CHAPTER 6

6 SPATIAL EXTENT OF STUDY AREA

6.1 Gujarat State

As it is not possible to study the setup of all the different states of our country and develop a model in the limited period of time available, selection of single state, Gujarat, has been done for the thesis.

The state of Gujarat came into existence as a separate entity on 1 May 1960. It is situated on the western coast of India between 20° 6' N and 24° 42' N north latitude and 68° 10' E and 74° 28' E east longitude. It is bounded by the Arabian Sea in the west, by the states 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, at present, comprises 25 districts, administratively sub-divided into 226 talukas, having 18618 villages,(13,819 gram panchayats) and 242 towns. It has a geographical area of 1.96 lakh sq.km. i.e. 6.19 per cent of the area of the country. The state consists of three regions: peninsula, traditionally known as Saurashtra, is essentially a hilly tract sprinkled with low hills; a Kutch on the north-west is barren and contains the famous Rann of a Kutch, and the mainland extending from the Rann of Kutch and the Aravalli hills to the river Damanganga which is on the whole a level plain of alluvial soil. The plains of Gujarat are watered by four major rivers: the Sabarmati, the Mahi, the Narmada, and the Tapti. The average annual rainfall ranges from 800 to 1,000 mm and the mean temperature from 25° C to 27.5° C.

The density of Gujarat is 258 persons per sq. km. The literacy rate in the state (excluding children in the age group 0-6 years) has increased from 61.29 per cent in 1991 to 69.97 per cent in 2001. About 37.67 per cent population of Gujarat resides in urban areas (excluding earthquake affected areas). The district map of Gujarat is given below:
6.2 Gujarat: Disaster proneness

The state is exposed to multiple natural hazards such as drought, earthquake, cyclone combined with storm surges and flood. In addition, due to high level of industrial development, it is also exposed to multiple man-made hazards such as industrial and chemical accidents.
6.2.1 Earthquake hazard proneness

Gujarat lies in the intra-plate region of the Indian plate and the Kutch region is less than 500 km from the tri-junction of the Indian, Arabian, and African plates off the Makran coast of Pakistan. The fault plane solutions for these earthquakes indicate that the reported earthquakes in Gujarat are due to thrust faulting. There are a few earthquakes along the plate boundary that are gravity faults and partly strike-slip faults. These fault planes solutions indicate that western Gujarat is under a compressional regime.

6.2.2 Flood hazard proneness

Gujarat has seen many damaging floods. Almost all the major rivers in the state pass through a wide stretch of very flat terrain (often more than 50 km) before reaching the sea. These flat lowlands of the lower river basins are prone to flooding from occasional heavy rainstorms in the middle and upper basins. Fairly impervious catchments (rocky or black cotton soils) and steep sloping upper catchments can concentrate runoff to cause heavy short duration floods which can be devastating in the small river basins of Saurashtra and Kutch. Floods are reported almost every third year in the less developed districts of Gujarat, located in Saurashtra, Kutch.
and northern Gujarat. Ahmedabad, Surat and Bharuch cities are also located on the flat alluvial plains of large rivers.

### 6.2.3 Cyclone hazard proneness
Gujarat lies in the western India with a coast facing Arabian Sea in the north Indian Ocean cyclone basin. Various regions of Gujarat fall into Very High (26 per cent), High (27 per cent) and Moderate (47 per cent) Damage Risk zones by area. A Gujarat specific mitigation strategy will have to focus on warning, awareness, targeted mitigation interventions, and an effective techno-legal regime to reduce vulnerability steadily over time.

![Figure 6.4 Cyclone Risk Map](image)

### 6.2.4 Drought hazard proneness
Gujarat suffers from intense droughts, which has resulted in severe scarcity and water shortages. With large parts of north Gujarat and Saurashtra having no sources of alternative irrigation, drought vulnerability increases with groundwater overexploitation. In large parts of central and northern Gujarat, groundwater is the main source of irrigation, and those areas may not get affected by drought compared to predominantly rain-fed regions.

This is the main reason for the higher impact of droughts in Saurashtra compared to north Gujarat. The average rainfall in Gujarat is about only 700 mm with more than half of the talukas of Gujarat receiving rainfall within the range of 200-400mm, which is insufficient even for millets and other dry land crops.

![Figure 6.5 Drought Risk Map](image)
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6.2.5 Chemical hazard proneness

Gujarat, one of the most industrialized states in the country, is known for its large concentration of chemical industries, particularly in a stretch of 400 km from Ahmedabad to Vapi, known as the Golden Corridor. In Bharuch district, Ankleshwar, which is situated on the Narmada estuary, is Asia’s largest chemical zone. A wide range of chemical process industries exist in Gujarat, including hydrocarbon processing/refining, petrochemicals-polymers and man-made fibres, fertilizers, health care products, plant protection chemicals, dyes, pigments and intermediates, fine chemicals, surface coating products, salt and salt-based products, ceramics, glass, cement, vegetable oils, fats, and detergents. A large number of medium and small-scale chemical industries are located in the industrial estates of Vapi, Ankleshwar, Panoli, Nandesari, Vatva, and Naroda, which produce numerous organic chemicals for domestic and international consumption. Gujarat has 1,600 km of coastline along which a number of ports are being developed. Considering the infrastructure proposed in the coastal areas, it is expected that port-based mega-chemical industrial estates would be developed. Some of the major hazards faced by the state in last 200 years are mentioned in the table given below:
<table>
<thead>
<tr>
<th>Hazard</th>
<th>Years</th>
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<tbody>
<tr>
<td>Earthquake</td>
<td>1819, 1845, 1847, 1848, 1864, 1903, 1938, 1956, 2001</td>
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