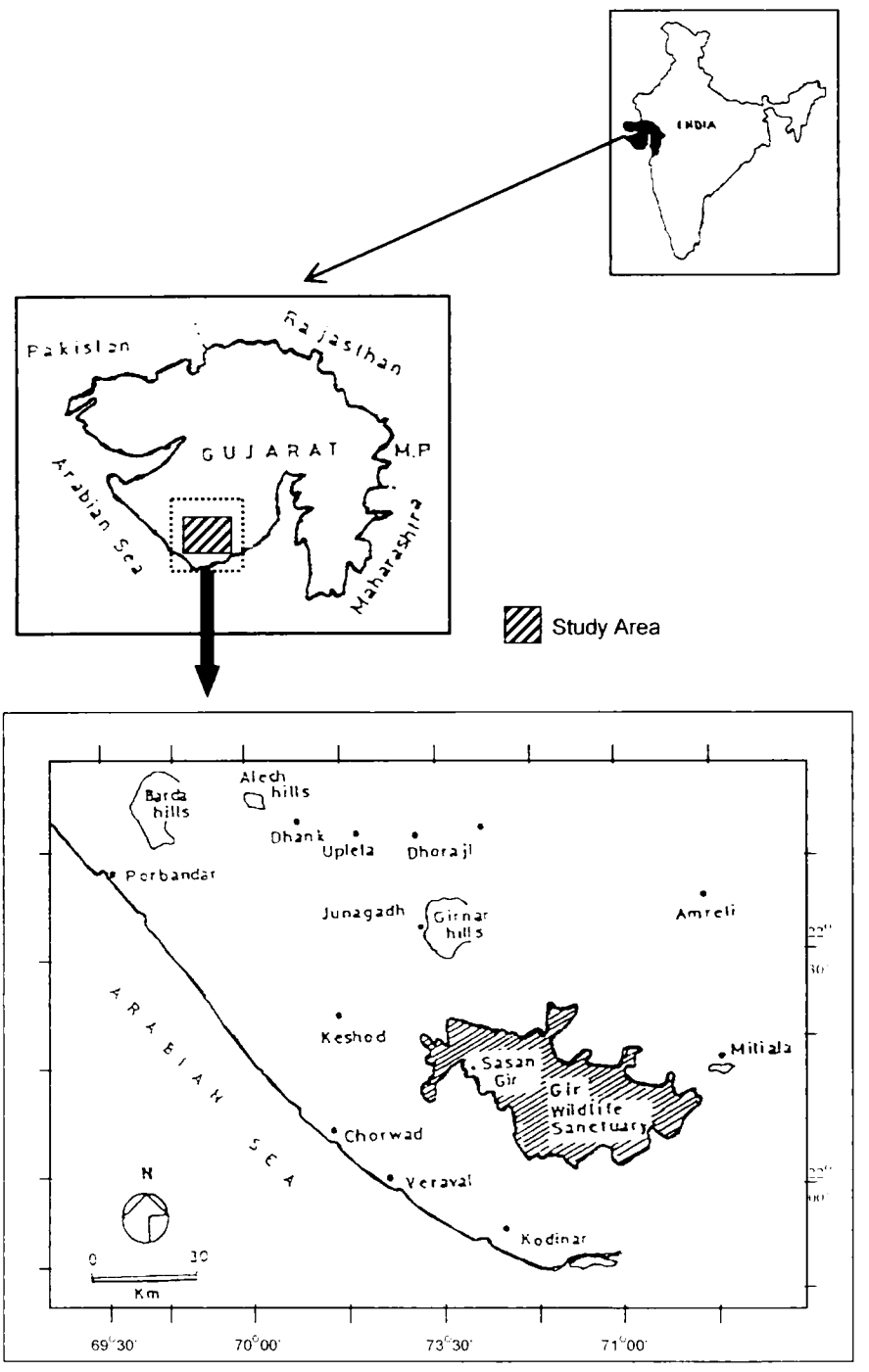
TABLE III: Mean seasonal Humidity (in %) recorded during 2000-2001

Season	Percentage of Humidity	
	2000	2001
Monsoon	84.75	89.8
Winter	59.5	59.57
Summer	65.75	64.6

TABLE IV: GPS Reading of the sites and major Forest Type

SITE	SUB SITE	GPS READING		FOREST TYPE
		Latitude N	Longitude E	
Gir West Site-1	Devalia	21°. 09'	70°. 30'	Southern Thorn Forest
	Dedakdi	21°. 16'	70°. 34'	Dry Grassland
	Dudhala	21°. 13'	70°. 35'	Dry Mixed Deciduous and Thorn scrub forest
	Kamleshwar	21°. 11'	70°. 39'	Dry Deciduous Teak Forest and Dry Tropical Riverine Forest
	Barwania	21°. 13'	70°. 42'	Dry Tropical Riverine forest
	Suvardi	21°. 12'	70°. 47'	Dry Savannah Forest
Gir N.P Site-2	Patnisar	21°. 09'	70°. 41'	Southern Dry Mixed Deciduous Forest
	Janvadala	21°. 04'	70°. 44'	Dry Deciduous Acacia Forest
	Dabhala	21°. 02'	70°. 48'	Dry Tropical Riverine Forest
	Chhodavadi	21°. 05'	70°. 54'	Desert Thorn Forest
	Banej	21°. 02'	70°. 53'	Desert Thorn Forest and Dry Acacia Forest
Gir East Site-3	Arel	21°. 04'	70°. 57'	Dry Acacia Forest
	Hadala	21°. 07'	70°. 59'	Dry Grassland
	Timberva	21°. 06'	71°. 02'	Dry Savannah Forest
	Ghodavadi	20°. 59'	71°. 00'	Dry Savannah Forest
	Rawal dam	21°. 02'	71°. 03'	Tropical Euphorbia Scrub Forest

FIGURE ii Location map



Gir PA : Study Area showing Sites and Subsites

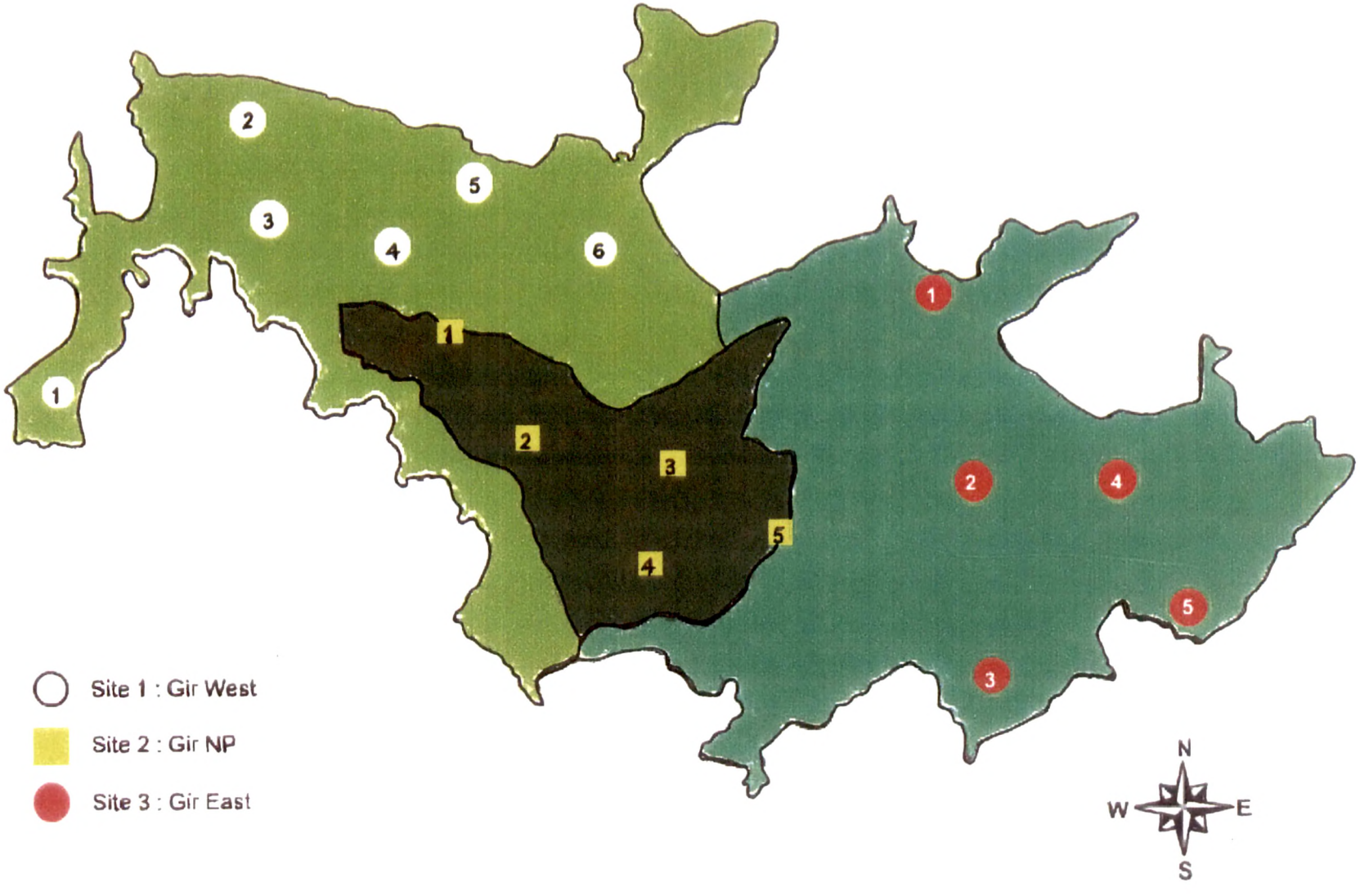


FIGURE iv Riverine Forest

FIGURE v Monsoon Teak Forest

FIGURE vi Kamleshwar Dam

FIGURE vii Enjoying Monsoon

FIGURE viii Leaf Litter Formation

FIGURE ix Dry Forest In Summer

FIGURE x Rich Vegetation

FIGURE xi Close Canopy

FIGURE xii Grassland

FIGURE xiii Peak Monsoon Scenario

FIGURE xiv N.P. In Summer

FIGURE xv View of N.P. In Summer

FIGURE xvi Premonsoon Shower

FIGURE xvii Water Reservoir

FIGURE xviii Human Settlement "Ness"

FIGURE xix Onset of Monsoon

FIGURE xx Scorching Summer

FIGURE xxi Collection in Process