

STUDY AREA

A reconnaissance survey was conducted in the major part of the state except for the south Gujarat region since it was felt unrealistic to cover this vast expanse without compromising the very objectives of the current study within the stipulated academic tenure. Gujarat is the western most state of India and is located between 22.40° N to 70.75° E. Gujarat has a very strategic location from the biogeographic point of view as it covers four biogeographic zones of India i.e. 40% of the total biogeography is represented in this state (Rodgers *et al*, 2002). Table 2.1 shows the biogeographic zones of Gujarat, along with the biotic provinces and biomes therein.

Table 2.1 Biogeographic Zones of Gujarat (Rodgers *et al*. 2002)

Sr. No.	Zone No.	Biogeographic Zone	Biotic Province	Biomes
1.	3	Desert Zone	3A – Kachchh Province	Saltflats Scrublands
2.	4	Semi-Arid Zone	4B – Gujarat – Rajwara Province	Dry Deciduous Forest Hill Forest Thorn Forest Grasslands Wetlands
3.	5	Western Ghats	5B – Western Ghats Mountains	Moist Deciduous Forest
4.	10	Coastal Zone	10A – West Coast	Mangrove Mudflats Sandy/Rocky Shores

As mentioned earlier that the study focuses mainly on the terrestrial reptiles especially squamates Zone No. 10 – The Coastal Zone was not included in the study area but the immediate adjoining patches of scrublands wherever they existed were rapidly surveyed for their reptilian diversity. However, as cited elsewhere, due to the steep escalation of area and limitation of time never permitted one to venture in to the south Gujarat region which marks the northern end of the Biogeographic Zone No. 5 Western Ghats Mountains, hence this area

was also left for future extension of the work. As almost $\frac{2}{3}$ of the state is covered under the Semi-Arid Zone (Zone No. 4) with Biotic Province 4A: Gujarat-Rajwara Province, possessing a variety of biomes, therefore this zone was considered for a detailed study and the intensive study areas were narrowed down from this particular biogeographic zone. Desert Zone (Zone No. 3) with its Kachchh Province (Province No. 3A) constituted the remaining $\frac{1}{3}$ of the land area of the state and second major terrestrial biogeographic zone, hence a small patch of scrubland from this biogeographic zone was also considered for the current study.

The total geographical area of Gujarat state is 1,96,024 sq km of which 19,113 sq km is the forest cover. This means only 6.64 % of the total geographic area is under forest cover which is far less than the ecologically optimum value of 33.3 % (FSI, 2001). Of this 19,113 sq km only 16,902 sq km constitutes the protected forest (National Park, Wildlife Sanctuary or Reserve Forest) the remaining 2,211 sq km is an unclassified forest but still rich in biodiversity (FSI, 2001). Figure 2.2 shows the forest cover of Gujarat state.

Based upon this reconnaissance survey, Intensive Study Areas (ISA) were decided for the further studies on the community structure of reptiles and ecobiology of lizards. Three intensive study areas were selected based upon their topography and land use patterns. First ISA was Pavagadh Hill forest, located in Panchmahal district of central Gujarat, east of Vadodara city, the second ISA selected was a patch open scrubland, in Sindhrot village of Vadodara district, central Gujarat, west of Vadodara city. The third ISA was the Vadodara city.

INTENSIVE STUDY AREA (ISA-1): Pavagadh Hill Forest

Location:

Pavagadh Hill Forest as said stands on the mount Pavagadh located on the southern fringe of district Panchmahal (Fig. 2.3). It was formerly the part of 'Champaner State', and has a glorious history and religious importance as one of the important holy shrine being present on the top of the mountain – the temple of 'Goddess Kali or Kalika'. The ancient remains of the 'Champaner State' exist in the form of historical monuments that are protected and maintained by the Archaeological Survey of India and was declared as the 'Heritage Site' in the year 2008. It is also an important area geologically as said to have emerged due to some volcanic activity and the geographical coordinates are 22° 26' N - 22° 30' N latitude and 73°

29° E - 73° 33' E longitude (Garmin, GPS 12XL). The hill stands at a height of 864 m (one of the high hills of central Gujarat), is about 11 km in length from north to south and 6.4 km wide. River Vishwasmitri a main river of central Gujarat originates from the western part of the hill (Gazetteer of India, 1979).

Land-Use:

The land use pattern of the study area was analyzed through the satellite imagery obtained from IRS 1C, LISS III image (1:50000) (Fig. 2.4). Visual interpretation of the image was done to identify the forest covered areas and based upon the imagery data the forest was classified into three categories; dense forest, moderate forest and degraded forest. The foothills have many small villages and settlements and remaining area is under cultivation. This hill forest is beautiful patch of dry deciduous forest but is fast diminishing due to increasing pressure from anthropogenic activities viz. logging of forest for timber, collection of forest products, encroachment for agriculture and most importantly developmental activities in lieu of tremendous pilgrimage and tourism pressure.

Vegetational Characteristics:

Based upon the remote sensing data, the three forest types that were classified showed a marked variation in their floral characteristics. The dense forest exhibited the maximum floral diversity constituting herbs, shrubs, trees and climbers. The most dominant tree species in this area was found to *Tectona grandis* – Teak, followed by *Cassia renigera* with a canopy cover of 80-90 %. Moderate forest also had the floral diversity almost comparable to that of dense forest but group and species composition varied viz. shrubs were found to less and the dominant tree species observed here were *Prosopis spicegera* and *Mimosa cinera* with a canopy cover of 40-60 %. The degraded forest exhibited a distinct decrease in the species diversity and composition as compared to the dense and moderate forest. All herbs, shrubs and trees were fewer in number as well as density with climber nearly absent. The dominant tree species in this area were *Borassus flabellifer* and *Dendrocalamus strictus*.

INTENSIVE STUDY AREA (ISA-2): Sindhrot Village Scrubland/Vadodara Rural

Location:

Located to the west of Vadodara city at an approximate distance of 16 km is an open scrubland near the village Sindhrot (22° 18' N - 22° 08' N and 73° 06' - 73° 21' E: Garmin, GPS 12XL) (Fig. 2.5). This scrubland spreads over a vast area of around 7 sq km and is

actually a part of ravines of two rivers namely Mahi a major river of central Gujarat and river Mini a small but perennial river of central Gujarat. River Mini basically meets river Mahi at one point and this scrubland is sandwiched between these two rivers (Gazetteer of India, 1979). The terrain is highly undulating with steep slopes at many locations. This scrubland supports a dense population of the Fan-throated Lizards – *Sitana ponticeriana*, hence this area was selected as one of the ISA.

Land-Use:

The land-use pattern of this study area was largely analyzed through the detailed ground truth. It was evident from the survey that the scrubland was having few small villages and scattered settlements. The part of the scrubland near the river bank was either converted into agricultural land or was owned as private farmland and converted into resort or other recreational activities were practiced. The major crops cultivated herein included cereals like maize, pearl millet, sorghum; pulses like gram and pigeon's pea; vegetables that included brinjal, bottle gourd, cucumber, teale gourd, drumstick, ivy gourd and occasionally cash crops such as castor or cotton.

Vegetational Characteristics:

The general vegetational topography of the area consisted of shrubs and thorny bushes followed by herbs and very few trees. The most dominant group of plants was indeed shrubs and the dominant species as observed were *Cassia tora*, *Ocimum canum* and *Ardonea sp.* Usually a scrubland is characterized by the dominance of *Prosopis sp.*, however in this area *Prosopis* was present but not as dominant species. *Calotropis prosera* and *Zizyphus sp.* were also found in good numbers and these formed the nurtured species by the locals due to their economic importance. Grasses mainly represented the herb group and the other herbaceous members were largely ephemerals. The non-grass herb found to be dominant in this area was *Tridax procumbens*. As mentioned, tree diversity was poor in this area and was represented by *Acacia nilotica* as the dominant form. Other tree species scattered at various points included *Azadirachta indica*, *Moringa pterigosperma*, *Acacia catechu*, *Cassia fistula*, *Terminalia catappa* and *Delonix regia*.

INTENSIVE STUDY AREA (ISA-3): Vadodara City/Vadodara Urban

Location:

Vadodara city having an area of 149 sq km is a part of Vadodara district covering a total area

of 7,794 sq km and is located at 22° 30' N and 73° 19' E (Garmin, GPS 12XL) (Fig. 2.5). It is the 18th largest city of India with a population of 1.6 million (Census, 2005) and literacy rate of 78 % (Census, 2005). Vadodara has a glorious history of over 2000 years or more, popularly known as the “Sayaji Nagari” (in the honour and fond memory of her visionary ruler H. H. Maharaja Sayajirao Gaekwad-III) or “Sanskari Nagari” (the city of culture), she also has to her pride the status of being the ‘Cultural Capital’ of Gujarat state. The city is located on the bank of river Vishwamitri that flows from north to south through the city, dividing the city into two unequal halves (Gazetteer of India, 1979).

Land-Use:

In the reign of Maharaja Sayajirao Gaekwad, Vadodara emerged as an educational, industrial and commerce hub in the western region of the country. Although major part of the city is an urban built up area but interspersed between this concrete jungles are few remaining patches of wilderness that nourishes some biodiversity. River Vishwamitri on both the sides of its bank form a rich riparian zone, the vast campus of the city palace ‘Laxmi Vilas Palace’ spreading over 700 acres, the campus of Baroda University (The Maharaja Sayajirao University of Baroda) covering an area of 260 acres and few areas under the defense jurisdiction likewise EME Campus, Air Force Station and the City Airport account for this urban wilderness areas.

Vegetational Characteristics:

Vadodara in the past was famous for its Banyan trees that were present in hundreds in the entire city, of which only a few survive today. A general picture of the flora could not be drawn for this study area as majority of the species were found to be of cultivated type. Though natural flora existed in the areas of the city palace, university campus and in the surrounding area of EME, Air Force Station and airport still it largely gave picture of a created green belt. The group composition and species diversity was entirely different at different locations. However, these areas sufficed the needs of lesser vertebrate fauna that included the herpetofauna (amphibians and reptiles), avifauna and few of the small mammals.

INTENSIVE STUDY AREA (ISA-4): A Scrubland near Naliya, Kutch

Location:

The arid zone (Biogeographic Zone No. 3) with its Kutch Province (No. 3A) makes up the

remaining $\frac{1}{3}$ land area of the state, hence one of the ISA was selected from this zone. Kutch has entirely different landscape from the rest of the state. The entire region is predominated by scrubland, interspersed with grassland in many areas and scattered saltflats and wetlands. Naliya is small town located in Abdasa taluka in the western most part of the Kutch district. A small patch of scrubland near Naliya town was selected as an ISA for the current study.

Land-Use:

Entire of the Kutch district is a part of the 'Greater Rann of Kutch', the largest protected area network of the state. The Greater Rann is confluent with the 'Little Rann of Kutch' that falls in the Surendranagar district of Saurashtra region. The entire stretch of Rann is thus a proposed biosphere region in the name of 'Kutch Biosphere Region' by the State Forest Department. Baring the protected areas like Narayan Sarovar Sanctuary, Flamingo City, Banni Grassland, Kutch Bustard Sanctuary, the rest of the open landscape is basically a no man's land. Scarcity of rains and lack of irrigation facilities have left major part of this zone untouched by agriculture. Whatever agriculture is practiced is totally rain dependent. However, as Kutch has been announced as a Special Economic Zone (SEZ), there is a rapid industrialization creeping in and thereby altering the picturesque landscape of Kutch.

Vegetational Characteristics:

As a typical feature of an arid zone, Kutch was also marked by the complete absence of tall trees, except for a few occurring in singles at scattered locations and those occurring in and around villages. The area was predominated by shrubs and the species with high density were *Prosopis sp.* and *Euphorbia sp.* Grasses of different variety formed the rest floral composition for the area. Though Kutch appears to be a dead zone at first glance but when closely looked upon it is full of life, few forms that are exclusive to this area.

ABIOTIC FACTORS

Climate and Seasons:

The overall climate of the central Gujarat regions varies considerably in different seasons. It is generally characterized by hot and humid summer and dry winter. The monsoon is a summer monsoon and humidity remains high during the monsoon months. Three main seasons are recognized: Summer (March to mid June), Monsoon (Mid June to September) and Winter (October to February). The southwest monsoon winds bring rain over the region and the downpour occurs from mid-June to mid-September.

Table 2.2 Meteorological Data – Temperature (°C) during the study period: 2006-2008

Month	Temperature					
	2006		2007		2008	
	Max	Min	Max	Min	Max	Min
Jan	35.3	9.6	34.6	11.2	33.8	8.8
Feb	39.6	14	37.4	13.8	34.9	6.3
Mar	40	15.8	42.8	15.1	39.2	14.7
Apr	41	20.2	42.5	21	41.6	19.4
May	42	23.8	42.9	19.3	40.8	25.1
Jun	39.4	24.2	42.2	24.9	38.9	18
July	36	21.5	34.9	24.1	34.5	24.2
Aug	33.1	24.2	34.1	24.5	33.9	24.4
Sep	35.3	24	34.9	20.1	36.3	23.8
Oct	38.4	20.4	36.8	18.7	38	20.1
Nov	36.2	13	35.5	14.2	34.8	15.7
Dec	33.2	12.4	34.3	10.4	34.8	12.8

Table 2.3 Meteorological Data – Humidity (%) during the study period: 2006-2008

Month	Humidity					
	2006		2007		2008	
	0830 hrs	1730 hrs	0830 hrs	1730 hrs	0830 hrs	1730 hrs
Jan	43	33.7	47	37.4	42.5	36.4
Feb	35.7	27.1	44.8	33.8	37.4	29.7
Mar	32.7	25.7	35.8	26	36.3	28
Apr	38.5	24	36	26.5	38.5	30
May	44.4	32.1	42.5	32	46	37.5
Jun	62.5	49.5	54	48.6	59.3	53.1
July	87.2	82.7	74.8	68.5	74	72
Aug	87.9	82.2	75.5	76	79	76.5
Sep	77.3	67.7	75.9	70	76	68.7
Oct	62	46.2	49.4	36	52.6	41.8
Nov	48.7	38.6	45.6	35.2	73.8	66.3
Dec	54.3	44.12	45.4	37.2	92.3	80.7

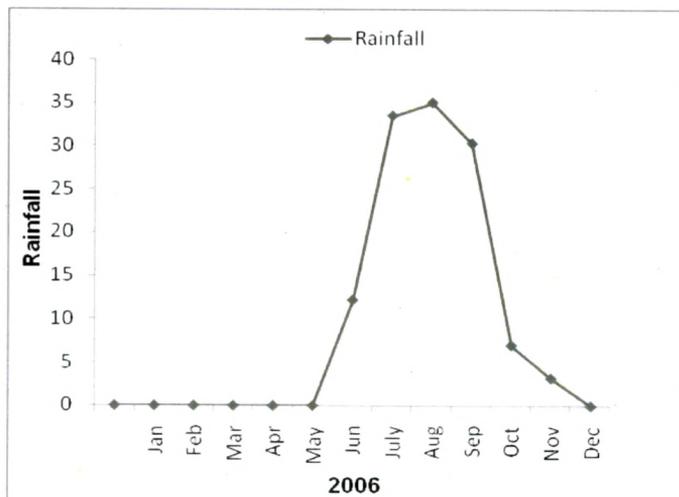
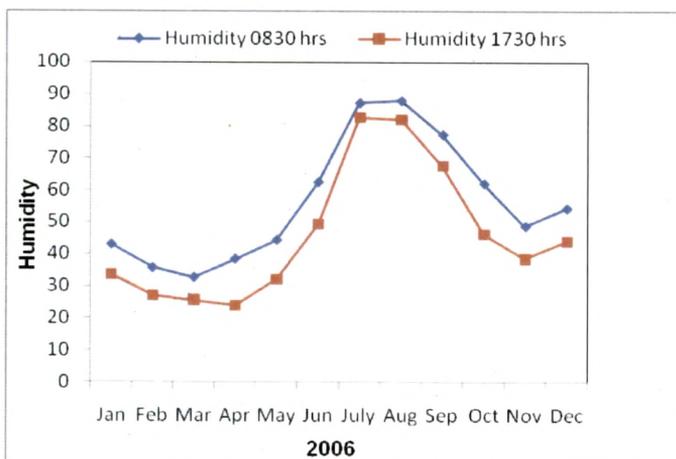
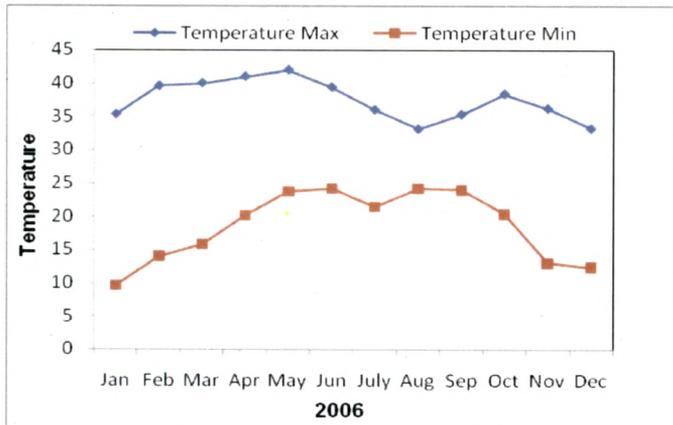


Figure 2.7 Maximum & Minimum Temperature, Humidity & Rainfall during the year 2006

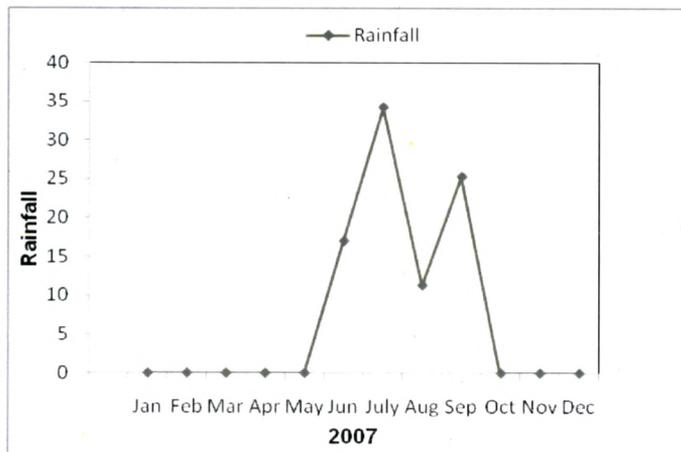
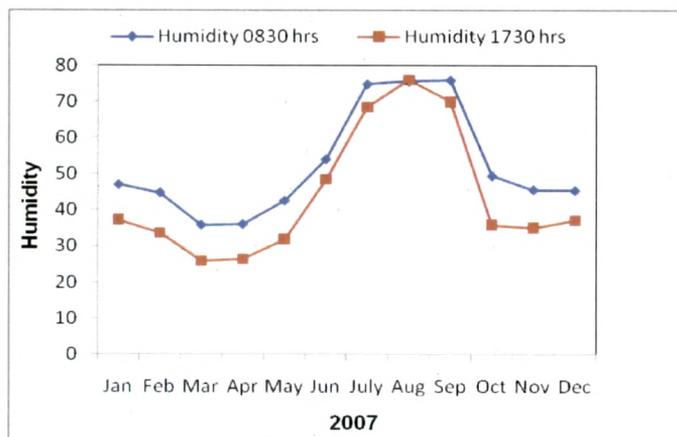
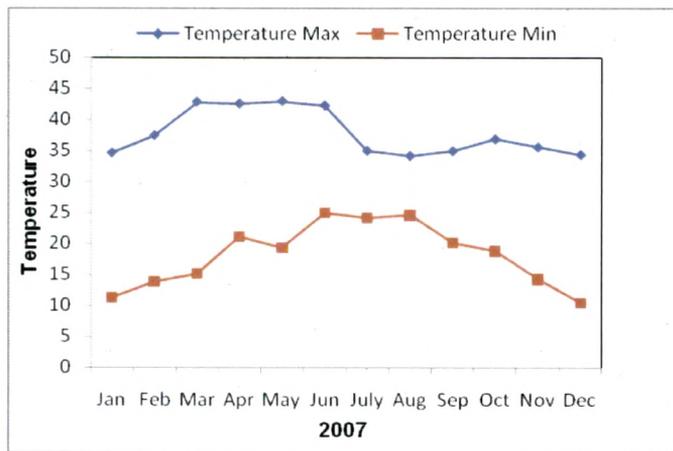


Figure 2.8 Maximum & Minimum Temperature, Humidity & Rainfall during the year 2007

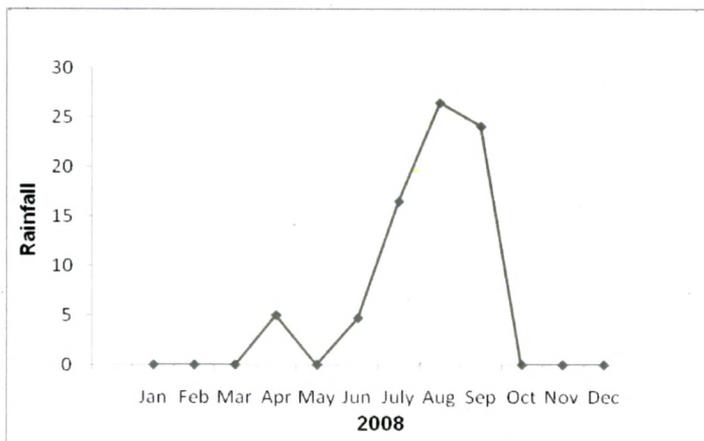
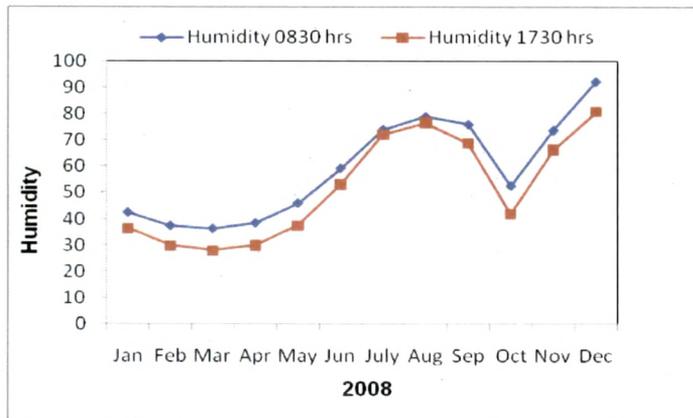
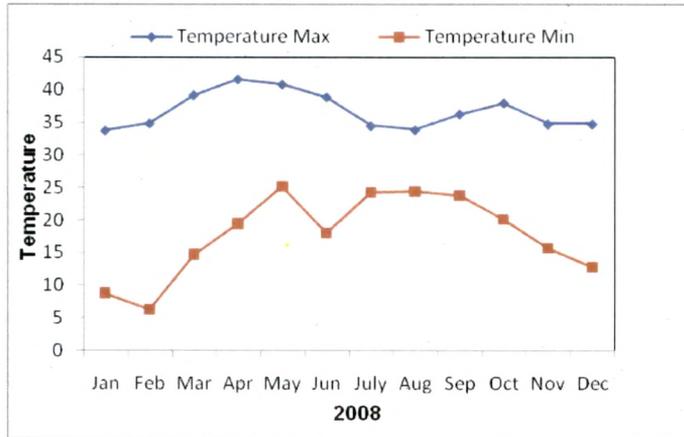


Figure 2.9 Maximum & Minimum Temperature, Humidity & Rainfall during the year 2008

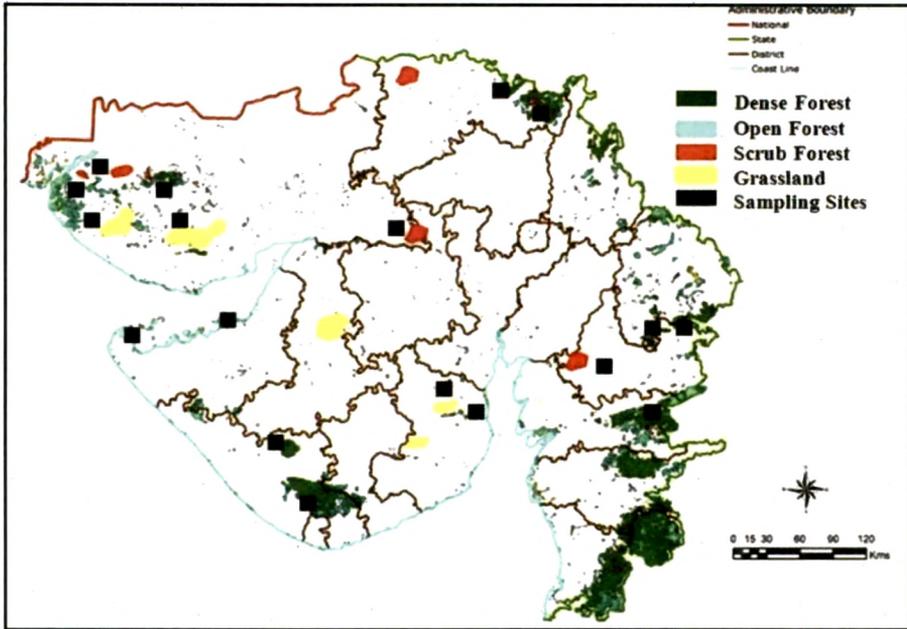


Figure 2.1 Map of Gujarat showing the Forest Cover and the selected Sampling Sites

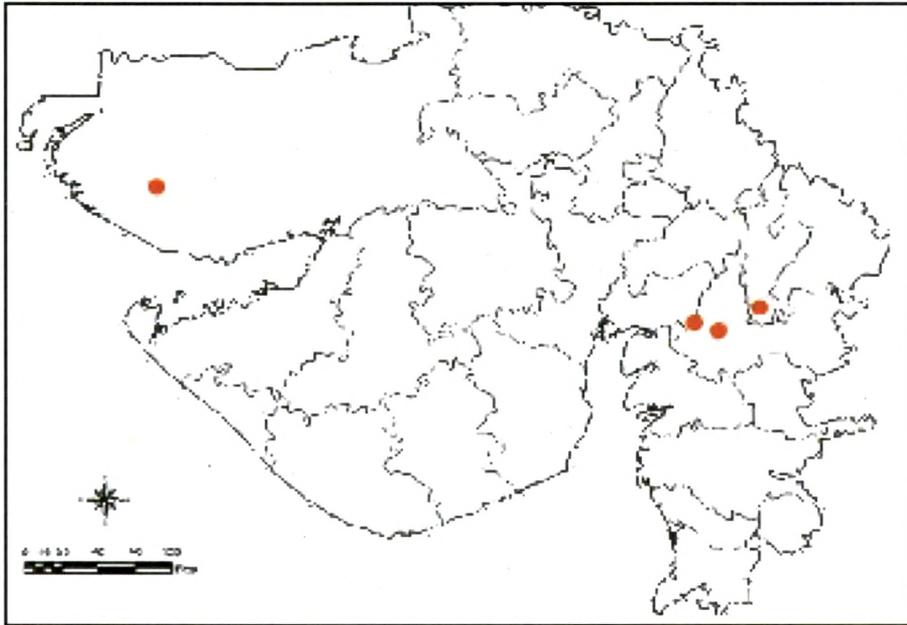


Figure 2.2 Map of Gujarat showing the locations of Intensive Study Areas (ISAs)

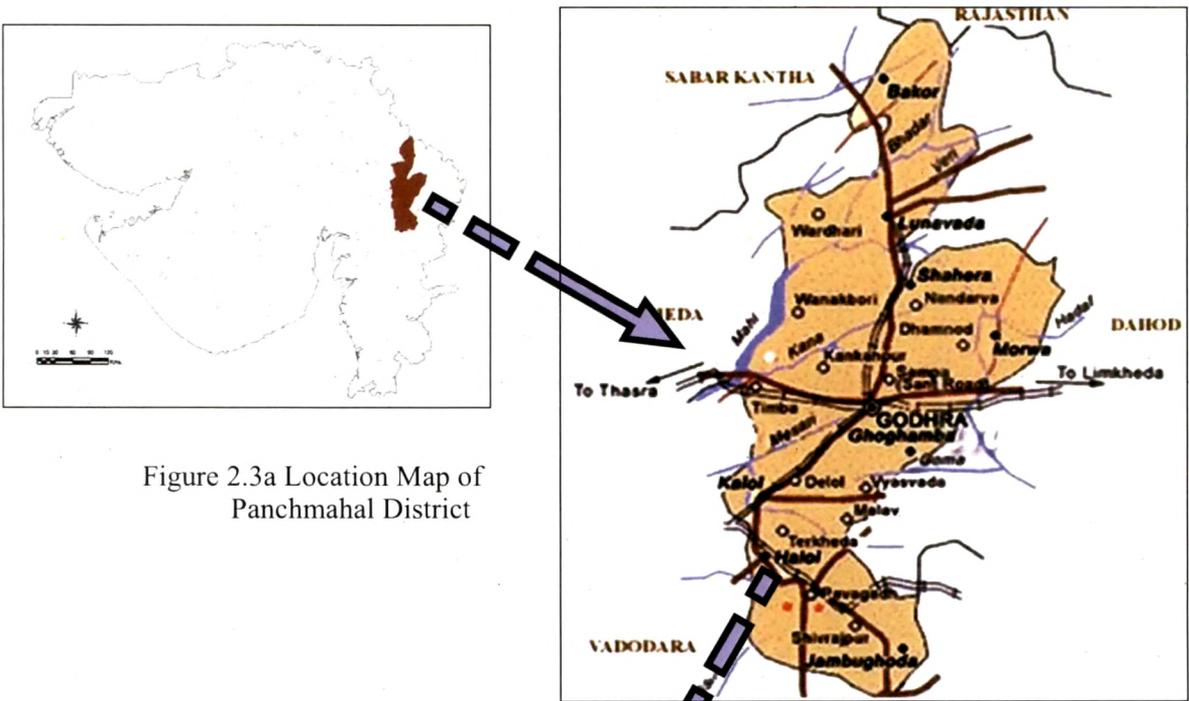


Figure 2.3a Location Map of Panchmahal District

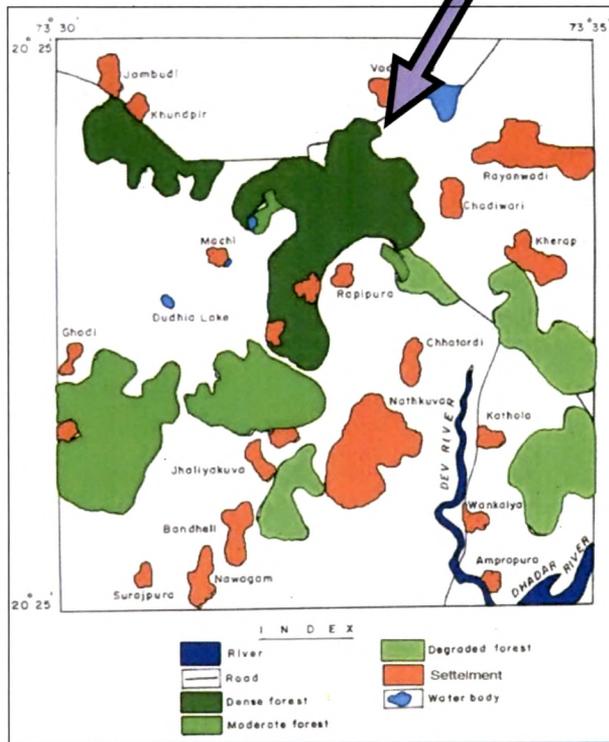


Figure 2.3b Map of Intensive Study Area (ISA-1): Pavagadh Hill Forest

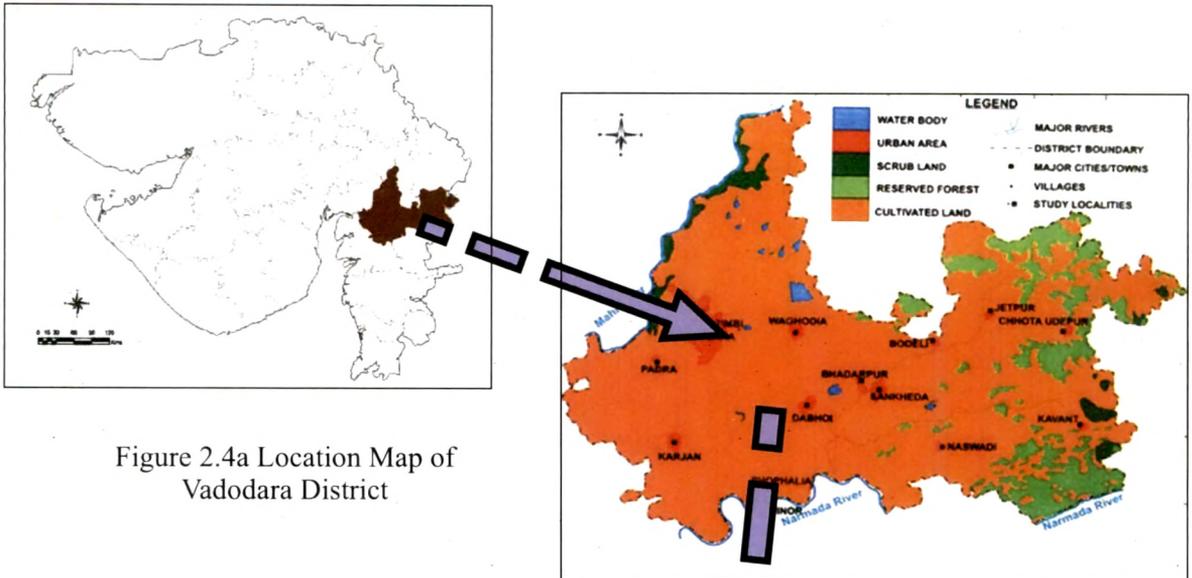


Figure 2.4a Location Map of Vadodara District

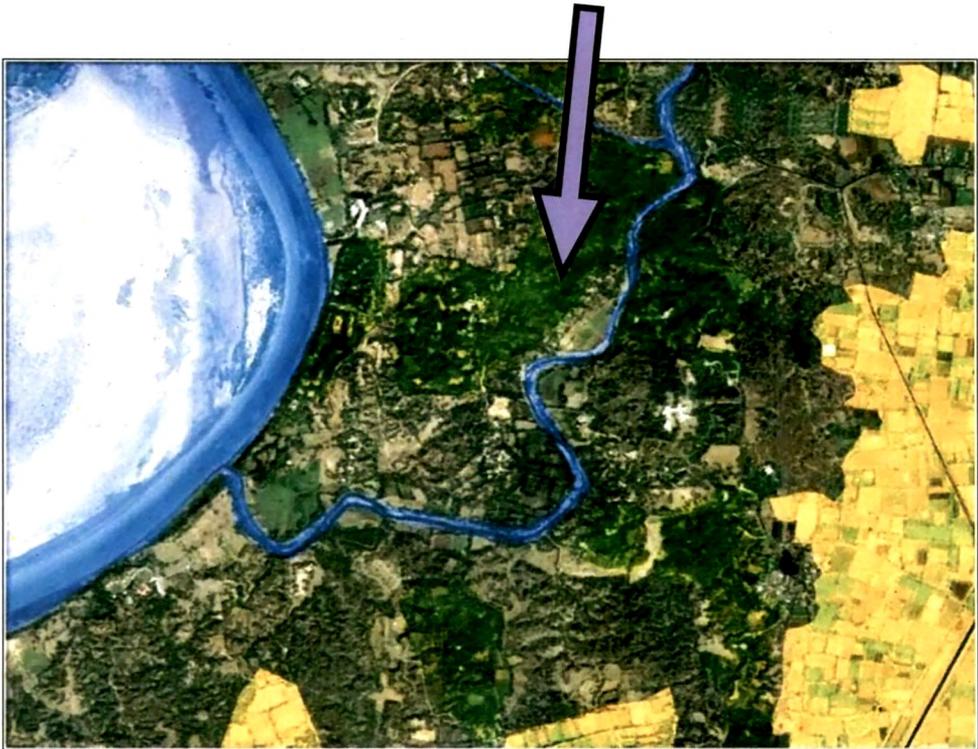


Figure 2.4b Intensive Study Area-2 (ISA-2): Sindhrot Village Scrubland / Vadodara Rural

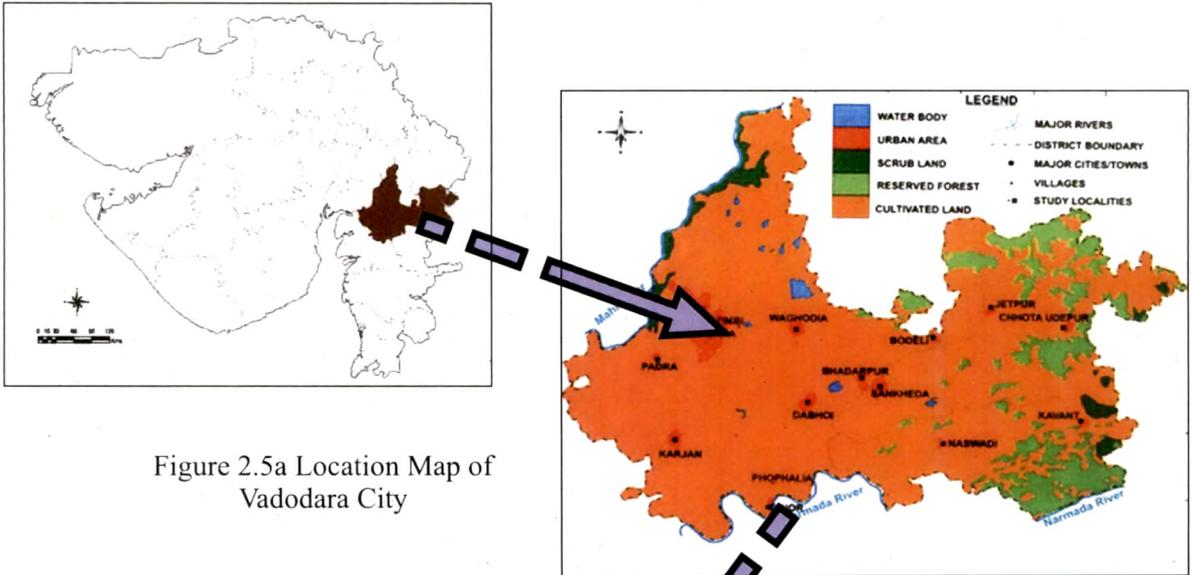


Figure 2.5a Location Map of Vadodara City

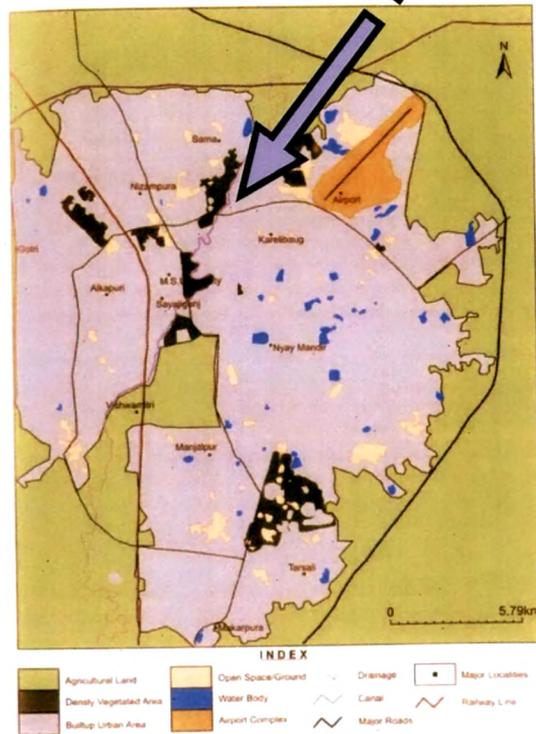


Figure 2.5b Intensive Study Area-3 (ISA-3): Vadodara City/Vadodara Urban

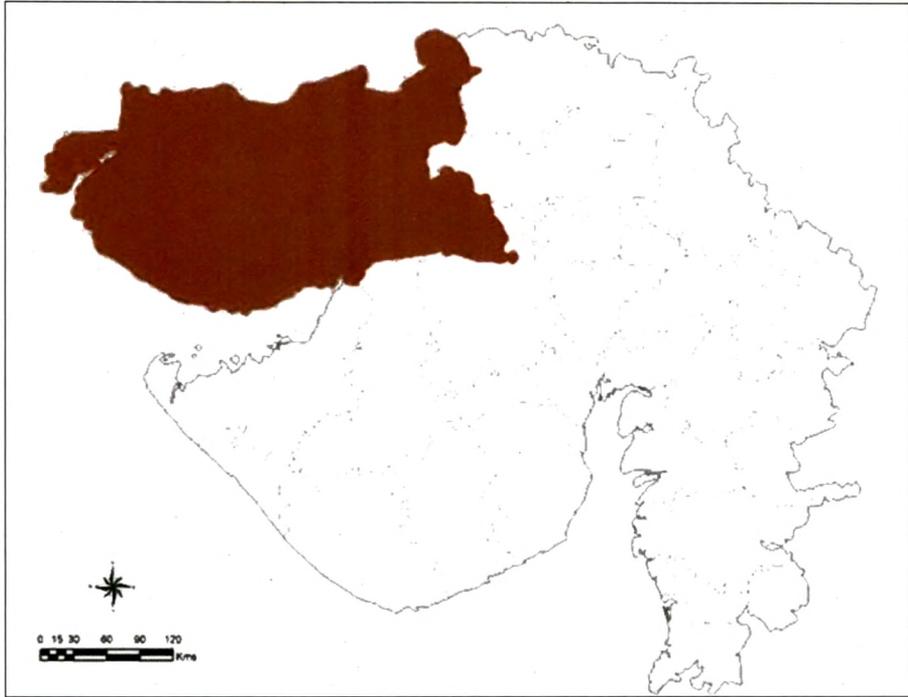


Figure 2.6a Location Map of Kutch District and Intensive Study Area-4 (ISA-4): Naliya Scrubland

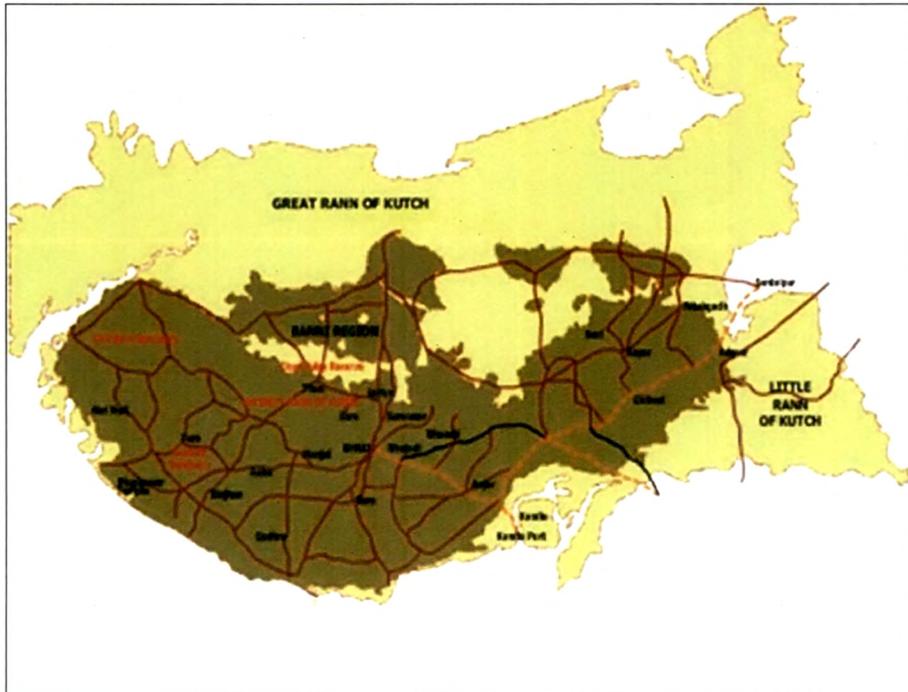


Figure 2.6b Map of Kutch district showing the location of Intensive Study Area