CHAPTER III
SITE OF STUDY

3.0 DESCRIPTION OF THE STUDY AREA:

3.1 Geographical Location:

Narmada district is located in southern part of Gujarat State of India. This district is spread out between 22^0 23" – 21^0 23" N latitudes and 73^0 17" – 73^0 58" E longitudes. Narmada district is bound on the north by Vadodara district, in the west by Bharuch district and in the south by Surat district; while on the eastern side it shares a state boundary with the Maharashtra. Location map of the site of study is depicted in plate 1. The geographical area of this district is 2,755.5 km^2. The district is covered with 10 Survey of India (SOI) topographical maps at 1:50,000 scale.

The northern and eastern portion of this area is hilly and rugged with many precipitous slopes. Southern part also has row of hills with gentle undulation, while western portion are comparatively flat and at some places shows gentle slopes.

3.2 Historical Background:

Narmada district has a recent origin as it got its administrative boundary in 1998. Earlier it was a part of Vadodara and Bharuch districts, but now it has been cut out from these two districts; Tilakwada taluka of Vadodara district and Dediyapada, Sagbara & Rajpipla talukas of Bharuch district were combined together to form a new district namely, "Narmada" which owes its name to Narmada River Valley, one of the major Deccan river. Rajpipla taluka was earlier known as Nandod or Nandot, was a princely State. Shoolpaneshwar wildlife sanctuary falls under Rajpipla East forest division. This area has some of the best forests and is rich in wild life too.

3.3 Geology:

The major feature of the district i.e. the Narmada valley is represented by marine transgressional depositions, which are the Bagh beds. It consists of sandstones, quartzites, impure limestones and shales. Sandstones of this area are coarse grained and massive. They are generally white but occasionally tinted red or brown. The limestones are generally fine grained, compact and black, light

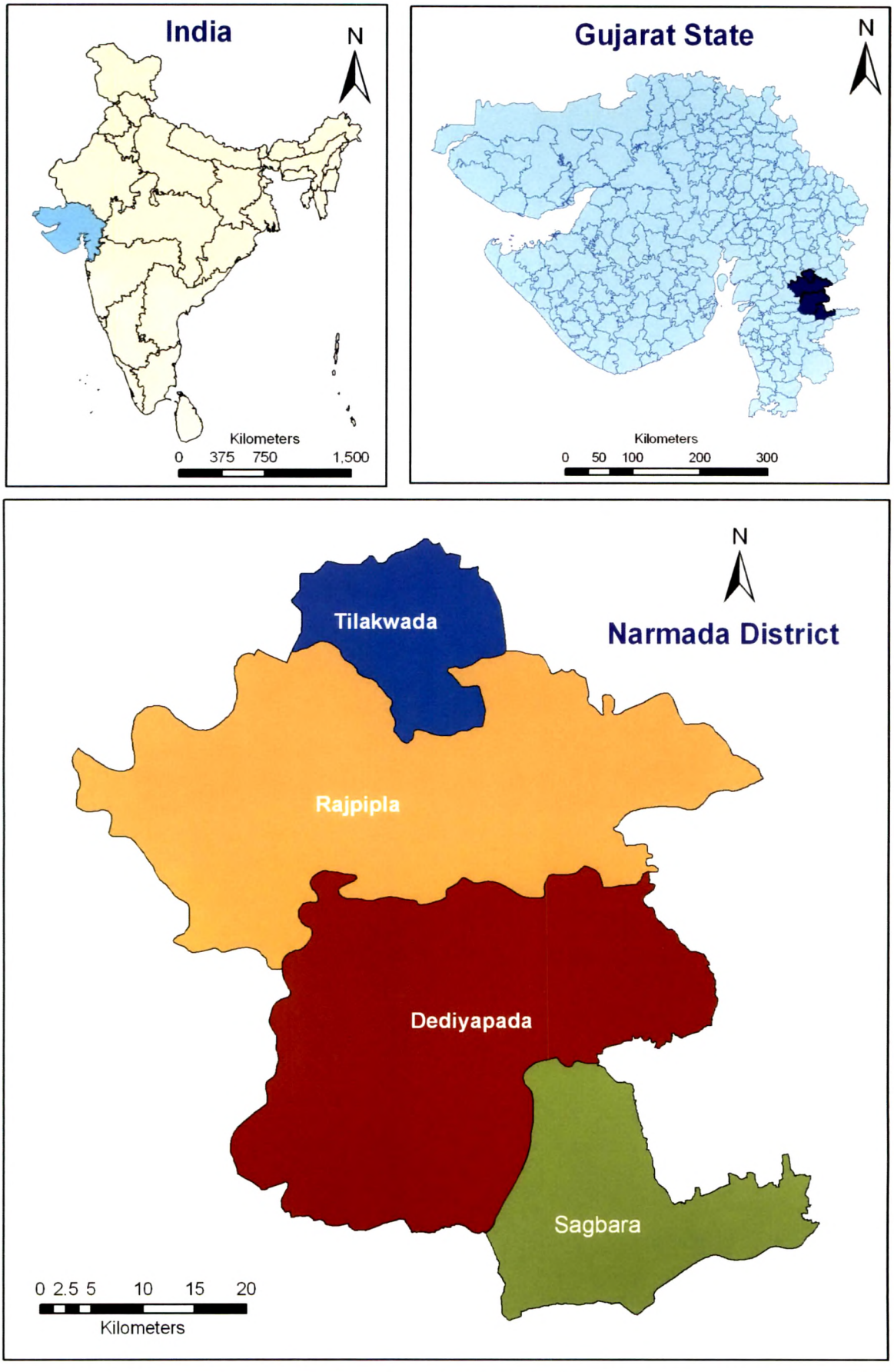

Plate 1. Site of Study

grey or greenish in colour. Limestones are useful in manufacture of hydraulic lime. There are calcium deposits at places, these are rich in calcium content but the extent is very little which is locally burnt for construction work. Shales are usually black and red, but sometimes grey, green and violet varieties are also found. These are very soft. Red shale beds are well exposed in road section through Bhadarwa hill near Garudeshwar (North-eastern part of the district). All the above rocks are at places affected by the heat of magma at the time of formation of Deccan traps and hence they are metamorphosed to quartzite, marble or slaty shales. In the Deccan trap, unlike the typical trap scenery of the step-like appearance in the features of hills forming plateaus at the top, the hills here are hogback shaped. Recent deposits of alluvium and surface soils cover the other formations in the tract. These deposits are seen almost everywhere wherever there is a stream.

3.4 Soils:

Soils of this tract vary in colour, texture, depth and stoniness depending upon the rock and topography. The soil conditions are normal with the pH values ranging from 6.7 to 7.4. The values of Electrical Conductivity ranges from 0.01 to 0.14, which indicates that the soil have no salt problem (Sharma, 1994).

The trap rock disintegrates into reddish brown loamy soil, which is generally shallow on the hilltops and slopes. Such areas are not particularly favourable for tree growth. It is only on the gentle slopes and undulating plains that soils of some depth are seen. The deep soils (over one meter) which are either recent alluvial deposits or black clay occupying flat portion are mostly in small and at times in sufficiently large strips or patches. The alluviums are clayey loam, light brown to grayish black in colors and form excellent forest soils being deep and rich. Some of the best teak stands grow on such alluvial strips along the riverbanks in Dediyapada Range. It is only in these patches that we find some natural regeneration of teak in the whole area. Black clay soils are usually compact and hard. They are very often underlain by calcareous mass in some areas. These soils appear pale black to black. In clayey soils the incidence of miscellaneous species like Sadad is high. Teak is present where the top layer is

thin and not very heavy. At places the top layer is black not because of clay but because of the influence of humus.

3.5 Climate:

Climate on the whole is healthy, warm and dry (Figure 9). Monsoon is irregular and erratic. The district receives an average rainfall of 976mm. Bulk of rainfall is received in a short period of about 10-12 weeks, starting from last week of June to mid-September.

Temperature varies at different stations. The average temperature of the region ranges from the lowest of 10.81 ^{0}C in the month of January to the highest of 43.0 ^{0}C in the month of May. Winter is of short duration from November to February. Dew is heavy during November to December, which has profound effect on the growth of vegetation (Sharma, 1994).

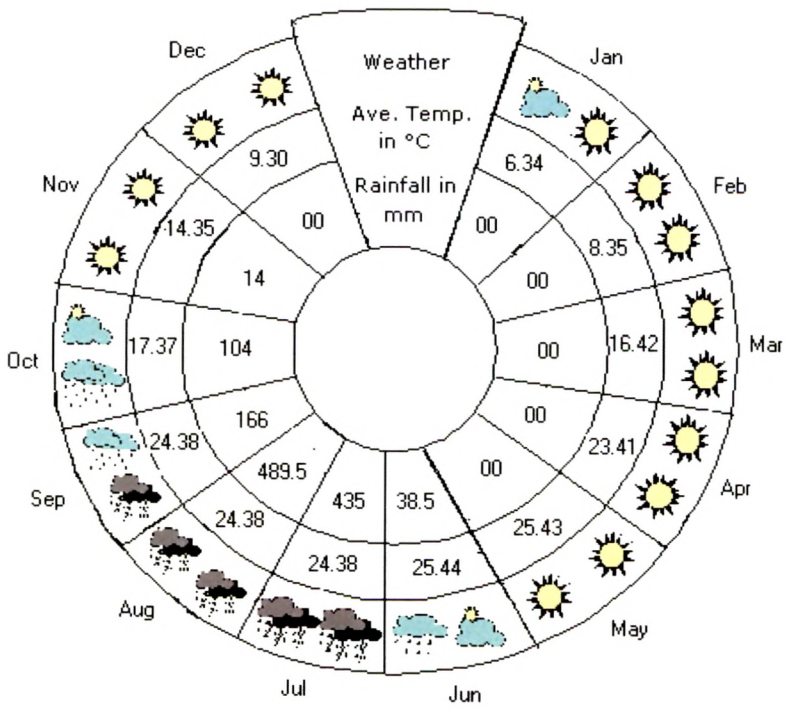

Figure 9. Climatic Scenario of Narmada district

3.6 Water Supply:

Narmada is the major river flowing through this region. There are number of tributaries and sub-tributaries of this river. The main tributaries of Narmada are the Karjan, Dev, Madhumati, Kavery and Amaravati. There are several sub-tributaries or nalas known as '*Khadis*' such as Sukli, Dhir, Dhamni, Karkhod, Raya, Tarsali, Tarav, etc. Karjan irrigation project on Karjan River supplies water by lift irrigation to some parts of Rajpipla and also parts of Bharuch district.

3.6.1 India's Largest River Valley Project on Narmada River:

Narmada district owes the credit of having the India's largest and world's second largest river valley project on the Narmada River. This river, on which the Indian government plans to build nearly 3,200 dams, flows through three states viz. Gujarat, Madhya Pradesh and Maharashtra (Doria, 1990). Not surprisingly, for its destructive ecological potential and for its daunting dimensions, the grandiose project has been draped in controversy ever since it was mooted. Amongst the 30 large dams planned for the Narmada, the Sardar Sarovar dam is the largest, falls within the present site of study and another one is in Madhya Pradesh. With a proposed height of 136.5 m (455 feet), it is the focal point of both the dam-builders plans and the Narmada Bachao Andolan's (Save the Narmada Movement) opposition. The government claims that the multi-purpose Sardar Sarovar Project (SSP) would irrigate 17.92 lac ha of land spread over Gujarat's 12 districts, 62 taluka and 3,393 villages and quench the thirst of the drought prone areas of Kutch and Saurashtra in Gujarat (Sheth, 1994). However the opposition believes that it will lead to the displacement of 3,00,000 people, chiefly from small tribal communities; disrupt downstream fisheries; increase the risk of earthquakes; submerge forest land; increase the spread of insect-borne diseases and threaten the fragile regional ecosystem through reducing, by two-thirds, the flow of water from the Narmada river into the Arabian Sea. The creation of the Sardar Sarovar reservoir will submerge 13,744 ha of forest, 11,318 ha of agricultural land and will require the relocation of 234 villages (Alvares and Billorey, 1988).

3.7 Human Population:

The district has among the largest rural population in the state. The population predominantly comprised of tribes namely Vasavas, Chowdharies, Bhils, Gamits, Chodharas, Dhodias, Nayaks. The most primitive amongst the tribes viz. Kotwalias, whose occupation is preparing bamboo articles also inhabit the forests. Majority of the agriculturists have small holdings and adopt traditional methods of cultivation. As a result, income from the agriculture is meager and local forest dwellers supplement their income from non-agricultural works such as labour work in forestry and P.W.D. works etc. Few tribals earn their livelihood by making articles from bamboos (Varsani, 1991).

3.8 Fauna:

3.8.1 Wildlife:

Sabnis (1992) has reported a rich invertebrate fauna in this area, represented by three phyla; Annelida, Arthropoda and Mollusca. Spiders form a major group of invertebrates. The density of insect population is very high in the Shoolpaneshwar wildlife sanctuary.

According to the old gazetteer there were wild elephants in Rajpipla forests. Bisons were seen in Gadi-Jantar of Gora Range. Herbivores were seen in large herds even along the roads. Other animals such as Tigers, Panther, Bear, Sambar were in plenty. Shoolpaneshwar sanctuary supports number of wild animals such as Panther, Sloth bear, Hyena, Wild cat, Cheetal, Jackal and birds such as pea fowl, blue rock pigeon, green pigeon, babbler, partridge etc. Among reptile, cobra, viper, rat snake and sand boa are common. About 607.82 ha of this sanctuary were submerged in Sardar Sarovar Project.

3.8.2 Livestock:

Cattle wealth occupies a pivotal place in the rural economy of the district. Cows and bullocks occupy the major livestock population of the district closely followed by buffalos and goats. Number of horses, ponies, camels, mules, pigs, sheep and donkeys is quite less.

Pisiculture activities in the district have been undertaken in the inland waters. Fishing centers are located in Rajpipla and Sagbara.

3.9 Flora:

A total of 600 plant species have been reported from this area, out of which 18 are fungi, six are bryophytes, five are pteridophytes and 571 are angiosperms. Some of the common pathogenic fungi reported from this area are *Cerocospora* spp., *Curvularia* spp., *Alternaria* spp., *Helminthosporium* spp. etc., while bryophytes reported are *Anthoceros* spp., *Cyathodium* spp., *Fimbriaria* spp., *Fuanria* spp., *Notothylus* spp., and *Riccia* spp., and the pteridophytes reported are *Actinopteris* spp., *Adiantum lunulatum*, *Marsilea* spp. and *Selaginella* spp. (Sabnis *et al.*, 1992).

3.9.1 Agriculture:

The major cash crops of the district are jowar, cotton, groundnut, bajara, wheat and rice. The food crops irrigated in the district are wheat, rice, chillies and sugarcane whereas non-food crops irrigated are cotton and fodder crops.

3.9.2 Forests:

Narmada district has one of the good forests of the state and it occupies more than 40% of the geographical area. According to the identification of forest types by Champion and Seth two distinct forest types are found in this area-

1. Southern tropical moist deciduous forests, subtype slightly moist teak forests.
2. Southern tropical dry deciduous forests, subtype dry teak forests.

These two types are not defined by distinct topographical features. They may occur in one and the same locality within a short distance. The former is generally confined to plain and gently sloping areas where soil and sub-soil moisture are favorable and the later is mostly found on poorer soils, ridges of hills and areas subjected to biotic interferences.

Slightly moist teak forests are seen in parts of Dediyapada and some parts of Rajpipla taluka. These are mixed deciduous forests with teak usually forming

about 25%of the crop. Under storey of bamboo is a characteristic feature of the crop. Ground cover mostly consists of evergreen to semi-evergreen species and occurrence of woody climbers is a common feature. The characteristic species of the top canopy are *Tectona grandis* L., *Terminalia crenulata* W. & A., *Dalbergia latifolia* Roxb., *Diospyros melanoxylon* Roxb.etc.

Dry teak forests are found in rest all parts of the district. Here also, the main species is teak but associates are more of drier type. Common associates of teak are *Anogeissus latifolia* Wall., *Terminalia crenulata* W. & A., *Garuga pinnata* Roxb. etc. These forests are found in dry and shallow soils, undulating ground and plateaus of the hills. Occurrence of bamboo is sporadic in such type of forests.

The forests have been subjected to heavy biotic influences, like fires, illicit cutting, over grazing, encroachments etc. However the intensity of illicit cutting in the interior parts of the forests is limited. The existing crop contains high proportion of miscellaneous species with teak as the main species.

3.9.2.1 Forest Management in Narmada District:

The history of forest management in the study area shows significant variations among areas since the different forest areas were under governance of different regimes in the past. A total lack of systematic management/planning was observed. Till 1885, the forests of earlier princely state, Rajpipla were managed by the ruler on '*Dan*' or royalty system. Any individual or trader could remove the material to any extent by taking a pass from one of the depots after paying royalty at schedule rates. From 1885 to 1928, little attention was given to the management and protection of forests. A felling sequence was proposed in 1920, but was never given effect to. Felling was generally of selection nature with the best trees being removed. After the Second World War, price of timber rose steeply. The forests were leased to contractors who worked for two to three years in each village. In 1950, a felling scheme was drawn up by V. M. Waghle and the area was divided into 33 felling series and continued for seven years, until a new working scheme was proposed by S. P. Jadhav in 1957. Sagbara forests were managed by the Chieftain who owed his allegiance to the ex-state of Rajpipla.

The chieftain used to exploit the offset according to his convenience. When the merger took place, unfortunately no mention was made about the forests of Sagbara in the treaty signed by the chieftain with the Government of the erstwhile Bombay State. Due to legal problems between the chieftain and the forest department, the forests could not be properly protected against the encroachments for cultivation and illicit cutting till May, 1970.

In 1972, M. B. Mehta's working plan for the Rajpipla Forest Division was prepared for a period of 10 years. This working plan emphasized on scientific management of the forests which had been subjected to heavy illicit cutting, heavy grazing and repeated fires. Loss of tree cover due to forest degradation has resulted in frequent flash floods. The construction of Ukai and Karjan reservoirs and the construction of Narmada reservoir were also taken into consideration by M. B. Mehta while fixing the objectives of management. This working plan emphasized on raising of large scale plantations of economically important species like bamboo for which management tips was prescribed on scientific lines. The plan also covered the areas of environmental concern such as wild life protection and soil erosion.

The last working plan for the year 1994-2004 has nine working circles namely, Conservation, Rejuvenation, Protection, Reboisement, Coastal Area, Wildlife Habitat, Bamboo (Overlapping), Non-Wood Forest Produce (Overlapping) and Tribal Development Working Circle (Sharma, 1994). Even though Joint Forest Management has been one of the major plantation activities of the district since 1991, it has not been included in any of the above mentioned working circles. It has been considered in the miscellaneous regulations in the working plan.

3.10 Need of the Present Study:

The Narmada district is one of the pioneers in Gujarat State to have passed JFM resolution. Thus, this district is entering the fourteen year of JFM implementation; it is, therefore, important to review the magnitude of its success, the extent to which its objectives have been achieved, and the reasons for its failure, so that the problems may be rectified and its sustainability ensured. It is

necessary to assess the institutional arrangements, the vegetation management practices adopted and their impact and relevance to the promotion of sustainable participatory forestry in the state. Apart from ecological issues, several administrative, managerial and policy issues also need to be considered. Such matters include: the initial mode of approval, formal agreements/MoUs between the Forest Department and JFMCs, membership issues in JFMCs, the role of gender, conflict resolution measures, technical guidance to people's institutions/JFMCs, equity of benefits in sharing intermittent and final harvests, continuance of people's participation and departmental support, involvement of Panchayats/ Gram Sabhas and financial support and cooperation between the various enabling agencies. It is also important to measure the changes in the socio-economic status and livelihoods of the dependent communities as a result of change in the availability of fuel wood, fodder and NTFPs, to study the system developed for marketing and processing NTFPs and the mechanisms for sharing the final usufructs. Thus looking at these lacunae, the present study was designed with the following objectives.

3.11 OBJECTIVES:

1. To select a proper season and suitable satellite data products for forest density classification based on the phenological pattern of the vegetation therein.
2. To attempt different digital analysis for enhancing the forest features and achieve further categorization of the forest classes.
3. To delineate forest cover using visual interpretation technique and generate a precise classification of the forest in the study area, which will be a base for plantation studies.
4. To demarcate the potential sites in the study area wherein JFM plantations can be undertaken as well as the potential villages wherein the JFM committees can be formed.
5. Evaluation of JFM plantations using satellite data.
6. Evaluate the success and failure rate of different program directed towards JFM and analyze the extent of its responsiveness to the needs of poor forest dependent.
7. Generate a database of various non-spatial/attribute data from different collateral source encompassing both ecological and economic aspects.
8. Assessment of the impact of different JFM programs initiated during past few years on the forest development and protection.
9. Recommendations for sustainable management of such Joint Forest Management program.