CHAPTER 5: STUDY AREA

4. STUDY AREA

- Introduction
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4.1 Introduction

The study of oceans and land together & to study their interactions is possible only at coastal area. India has one of the longest coastlines of about 7517 km. The coastal area of Gujarat state has one of the best-maintained biodiversity and ecology. Same way the economic activities in the coastal area is very high. There is a need to control these activities in the interest to save the environment.

Study Area Gujarat

Gujarat, located at the northwestern frontier of India. Its located between 20° 01’ and 24° 07’Nlatitude and 68° 04’ and 74° 01’Elongitude and occupies an area of 196,024 Sq. Km. It has a coastline of 1663 Km with a continental shelf of 165,000 Sq. Km. 4 major, 5 medium, 25 minor and 5 desert Rivers annually add 71,000 Mm$^3$ water to the seas around the state. It’s the longest coastline among all the littoral states of the country and is 21.3% of the Indian coastline.

The coastline has two indentations, the Gulf of Kambhat and Kachchh, and these together, cover around 60% of the coastline of the state. The state has about 150 km$^2$ inter-tidal coral reef flats and 991 km$^2$ mangrove areas.
The population of Gujarat as of 2001 is around 50.5 million. There are one major, 11 intermediate and 28 minor ports which collectively handled 65 million metric tones of cargo (during 1997-98). Gujarat has 24 large and 5 medium industries together with 6 industrial estates along the coast (as of 1996).

Figure 4.1
Image of India (above) & Gujarat (alongside) as viewed by WiFS sensor
4.2 Gujarat Demographics

Gujarat state came into existence as a separate State on 1st May 1960. It is bounded by the Arabian Sea in the West, by the State of Rajasthan in the North and North East, by Madhya Pradesh in the East and by Maharashtra in the South and South East.

The State has an international boundary and has a common border with the Pakistan at the north-western fringe. The two deserts, one north of Kachchh and the other between Kachchh and the mainland Gujarat are saline wastes.

As per 2001 population census, Gujarat State comprised 25 districts, sub-divided into 225 talukas, having 18066 inhabited villages and 242 towns. Gujarat has geographical area of 1.96 lakh sq. kms. and accounts for 6.19 percent of the total area of
the country. At present state comprises 27 districts. And its total area is about 14100 square kilometers.

This study has been conducted only for a coastal area i.e. low tide line to line of 500 meters from highest tide line toward the land. The coastal area of Gujarat is about 16000 square kilometers (area up to 500m from HTL).

Gujarat state has highly diverse coastal ecology, different types of environment, critical habitats etc. Some areas like Pirotan Island, Gulf of Kutchh and Khabhhat, MNP&S show presence of great level of biodiversity present in state. Gujarat state also has high level species diversity of algae, sea grass, coral reef, marsh vegetation, fish & other marine habitats etc.

Apart from ecology and environment Gujarat state is exceptional in infrastructure and development. It has major industries like Tata chemicals Ltd. (Mithapur), Reliance petroleum, Nirma Chemicals, Alang ship breaking yard, Special Economic Zone, various diamond, textile, cement & other important factories, salt related industries etc. The seat of two of the twelve ‘Jyotirlingas’ in India referred to as Somnath (Junagadh) and Nagesh in Darakvan (Okhamandal-Nageshwar). The most famous religious and tourist places like Somnath, Dwarka, Mount Girnar, beautiful beaches, etc. are present in Gujarat State.
**Gujarat State – At a glance**

<table>
<thead>
<tr>
<th><strong>AREA</strong></th>
<th>14,125 Sq. Kms.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POPULATION</strong></td>
<td>50671000</td>
</tr>
<tr>
<td><strong>LITERACY</strong></td>
<td>69.14%</td>
</tr>
<tr>
<td><strong>CAPITAL</strong></td>
<td>Gandhinagar</td>
</tr>
<tr>
<td><strong>DISTRICTS</strong></td>
<td>26</td>
</tr>
<tr>
<td><strong>VILLAGES</strong></td>
<td>18066</td>
</tr>
<tr>
<td><strong>LANGUAGES</strong></td>
<td>Gujarati, Hindi, Sindhi, English, Maharashtrian</td>
</tr>
<tr>
<td><strong>CROPS</strong></td>
<td>Cotton, Groundnut, Jowar, Bajra, Wheat, Sugar-cane.</td>
</tr>
<tr>
<td><strong>DIET</strong></td>
<td>Jowar, wheat, Bajra, Dal, Rice, Corn, Milk, Curd, Butter Milk, Fruits, Vegetables</td>
</tr>
<tr>
<td><strong>DRESS</strong></td>
<td>Men wear &quot;Chorna&quot;, &quot;Kediya&quot;, &quot;Pagdi&quot; and &quot;Khes&quot;. Women wear petticoat of thick cloth, blouse with long sleeves and &quot;Odhani&quot;. Sari, Jens, Shirt, Trousers</td>
</tr>
<tr>
<td><strong>INDUSTRIES</strong></td>
<td>Textile, Cement, Chemical, Petroleum, Fertilizers, Engineering, Electronics, Dairy Products, Shipbreaking yard, Precision Brass Components, Plastic Buttons, &quot;Bandhanis&quot; (Tie &amp; Dye Sarees)</td>
</tr>
<tr>
<td><strong>ANIMALS</strong></td>
<td>Cow, Buffalo, Bullock, Sheep &amp; Goat.</td>
</tr>
<tr>
<td><strong>HILLS</strong></td>
<td>Gir, Chotila, Aravalli, Sahyadri, Vindhya, Saputara, Bardo, Gop, Aaloch, Bara</td>
</tr>
<tr>
<td><strong>AIRPORTS</strong></td>
<td>Vadodara, Bhavnagar, Bhuj, Surat, Jamnagar, Kandla, Keshod, Porbandar and Rajkot.</td>
</tr>
<tr>
<td><strong>Major Cities</strong></td>
<td>Gandhinagar, Ahmedabad, Vadodra, Surat, Rajkot, Jamnagar, Bhavnagar.</td>
</tr>
<tr>
<td><strong>CLIMATE</strong></td>
<td>Summer: 27 C to 42 C  Winter: 4 C to 29 C  Monsoon: June to September</td>
</tr>
<tr>
<td><strong>LOCAL TIME</strong></td>
<td>+5.30 GMT</td>
</tr>
<tr>
<td><strong>COAST LINE</strong></td>
<td>1600 Kms</td>
</tr>
</tbody>
</table>

*Table 4.1 Gujarat – at a glance*
Climate

The Climate of Gujarat State varies with hot summer, cold winter and low to heavy rainfall. The summer season extends from March to June, with day time temperature reaching to 42°C. The monsoon is from July to September. Winter season sets in during October and extends till February. Winter in Gujarat is mild, pleasant and dry. In association with cyclonic storms or depressions in the Arabian Sea, monsoon season occurs earlier, to a lesser extent in May and June. The state experiences strong winds and widespread rain. Thunderstorms occur in June and July. In the cold season occasional fog occurs. The summer temperature ranges from 24°C to 43°C and winter temperature ranges from 10°C to 24°C.

Geography

Based on physiology and culture, Gujarat can be divided into several regions like Kutch, Saurashtra, Kathiawad, South and Northeast Gujarat. Kutch is situated on the northwestern border of the state bordering Pakistan with a maximum altitude of 300 meters and almost desert-like topography. The ridge of Jurassic sandstone in the central part of the region breaks into the landscape at several places. In the north is Rann of Kutch, a salt marsh and in the south is Little Rann of Kutch. Between Saurashtra and Khambhat is Kathiawad with a maximum altitude of 180 meters and it is flanked by sandstones in the north. It is a region made up of
Deccan lavas and cut across by the lava dykes. The Central Kutch region extends to Northeast Gujarat and the region has low hills and small plains. Southeast Gujarat is an extension of the Western Ghats and receives the highest rain in the state. The forest cover in Gujarat is relatively little with 9.61% area covered with forest, it still supports more than 40 species of animals including the rare Asiatic Lion, wild ass and blackbuck. An assortment of birds and reptiles completes the tally of wildlife this state supports.

Mountains
Gujarat's mountains are rich in scenic beauty and have been closely associated with religious and historical aspects of the people. The northern and eastern borders are made up of mountains which are the tails or offshoots of outside ranges like the Aravallis, Vindhyas, Satpuras and Sahyadris. Saurashtra contains two parallel ranges, one stretching from east to west and the other from north-east to south-west. The tracts of saline land of Kutch have three mountain ranges. The Aravalli which is the most ancient mountain range in Gujarat lies largely in Rajasthan and enters Gujarat at Abu and zigzagging up to the Pavagadh merges into the Vindhyas. The Taranga lies on the line from Mehsana to Visnagar. The Arasur branch of the Aravalli goes in the direction of Danta, Khedbrahma, Idar and Shamlaji and joins the Vindhyas. The Satpura tail lies between the Narmada and Tapi with Rajpipla hills. The ranges of the Sahyadri lie across the Tapi with the highest rainfall and the densest forest in the state. The
SalerMuler and the Parner form part of the Sahyadri range. The rocky region of Saurashtra has only two regular mountain ranges, the northern one having about a 357 metre peak in the Panchal region. The Girnar which is the highest mountain in the state (1,145 metres) forms a part of the range south of the Bardo and is about 160 km in length. The highest peak is named after Guru Dattatreya. Garakhnath, Amba Mata, Kalika Mata are the names of the other peaks of Girnar. The small hill beside the Girnar, called the Jamial Shah Pir is a Muslim holy place. The Shatrunjaya hill near Palitana is one of the five sacred hills of Jains. The hills of Talaja, Lor and Sana are known for their Buddhist caves. Kutch is a saline tract with three mountain ranges. The hills of Kutch are devoid of plant life. Among the three main ranges in Kutch, the northern one goes by Pachham, Khadir and Pranjal. The Kala Parvat forming a part of the ranges lies between Kutch and Sind. The southern range begins at Madh and goes up to Roha.

**Rivers**

The Banas in the north, originating in the Siranva hill in Sirohi in Rajasthan, flows by the foothills of Abu and disappears in the desert. The Saraswati takes its birth at Koteshvar near Ambaji, flows by Siddhpur and Patan and merges into the desert. The Sabarmati, one of the biggest rivers of north Gujarat, originates from the Dhebarlake in Rajasthan and flows towards the Gulf of Cambay. The Hathmati, Vatrak, Mazam, Meshvo, Shedhi, Khari and the other rivulets also join it. The three virgin rivers of the
north and the Sabarmati with its tributaries are the daughters of the Aravalli ranges, while the Mahi and Narmada with their families originate from Madhya Pradesh. The Narmada, one of the biggest and holiest river along with the only tributary, Karjan, meets the sea, about 16 kms. from Broach. The Tapi takes its birth in the Satpura ranges near Betwa and enters Gujarat at Kakarapar. It flows around Surat and Rander and falls into the sea. The Mindhola, Purna, Ambika, Vanki, Auranga, Vapi, Par, Kolak and Damanganga are the rivers of south Gujarat, which originates in the Sahyadri. Most of the rivers of Saurashtra and Kutch dries up in the summer. The rivers which originate in the central Saurashtra in the Chotila range flow to the south into the desert of Kutch. Only the Aji, Machhu and Brahmani are northward flowing rivers. The rivers originating in the Girnar and Gir namely, the Ojhat, Kamb, Surekh, Somal, Sangwada, Hirani, Kapila and Saraswati flow into the sea. The Saraswati and Vastu are sacred rivers. Though Kutch has many rivers, they are small and do not have much water. The Khari flowing by Bhuj meets the desert and Magh and Tara empty their waters in the Gulf of Cambay. The Rudramata has been bunded for irrigation, providing the only irrigation project in Kutch.

Rainfall

The average rainfall in Gujarat varies from 33 to 152 cms. The southern region of the state has an average rainfall ranging from 76 to 152 cms, Dang district have the highest average of
about 190 cms. The northern district have a rainfall ranging from 51 to 102 cms. The rainfall in the southern highlands of Saurashtra and the Gulf of Cambay is approximately 63 cms while the other parts of Saurashtra have a rainfall less than 63 cms. The semi-desert area of Kutch has a very low average rainfall. Certain areas in Ahmedabad, Mehsana, Banaskantha, Panchmahal, Surendranagar, Jamnagar and Kutch districts receives very less or no rains. As the Tropic of Cancer passes through the northern border of Gujarat, the state has an intensely hot or cold climate. But the Arabian sea and the Gulf of Cambay in the west and the forest covered hills in the east soften the rigors of climatic extremes.

**Cropping pattern**

The crops of Gujarat are Bajri, Groundnut, Cotton, Tobacco in Kharif and Wheat, Mustard, Potato, Garlic, Chillies etc. in Rabi. Groundnut, Wheat and Bajra has been the principal crop of the state. As groundnut is entirely a monsoon-based crop, the output varies with the amount and timing of the rainfall. In certain areas and tracts where conditions permit, fruit cultivation has been undertaken. The fruits commonly grown are mango, coconut, chikoo, papaya and banana. Low yields result from poor soils, inadequate rainfall, frequent droughts and floods, bad drainage and undeveloped irrigation facilities.
Ecology

The Coastal area of Gujarat state is rich in various types of flora and fauna. Primary production in the Gulf of Kachchh and Khambhat is rich in species diversity of phytoplankton, zooplankton, macro and microbenthos. The Gulf of Kachchh dominated by population of foraminiferans, polychaetes, gastropods and crustaceans.

The inter-tidal expanse, gentle slope and mostly coralline sub stratum make the coast of Gujarat is very conducive for algal growth with number of species varying from 40-49 like ulva, ernodesemisstruvea and microdictyon etc. a few seagrass species were observed to grow in sub tidal regions of rocky and sandy beach of State. The gulf of Kachchh is the only area in Gujarat where corals exist. Various kinds of about 19 species of coral are available at Jamnagar coastline and Gulf of Kachchh.

Gujarat is very rich in animal life. The forest areas of the Gir in Saurashtra, Panchmahals and Dangs have herds of gazelles, black buck and spotted deer. The Asiatic lion is now localized in the Gir forest, which has also smaller mammals including langurs and blue bulls. Gujarat having an extensive coastline, perennial rivers and lakes and ponds are rich in a variety of fish. Besides Asiatic lion, tiger, panther, cheetah, wolf, jackal, fox, Civet, greyish langur, rabbit and porcupine are also found in the forest areas of the state. The wild ass is a distinctive species found only in Gujarat, in the Rann of Kutch. The thick forests of Dang, which receive maximum rains and have abundant greenery, are the home
of beautiful birds such as Trogon, hornbills, barbets, babblers, racket-tailed drongos and minivets. The Saras, pea-fowls, red-wattle lapwings, parakeets, babblers and mynas are mostly found in the plains. The extensive coastal regions of the state give shelter to various birds like plovers, stints, sand pipers, curlews, lesser flamingoes, terns and gulls. During the winter, flocks of migratory birds came to Gujarat from faraway countries, like the pied-crested cuckoo, rosy pelicans, white storks, Brahmany duck, demoiselle cranes, common cranes, ducks, coots, snipes, moorhens, curlews and stints. During monsoons, the great and the little Rann of Kutch, serve as breeding ground for flamingoes, pelicans and avocets. While drier areas of Kutch and north Gujarat serve as haunt to grey partridges, larks, white-ear bulbuls, finch larks and sand-grouses.

**Forest**

Gujarat state is situated along the western coast of the country with a total geographical area of 1,96,024 sq km having only 9.8% designated forest lands, divided by the Tropic of Cancer. The forests of Gujarat consist of four major types, namely (1) Tropical Moist Deciduous, (2) Tropical Dry Deciduous, (3) Littoral and Swamp and (4) Northern Tropical Thorny Forests. Most of the forest area is confined mainly in the districts of The Dangs, Valsad, Vyara, Rajpipla, Chhotaudepur, Baria, Godhra, Sabarkantha, Banaskantha, Junagadh and Kachchh.
The essential criteria for the growth of forests are suitable conditions of temperature and a heavy rainfall. In Gujarat, high rugged areas receive a higher rainfall than the plains. The rainfall in the state increases from the plains to the mountains and from north to south. The forests are therefore concentrated in the hilly parts of the state in the south-east and in the hills of Saurashtra. The hills of Kutch are bare because of low rainfall and the absence of any orographic features. South, south-east and east Gujarat are the only areas which have a considerable forest cover. Gujarat has about 19.66 lakh hectares of land under forest. A large part of the forest cover which is economically exploitable is distributed in the districts of Dang, Panchmahal, Broach, Surat, Bulsar, Junagadh, Sabarkantha and Banaskantha. The south and south-eastern parts of the state support the growth of tropical deciduous forest typified by teak, Shorea Robusta for which the district of Bulsar is well known. Moist Deciduous Forests occur in Dang and parts of Vyara in Surat division. These forests are not evergreen and shed their leaves during March and April. Dry deciduous forests with teak occur in north-east Gujarat, particularly in Sabarkantha district. The thorny forests which occur either in Kutch or north Saurashtra and Banaskantha district are characterized by Acacia Arabica, Acacia Leucophloea, Capparis Ophylla, Zizyphus Mauratiana etc. There are large stands of bamboo in South Gujarat than in the North.