CHAPTER I:

INTRODUCTION

INTRODUCTION

"The world has enough for everyone's need, but not for everyone's greed."

This famous statement by the father of the nation, Mohandas Karamchand Gandhi stands relevant in today's ecological crisis. Humans have measurably altered the modern world no matter how much like a wilderness it may appear. Human activities have affected the entire globe from the depth of the ocean to the highest levels of the atmosphere. What we are witnessing on the name of development is the maximum exploitation of the earth's natural resources without even thinking of replenishing it. It is however important to understand that no economic development can be sustained long enough under the current system of massive destruction and wanton exploitation of scarce natural resources, including both the renewable and non-renewable ones. It is virtually impossible to achieve sustainable development of the economy without paying adequate attention to the necessity of maintaining the vital ecological balance among all the elements of the environmental set up.

It is a universal fact that history necessarily, is a continuous dialogue between the past and the present[1]. Historians give meanings to the facts and the latter is meaningless without the former. The pattern of historical researches changes frequently and it has changed considerably in the past century. Though the environmental history as a new and a recent discipline of study has emerged in the past thirty years or so, the concern for the environment in the human society has always been there. Historians and philosophers of the past were aware that the natural environment plays an important role in how the humans behave, relate to one another, and organize themselves. Historians since Herodotus and Thucydides understood the value of geography and the environment

[1] E.H. Carr, *What is History*, London, 1967, pg.14

in the understanding of the human societies. The origins of the environment history are firmly rooted in social, cultural or economic history, history of science and technology, history of health, sanitation and beyond. It shares a perennial border with economic and social histories. However till the recent time, the study of environment was done on a micro level occupying only few pages in the beginning of any historical studies. It's only recently that environment and ecology have become an important part of history. Environmentalists long assumed that they could study the laws of nature apart from the human history. Human influenced systems seemed to be aberrations, because human history seemed too brief in evolutionary times. Many believed that over time, natural processes would eventually erase the effects of different initial stages in the life of an ecosystem. However recent researches and experiences have proved that past environmental conditions play a continuing role in most ecological systems; one cannot erase or ignore history, and people are one of many sources of historical disturbances that shape environment. With this revelation, historians also began to take interest in this stream, which for long was neglected by them. Besides, it is increasingly being acknowledged now that the recent environmental crises call for an active and independent role of historians to develop new paradigm for the future.

Nature since past many centuries has been depicted in various forms. It first symbolized green and the virgin earth, it then came to be associated with women and culture, and later it was visualized and seen as an area of earning profits. Three subplots organize its base: Christian religion, modern science and capitalism. According to the Bible, God first created the land, sea, grass, herbs, birds, whales and then humans. The first male and female (Adam and Eve) were instructed not to touch the tree of knowledge in the Garden of Eden. The temptation of Eve by the serpent and the consumption of the forbidden fruit led to their expulsion from the

garden. This fall symbolized the decline from the garden to desert, as the first was cast away from the light of an ordered paradise into a dark, disorderly wasteland.

However in Europe, the emergence of mechanistic science and industrial revolution in the 17th century denoted the recovery from the great fall- to create a grand master narrative of the Enlightenment. Mechanistic science acted as an instrument to reinvent the last garden on the earth. Science and technology were used to dominate nature, which was now no longer virgin and pure. Capitalism was seen as a process, which initiated the movement of 'desert' back to 'garden' through the transformation of undeveloped nature into the state of civility and order[2]. A good State always ensures the smooth functioning of the capitalist production by imposing order on the fallen worlds of nature and the human nature (also giving rise and justification to imperialism and colonialism). Thomas Hobbes 'nation state' was the end result of a social contract created for the purpose of controlling people in the violent and unruly state of nature. John Lock's political theory rested on the improvement of undeveloped nature by intermingling human nature with the soil and subduing the earth through human dominion. Simultaneously Protestantism helped to speed the recovery by sanctioning increased human labour just as science and technology accelerated nature's labour[3].

Ecology was derived from the term 'oecologee', as coined by the German zoologist Earnest Haeckel in 1866, which embraced the science of the relations of the living organisms to the external world, their habitat,

[2] Marshall Sahlins, *Culture and Practical Reason*, University of Chicago Press, Chicago, 1976, pg.53

[3] On the definition of natural resources, see John Yeats, *Natural History of Commerce* (London, 1870), pg.2. Thomas Hobbs, "*Leviathan*", 1651, in English Works, 11 vols. (reprint edition, Alsen, W. Germany: Scientia, 1996), vol III, pp.145, 158. John Locke, *Two Treatises of government*, 1690, ed. Peter Laslett (Cambridge: Cambridge University Press, 1960). *Second Treatise*, Chap.5, secs. 28, 32, 35, 37, 46, 48

customs, energies, parasites, etc. With its distant echoes of the domestic household, ecology implied a family of living organisms, each in close proximity to the other, sharing the same physical space, with conflicting appetites or complementary needs[4].

Ecology to be precise is the symbiotic relationship between various life forms. With the sciences themselves coming increasingly to be scrutinized as cultural and historical constructions, the historiography of the history of environment shows that in environmental history there is an emphasis on various ecological factors and their impact on the history of various regions.

An external force, substance or condition that surrounds and affects the life of an organism in any way becomes a factor of its environment and is called an environmental or an ecological issue. Historians may always map out the social, economic and cultural impact of the changes in the ecosystem. An eco system can be defined as the grouping of various kinds of plants, animals, and microorganisms interacting with each other and with their environment. Thus an eco system consists of living organisms and the physical environment in which they live. Grassland, a forest, a pond, or a lake may be considered as an ecosystem. A historical study of an ecosystem is ecological history or the environmental history. Ecological history, may also chart the chronological course of the ecological sciences, of the historical observation and shifting the scientific interpretation of natural phenomena[5]. From the late twentieth century perspective, with images of desertification and deforestation present before us, and with talk of greenhouses gases and global warming, ecological history very much has now become the part of human history.

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[4] Cited in Donald Worcester, *Nature's Economy: A History of Ecological Ideas*, Cambridge University Press, Cambridge, 1985, pg.192.

[5] D. Arnold and Ramachandran Guha,*Nature, Culture and Imperialism- Essays on Environmental History of South Asia*, Oxford University Press, New York, 1998, pg.29

According to an ecologist historian Nancy E. Langston environmental change comes about not just because people cut down tree, plow lands or burn fossil fuels, but they do these things in a world where nature, culture, science and markets tangle in a complex ways. The reasons for environmental change fall into three interwoven categories[6].

1. Cultural: It deals with effect of cultural ideals on the people which in turn define their relationship with the land or forests, like the worship of trees etc.
2. Political: Over the course of several centuries, many ecological systems, like that of Asia or Africa have been transformed into collection of resources exported out of the region to feed the demands of the local and distant markets. Economics, industrialization, the development of the global markets have all profound effects on the world's ecosystems and people.
3. Natural: these are biological and physical factors that shape the landscape. Plant communities, animals, disturbance processes such as fires floods, insect's epidemic, soil processes, nutrient cycle, erosion and the movement of water are major players in the ecological history.

Nature has always been an arena, for which people have fought to gain control. One of the flash points within the human societies of the past was fuelled by the unending effort to resolve the question of the legitimate use of the nature's resources. With the increase in human settlements and the advancement in technology, this urge to resolve the fundamental question relating to the legitimate use of the natural world increased. Imperialism and colonialism were the outcome of this effort. A nation's desire to control the natural resources and consequently trade and industries of the colonized country, was the direct result of the quest

[6] S.I. Dodson (ed), *Ecology*, Oxford University Press, NewYork, 1998 pg.29

of the legitimate use of the nature. It has been a question central and global to the entire human population. Writers, philosophers, lawmakers, historians, administrators and thinkers have been trying to settle this unresolved problem.

Broadly, one could categorize environmental history into four perspectives

1. Environment- oriented environmental history.
2. Cultural or intellectual environmental history.
3. Environmental history that uses environment as a site for the exercise of power, and
4. Environmental history through all above three.

Environment- oriented environmental history primarily deals with the changes in biological or physical environments and their effects on humans and vice versa.

Cultural and environmental history presents a large picture of human nature relationship in various forms. Nature is represented in ideas, painting, sculpture, and letters. It reflects the light on the societies that produce them.

The third category uses environment as a base for the exercise of various kinds of power. It includes law making and its implementation, state policy etc. and shows how State uses its power over nature and its inhabitants.

The last category of environmental history is rich as it includes all the above three streams discussed.

Nothing in this world is static as constant changes take place in every sphere of life. Long before our Hominid ancestors came on the scene, all

embracing factors such as plate tectonics, worldwide changes of sea level, profound alterations in the pattern of climate, and the evolution of the new species of plants and animals have been continuously altering the face of the world. In response to such comprehensive change, more local development related to the environment was in making too. Rivers changed their courses, rich alluvium soils was formed or swept away, the average annual rainfall of the region increased or decreased, and the balance of plant and animal populations altered. The Hominid ancestors initially must have been no more than an additional minor factor playing a very small part in that was taking place[7]. We may always assume that when Hominids or early human populations became conscious of their surroundings they began to consider the ways in which it could be changed to their advantage. Stone artifacts remain the prime source of information. When compared with the knowledge of fire making, and later, the evolution of wheel, these skills must have enabled our ancestors to have an impact on the environment far beyond that of other animals, particularly by burning the grasslands and forests as many indigenous people are known to have done, and still do as a regular part of their yearly cycle of hunting and gatherings[8]. The same kinds of skills also made it possible to live in potentially hostile environments, where winters were cold and the main source of food and clothing was in form of large active animals that had to be hunted with missiles carefully made from the combination of materials such as stones, bone, wood, hides etc[9]. There is evidence from many parts of the world for highly effective exploitation of the environment of this kind during the later phases of the Stone Age[10]. The Indian subcontinent too is not an exception. It provides a whole range of climatic and topographical situation. Every kind of

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[7] Bridget Allachin, *Essays on the Environmental History of South and South East Asia*, "Early man and environment in Asia", Oxford University Press, 1998, pg.130.
[8] *ibid*, pg.31
[9] N.N. Bhattacha, *Ancient History and Civilization*, Delhi, 1998, pg.4.
[10] H.D. Sanklya, *Prehistory and Protohistory of India and Pakistan*, see segments referring to Gujarat, pp. 119-149, Pune, 1974.

environment, from deserts to regions of high rainfall occurs in both, the mountains and lowlands. Alongside this diversity, there are important common factors, of which probably the most crucial, from the point of view of the inhabitants is a tendency towards rapid, large-scale erosion and deposition. It is particularly marked in the mountains that coincide with the northern, northwestern and northeastern boundaries of the Indian subcontinent in their foothills and in great alluvial plains of Northern India. This is on account of the proximity of the active contact zone between the Indian and the Central Asian plate of the earth's crust, which is still the cause of earthquakes and mountain buildings. The tendency towards erosion is accentuated by the nature of the monsoon climate. In terms of world climatic zones, most of the subcontinent as far south as Maharashtra lies in the northern belt, which includes the Sahara, the Arabian Desert etc.

The extent of the Thar Desert is curtailed by the relative position of the mountains of the subcontinent, so that the southwest monsoon winds precipitate rain, somewhat erratically over much of North and central India, an area, which would otherwise be a desert[11]. The result as well known is that conditions of aridity, low and uncertain rainfall in much of the subcontinent, and sudden, heavy rain frequently follows the long periods of drought. This makes the environment fragile, where the balance between desert and non-desert is delicate and easily be disturbed: the environments, in which erosion takes place all the time, is easily accelerated and not easily controlled.

Erosion in South Asia is further accelerated by tectonic activity stemming from the ongoing collision between the Peninsular India and main Asian landmass with which it first came into contact approximately twenty

[11] *Environmental History of South and South East Asia*, pg.33

million years ago. All these factors combine to create peculiarly unstable conditions in many regions of the subcontinent. One is the continuous uplift of the Himalayas, the Karakoram and the Hindukush (all young mountain ranges), and the Tibetan plateau. The process is accompanied by the compensatory down cutting of the main rivers and their drainage pattern. This greatly accelerates erosion of all kinds especially in the Karakoram and other arid western mountain ranges. In the better-watered eastern Himalayas ranges and the south Gujarat regions, the effects are perhaps not so immediately obvious, but highly volatile nature of environmental situation in these areas, at times, becomes apparent wherever terraced field systems, created on steep slopes, have been briefly neglected or where the forests have been depleted. In both the situations huge amount of topsoil are likely to be lost and carried down to the plains or to the sea. Further examples of the secondary effects of the upliftment of the mountain ranges are the many changes in the course of the major tributaries of the River Indus that are known to have taken place in Punjab, the massive 'badland' types of erosion so widespread in the Shiwaliks; change of level in the Rann of Kutch, leading to the incursion and the excursion of the sea[12] and the rapid accumulation of silt that constantly extends the Ganges-Brahamaputra delta.

The most important outcomes of the combined climatic\ tectonic situation, in terms of human settlement, are the great alluvial plains formed by the rivers Indus and Ganga in the north, Narmada and Tapi in Gujarat and parts of central India and rivers Krishna, Son and Kauvery in south India. At present Indus and its major tributaries tends to build up their beds and frequently alter the courses, making for an unstable situation. The rivers of Ganga system, and most of those in central India and the Deccan, are fairly deeply incised into their alluvial plains and thus are more stable.

[12] "The Cutch (Kutch) Earthquack of 12 June, 1897, in Memorial of the *Geological Survey of India*, 46:2 (1926), pp.71-147.

Although here too certain rivers like Son or Tapti in west are notorious for changing their course locally.

We can only speculate the on the ecological-niche relationship of the hunter-gatherer populations. It can be assumed that so long as the total demand on resources remained limited, the human population tends to reach equilibrium with their resources base after the elimination of the elements that were over utilized[13]. Climatic changes resulting from the withdrawal of Pleistocene glaciations 10,000 years ago seem to have resulted in the extinction of many species all over the world; this could in part have been due to the over extension of human hunting after major changes had taken place in the prey populations. The Baboon and Hippopotamus had become extinct in India at this time, perhaps as a result of such processes[14]. Agricultural and pastoral people did spread over the Indian subcontinent about 10,000 years ago[15]. Without metal tools they could not readily penetrate the moisture forests, such as those of Gangetic plains or the west coast. The habitat most favourable to them for cultivation was along the small watercourses in the relatively drier tracts of North Western India, the Indus plains, and the Deccan peninsula. This is where agricultural settlements developed over the period 6,000-10,000 B.C[16]. It thus suggests that there was a gradual deforestation in these parts. Hunting, gathering along with the shifting cultivation, might have continued to dominate all the moisture tracts of the subcontinent[17].

The first urban civilization of the Indian subcontinent embraced a very wide region of the northwest. Archeological evidence suggests that this culture was familiar with the use of plough and grew crops such as rice,

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[13] R. Guha and M. Gadgil, *This Fissured Land, An Ecological History of India*, Oxford University Press, New Delhi, 1991, pg.73.
[14] *ibid*, pg.73
[15] *ibid*, pg.76
[16] *ibid*, pg.77
[17] *ibid*, pg.77

pulses, barley and lentils[18]. The agricultural surpluses thus produced led to the establishment of many towns and trading activities. The Harappan culture came to an end between 2000 and 15000 B.C[19]. Various reasons are attributed to the end of this civilization. The explanation with the best-documented evidence relates to the shifting of the river courses, on the account of geological changes associated with the continual lifting up of the Himalayas. Satellite imagery clearly shows the palaeo channels of the river Saraswati, which dried up when the river Satluj shifted its course westwards to join Indus and the Yamuna eastwards to join the river Ganges[20]. There have also been suggestions of climatic change, as evident from paleobotany, the flooding of the river Indus, and of the salination of agricultural soils on account of irrigation[21].

Environment in Indian Philosophy and Tradition

"Even if there is only one tree full of flowers and fruits in a village, that place becomes worthy of worship and respect[22]".

Since the ancient past, concern for environment has been an integral part of the Indian intellectual and popular traditions. The configuration of environment in the Indian thought includes the entire Universe within itself. A more commonly used word for the Universe is '*Srishti*'. Indian philosophical traditions have visualized *Srishti* as a creation of the almighty including the humans. As both are the creation of God, there is greater stress on maintaining the relation between the two. At the same

[18] B.K. Golakhia, *Ancient Indian History and Culture*, Educational Publishers, Bombay, 1958, pg.60.
[19] D.N. Jha, *Ancient India, An Introductory Outline*, People's Publishing House, New Delhi, 1997, pg. 8.
[20] *This fissured Land*, pg.78
[21] M. Gadgil, "Towards an Ecological History of India", *Economic and Political Weekly*, vol. XX, 1985, pg.1911.
[22] *Mahabharata, Adiparva,* 138.25

time humans are considered as the most intelligent race, and therefore it is imperative for them to ensure a peaceful coexistence with other human beings and nature.

The theory of creation according to BhagwatGita has been most elaborately expounded in Santiparva of Mahabharata. It states[23]:

> "The father of all creatures, God, made the sky. From the sky he made water and from water, he made fire (*agni*) and air (*vayu*). From fire and air, *prithvi* (earth) came into existence. Mountains are his bones, earth is the flesh, sea is the blood, sky is his abdomen. Air is his breath, *Agni* is his '*Teja*', and rivers are nerves."

The idea of environment and its components since past, have been deeply embedded into the Hindu religion. The Vedic deities are generally classified according to their natural characteristics. The Rigveda classifies them as below:

1. Celestial Deities: *Varuna*, *Mitra*, *Surya*, *Savitri*, *Pusan,* the *Asvins* and the Godess *Usha* and *Ratri.*
2. Deities of atmosphere: *Indra*, *Apam*, *Rudra*, *Marut*, *Vayu*, and the *Apas.*
3. Terrestrial Deities: *Pritvi*, *Agni* and *soma.*

Therefore we find that during the Vedic age, the people worshiped the nature and its components. The Vedas and the Upanishads also assumes that the humans are made up of elements, which at their death disintegrates and dissolves into nature.

In oral tradition in India, environment have been perceived in a symbiotic relationship with the humans where environment is also considered as a living organism which breathes, feels and possesses sensory perceptions.

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[23] *Mahabharata, Mokshaparva,* 182.14-19

The trees and animals are one of the basic components of popular folk tales, which are a part of the oral traditions in India. The flora has been part of the themes of different stories. It is understood that the human survival is possible only with the conservation of entire flora and fauna. According to the tradition forests were extremely vital and were regarded as abodes of spiritual solace and the concept of preserving forests and wildlife developed around the ashrams of the sages, where trees and animals were loved and given protection. These forest-based ashrams propagated *aranya sanskriti* or a forest culture and human understanding of the fundamental ecological utility of forest ecosystems and their economic importance, which led to trees and animals being treated with veneration[24].

The table on the next page prescribes various punishments awarded to the people in ancient India who do some kind of damage to plants, animals and crops[25].

[24] A.S. Rawat, *A History of Forestry in India*, Indus Publishing Company, New Delhi, 1991, pg.130.
[25] Priyadarshan Sensharma, Conservation of Biodiversity: Traditional Approach, *Indian Journal of Traditional Knowledge*, vol. 3(1), Jan.2004, pp.8-9.

Table I A

Table prescribing various punishments awarded to the people on damaging plants, animals and crops.

Sr. No.	Nature Of Offence	Punishment Prescribed
1	Cutting of a twine, climber or shrub	Payment of a fine of Hundred *karsapana*(a coin or a weight of different values)
2	Destroying of a herb or grass	One *karsapana*
3	Damaging crop in the field by domesticated animals.	Quantity of compensation to be paid according to the destruction of the crops by the owner of the offending animal.
4	Killing of an elephant	Mutation of one leg and one hand of the offender
5	Killing of a wild animal	Payment of 50 *karsapana*
6	Killing of a bird or a fish	Payment of 10 *karasapna*

The above table points out few things very clearly. Tribals have always utilized biodiversity (plants and animals) for food, skins and customs etc but they also have customary laws to facilitate equitable distribution of resources as well as to allow resource regeneration. Firstly, the environmental conditions always play a crucial role in explaining the prevalent practice of punishments in the form of cash fines. In the arid and semi arid regions of the country specially in Rajasthan, Saurashtra and Kutch, cattle population and trees played vital road in sustaining economic lives of the humans. For e.g. Anup Singh, the king of Bikaner prohibited the cutting of green trees in the villages dominated by Bishnois (It is a community settled mostly in Rajasthan, who believe in

maintenance of harmony with the environment) in 1752 AD. The King of Jodhpur, Man Singh issued a similar order with respect to the Khejri trees.[26]

Similarly, the natural resources was regulated in the colonial and post colonial times by the rulers because of the revenues it generated. Timber has always been a vital source of income for the State and thus fines were also imposed on the illegal cutting of trees, twine and climber. One thing which emerges from the above discussion is that, in India non violence was practiced only by certain societies. The punishments mentioned above indicate that the society always did not have a benign attitude towards nature. That is the reason why State felt a need to punish those who violated and exploited the natural resources.

It was not only the Aryans and their religious texts, which signified the value of nature. The third century B.C. saw the rise of a great king Ashoka, who emphasized the value of the non-human world. Filled with remorse after the Kalinga war, he converted to Buddhism and formulated the principle of '*Dhamma*', which laid stress at the building up of the attitude of mind in which social responsibility and the behaviour of one person towards the other was considered of great relevance in his principle of *Dhamma*, he upheld the doctrine of toleration. Non-violence was another fundamental component of his policy insisting on the recognition of the sanctity of all life. He led the example himself. The unrestricted slaughter of animals for the royal table was first limited to one deer and two peacocks and later it was totally abolished[27]. He enacted a piece of comprehensive legislation in the 26th year of his reign, to restrict the slaughter and injury of specified creatures. Those not

[26] Mayank Kumar Claims on Natural Resources in India: Exploring the role of Political Power in Pre colonial Rajasthan, India, *Conservation and Society*, vol. 3, No.1, June, 2001, pp 143.

[27] *The History of India*, pg.83.

economically useful as a source of food or service, like parrots, wild gees, bats, ants, tortoise, squirrels, porcupines, lizards, rhimes, pigeons were declared protected and inviolable (*avadhya*). He also stated that fish must not be killed, sold or consumed on specified days numbering 56 in the year.

The following extract shows his works that were done in conformity with his doctrine of *Dhamma*[28].

> "On the roads I have had banyan tree planted, which will give shades to beasts and men. I have had mangroves planted and I have had wells dug and rest houses built every nine miles and I have had many watering places made everywhere for the use of beasts and men. But this benefit is important, and indeed the world has enjoyed attention in many ways from former kings as well from me. But I have done these things in order that my people might conform to dhamma".

The prevalence of Asoka thus extended not only to the human, but also to the non-human world. The protection of elephants had become important by this time. The Arthashastra mentions rules for protecting the 'elephant forests'.

It is evident from the above philosophy of environment propagated in the ancient Indian tradition that a sustainable ecology was a concern for the state as well as the society.

I would like to introduce briefly the archaeological history and the physical setting within which the unique ecology of Gujarat undergoes a transformation as a result of human interference. (See map IA showing the location of Gujarat).

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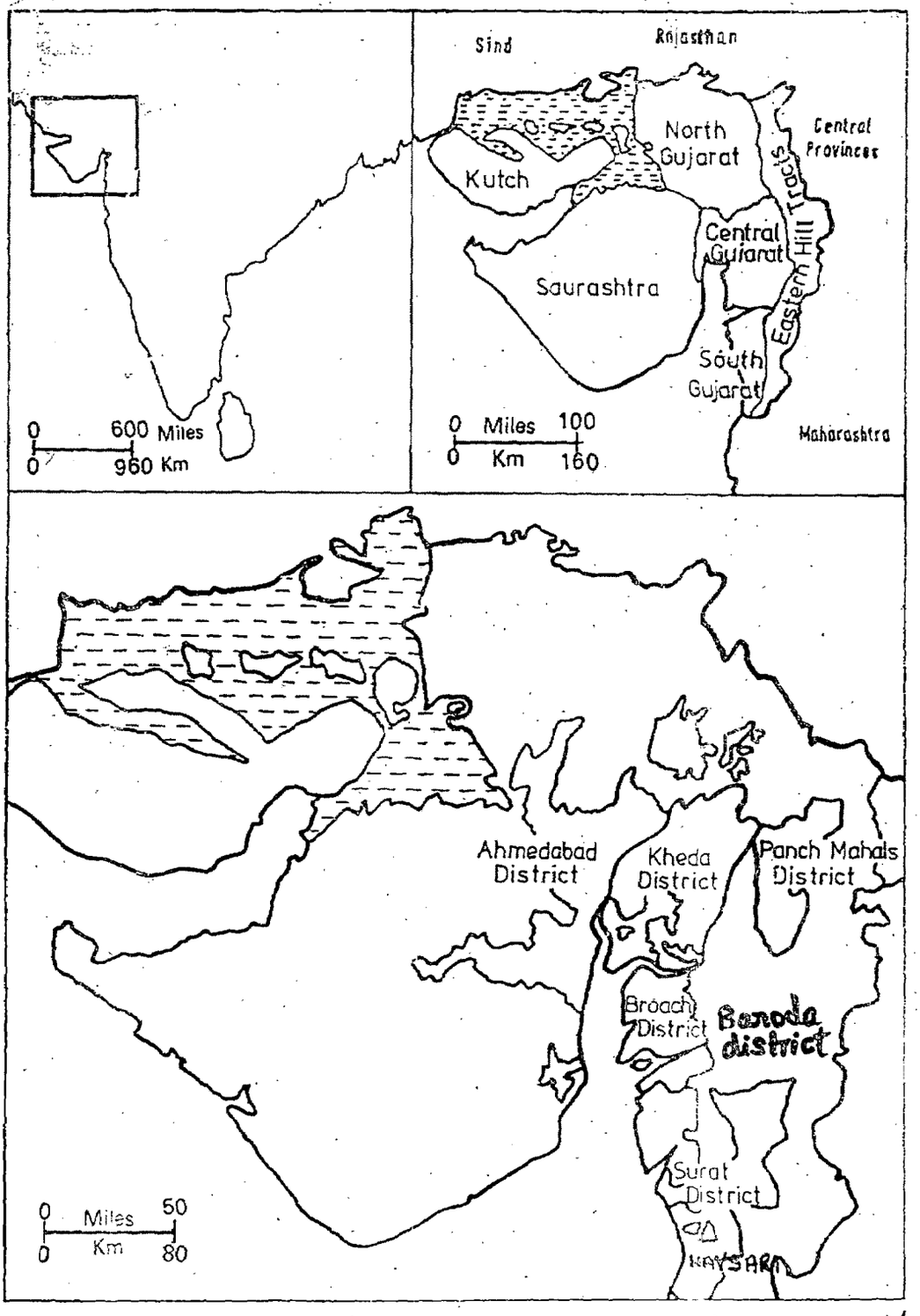
[28] *ibid*, pg.85

Map IA

Location of Gujarat



Source: The Encyclopaedic district Gazetteer of India, Gyan Publishing House, New Delhi, 1997

The Archeological History of Gujarat

The Gujarat region is one of the early settled parts of the country. The state with a long shoreline became a set of some of the towns of the Harrapan civilization, like that of Lothal, Padri, Bet Dwarka, Dholvira etc. **Lothal** is located at the head of the Gulf of Khambat, which is situated about 12 meters above the mean sea level, on the left bank of the river Bhogwa, the discovery of Persian Gulf seal, Terracotta models of African mummy and guerrilla clearly demonstrate Lothal's maritime connection and its relation with Mesopotamia and Egypt[29]. Boats might have been reaching the dockyard through a channel of the river Bhogawa, making it one of the major Harappan sites.

Padri is another recent excavated site. It is located in the Gulf of Khambat about 60km south of the Bhavanagar port, just 1km away from the shoreline. According to the excavating team, the site belongs to a fairly mature Harrapan period, dating back to 2200 B.C[30]. There are numerous evidences of utilization of marine resources at this site. One of the major findings is a large Harappan copper fish hook, which is 14cm. Long with barbed point and loop on the other hand, weighing more than 50kg [31]. This indicates that the Harappans of Padri had perhaps mastered the technique of deep-sea fishing.

Dholvira: It is yet another Harappan site located in the Rann of Kachchh on a Khadir belt. Dholvira has witnessed the earliest habitation of Protohistoric period in Gujarat. Excavations has reveled a long cultural sequence, which commences from the beginning of the third millennium

[29] A.S.Gaur and K.H. Vohra Shorelines of Gujarat, India,during the Indus Valley Civilization, 'A study based on archaeological evidences, 2007, pg.2

[30] V.S. Shinde, Padri and Indus Valley Civilization, *South Asian Studies*, vol.8, 1992, pg.55

[31] Shorelines of Gujarat, pg 3

BC, when perhaps a group of people from Makran coast arrived on the island through Kori creek. Dholvira was an active port and was found by the Harrapans as a safe harbour for anchoring boats. The long habitation history of the area highlights the importance of the location and maritime activities.

The proto historic site is located at **Bet Dwaraka**, Okhamandal in Jamnagar. Explorations in and around this site since 1979 have yielded a large quantity of protohistoric pottery including perforated jar, bowls and few seals. Discovery of a large number of conch shell collumela and shell bangle in the region suggests that this site was a small port during the Harappan period[32]. Historians and geologists attribute the destruction of the site to the ever-advancing shorelines. Further excavations at **Mavlan** in the South Gujarat region suggests that this was a post Harappan estuarine port, dating back to 1400 B.C. The site was located on the banks of the Tapti River.

Thus we see that Gujarat with its long coastline with fertile soil was once the flourishing center of the Harappan civilization.

Gujarat-the Physical setting and Physiography

The Gujarat region consists of major and minor peninsulas, gulfs, islands, creeks, marshes, hills, plateau and coastal strips. The geological evolution of Gujarat began with the breaking up of the Gondwana land. Its subsequent geographical history is related to the northward drift of the Indian subcontinent and the breaking up of the western continental margin[33]. (See map I B)

No state of India, other than Gujarat presents a varied ecological picture.

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[32] *ibid*, pg.6

[33] *Land and People of Indian States and Union Territories*, Gujarat, Govt. of India, vol.8, Kalpaz Publications, Delhi, 2005, pg. 30

Map I B

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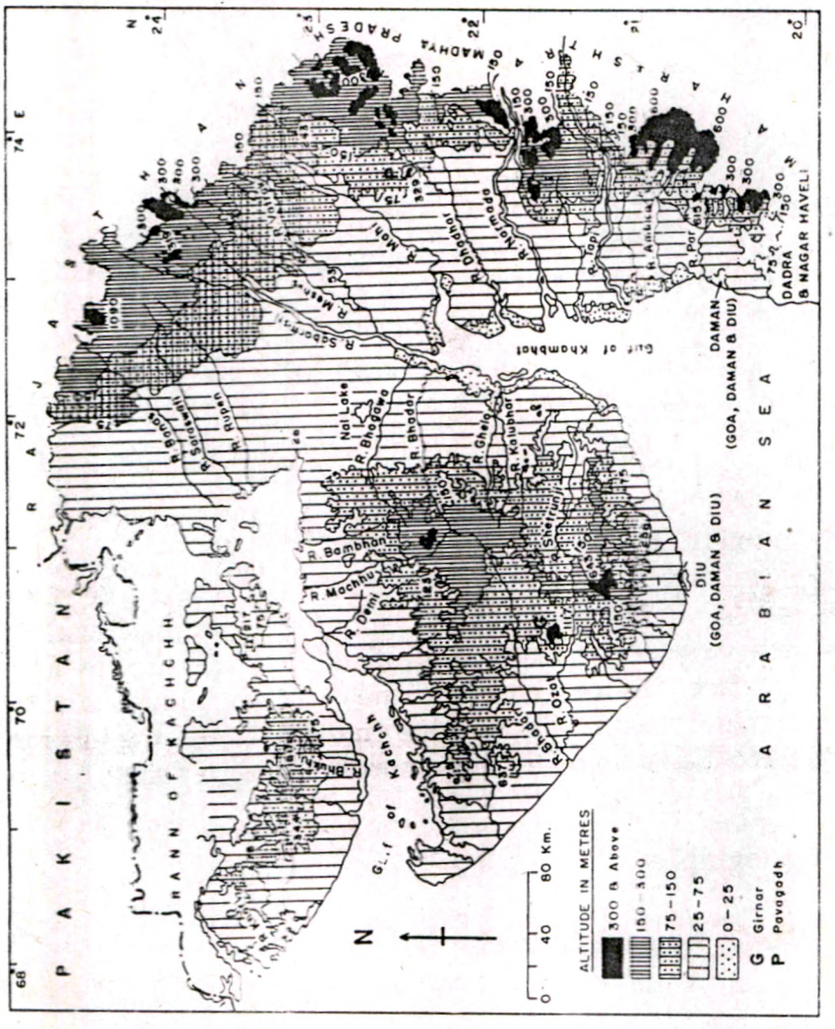
Physiographical Map of Gujarat



Physiographic Map of Gujarat

Source: C.D. Deshpande, Western India, A Regional Geography, Dharwar, 1948

Where as Kutch and Saurashtra presents an example of desert ecology, the mainland Gujarat is known for its wetlands, higher rainfall and the alluvium soil.

Physiographically, the state comprises of three distinct zones[34];

1. The mainland Gujarat
2. The peninsular region of Saurashtra
3. Kutch

Saurashtra and Kutch have a large area of desert land known as the Rann of Kutch. Besides it, the two districts are also considerably inhabited and have cultivated lands. These desert regions are varied as they are intersected at various places by ranges of hills and isolated low peaks, rugged and deeply cut river beds, valleys and large tracts of pasture lands.

The mainland Gujarat is one of the most fertile regions. It is marked by the various relief features. The Aravali range enters Gujarat from Rajasthan near Mount Abu and extends into the eastern part. It forms the Pavagadh region, near Baroda and merges itself with the Vindhyas. Between the Narmada and Tapti lie the Satpura hills and the low hills of Rajpipla. The Satpura hills between the Narmada and Tapti and the low hills of Rajpipla take off from there. The southern parts of the state, which are watered by the Tapti and its tributaries, the Sahayadri range from Maharashtra provides a break in the plain relief.

The Sabarmati, the Mahi, the Narmada and the Tapti are four principal rivers of Gujarat. In addition, there are other small ones, like the Khari, the Hathmati, the Meshva and the Bhogava in Ahemadabad, the Shedi,

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[34] *The Encyclopedic District Gazetteer of India*, vol.7, Gyan Publishing House, New Delhi, 1997, pg.89.

the Mul Khari, the Vatrak and the Mohar in Kheda, the Kim and the Dhadhar in Bharuch, the Mindhola, the Purna, the Ambica, the Auranga, the Par and the Damanganga in Surat and the Jambuva, the Surva, the Vishwamitri and the Dhadhar in Baroda. The principal rivers make the state rich in the alluvial soil, as a result the state prospered due to cotton cultivation in the 19th and the 20th centuries.

The drainage of Gujarat is unique and the rivers generally get flooded causing considerable damage (due to various reasons discussed later). The Narmada for about a hundred miles from the sea is navigable at all seasons by country boats. The Tapti, though a smaller river, has a great commercial importance, though both the rivers run for the most part between high banks and thus have little use for the purpose of trade. The streams of Sabarmati and Mahi are narrow, consequently are not used for navigation[35]. In the Monsoon, the rivers become violent making the trade impossible. In 1852, before the advent of railways, the possibility of making Tapti navigable over a distance of 232 miles eastwards from the city of Surat was explored[36]. On the account of their high rugged banks and the tidal influence, all the year round, the principal rivers cannot be used for irrigation. The Sabarmati has provided irrigational water to an area of fourteen miles in the Kheda district. Besides this, the waters of the Sabarmati, the Khari, and the Hathmati have been harnessed through engineering projects.

Along the coastline the most important regions are the mouth of Tapti and the Gulf coast of Cambay. It is this region of river valleys, which produce the major crops like rice, jowar and wheat. Land in Surat district has been reclaimed from the sea for rice[37]. There is considerable

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[35] M.B. Desai, *The Rural Economy of Gujarat*, Oxford University Press, 1948, pg.9
[36] R.D. Choksey, *The Economic Life in Bombay Gujarat*, Asia Publishing House, New Delhi, 1968, pg.5.
[37] *ibid*, pg.6

development at the mouth of almost every estuary. Daman port (at present in Union Territory of Daman and Diu) has influenced the commercial development of this region, but largely it has been the city of Surat that has dominated the commercial activities in South Gujarat[38]. The region owing to the ports of Baruch and Cambay became an important trading center, all trade in northern India over some centuries passed through them. Anklehswar and Hansot were the ports of lesser importance. They later lost their significance due to the silting of river mouth[39].

The central plain is extremely fertile. Most of this region belongs to the state of Baroda. Dissected by streams, receiving moderate rainfall with the alluvium soil explains the high degree of its fertility and land utilization. Another name for the north Gujarat plains is Charotar, which once was under the dominions of the Gaekwads. Cereals were produced in large number followed by tobacco and oilseeds.

On the east and north of Charotar, the region merges into Ahmadabad plains. *Bajra*, *jowar* and oilseeds are main crops cultivated here. The city of Ahemdabad is the hub of all the cultural and political activities in the past.

The present study covers south and central region of Gujarat, which includes Bharuch, Surat, Dangs and Navsari (which was a part of the Baroda state under the Gaekwads) and Valsad in south, and Baroda, Kheda and Ahmadabad in central region of the state.

The territories of South and Central Gujarat were not uniformly administered. Ahmadabad, Kheda, Dangs, Surat and Bharuch were the

[38] C.D. Deshpande, *Western India, A Regional Geography*, Dharwar, 1948, pg.195
[39] *The Economic Life in Bombay Gujarat*, pg.6

parts of the Bombay Presidency while Baroda state was ruled by the Gaekwads, which included the present district of Vadodara, Amereli, Kadi, Okhamandal and Navsari.

South Gujarat is an extremely fertile region of the state with adequate rainfall and good agriculture production. Here is the region wise geographical and ecological analysis of the principal districts which are included in it.

Bharuch: It is the eighth largest district measuring 9,045 kms and accounting for 4.62% of the state's total geographical area. It lies between 21° 24' north latitude and 73° 59' east longitudes. It is bounded on the north by Vadodara and Kheda districts, on the south by the Surat district, in the east by the Dhulia district of Maharashtra and in the west by the Gulf of Cambay.

There are at least three traditions regarding the rise of Bharuch. The *Puranic* tradition connects it with the Brigus and their struggle with the Haihaya king Saharrarjuna, of Mahismati in the Narmada valley. According to the Buddhist tradition preserved in Divyavadana, Bhiru, who escaped from Sauvira, when it was destroyed by the advancing sand dunes, founded the city of Bharukachch. However the Jain tradition relates that Bharukachch was under the king Pradyot of Ujjayini[40].

The original district of Bharuch (earlier known as Broach) was constituted of a marginal strip of 3,776 kms* of the southern Gujarat alluvial plain. The territories of old Rajpipla state were subsequently merged with the then Broach district. The district thus came to consist of two regions of geographical contrast, the alluvial plains of north and

[40] *Broach District Gazetteer*, Ahemadabad, Govt. of Gujarat, 1961, pg. 54.
* I have used kilometers for measuring land, squre kilometers for an area of land and miles for describing the length of the river.

northwest and the Rajpipla hills in the northeast.

Bharuch is drained from east to west by four main rivers, the Mahi which marks the northern limit of the district, the Dhadhar about 33 Kms. south of Mahi, the Narmada in the center and the Kim in the south. These rivers flow parallel to each other and geologically they have developed the alluvial plains of South Gujarat of which Bharuch is a part[41]. The alluvial plain is a product of the age-old processes of erosion and deposition of soil carried out by the major rivers of southern and central Gujarat flowing westwards from the Malwa highlands to the Gulf of Cambay. However with the present degradation of environment resulting from the continuous deforestation in the last hundred years, the extensive depositional features are now marked with equally extensive erosion. The alluvial plains are also dissected by the gully erosion and deep cut channels. The rivers and their tributaries are often marked by a network of ravines by the force of their waters. This denudation action accounts for the intense soil erosion and the difficulties in bringing agricultural areas under irrigation.

The whole of the Bharuch district is one huge plain of alluvium and its soil is free from rocks and stones. "The soil may be said", remarked a revenue surveyor in 1819,"even without a pebble"[42]. The soil is classified into two principal divisions, viz. '*marwa*' or '*gorat*' and '*kalibhoi*' or 'black soil'. *Gorat* is a sandy soil, which absorbs the rain rapidly, and thus water is found in every part of it at a comparatively short depth from the surface (30-35ft.). The black soil occupies a greater part of the region. It is eminently suited to the cultivation of cotton.

The district has a forest cover of 1725.52 kms of which 1129.94 kms is reserved forest, 292.79 kms is non-categorized forest and 302.79 is the

[41] *ibid*, pg. 3
[42] Monier Williams *Memoirs of Bharuch*, Bombay, 1855, pg.41.

private forest. Teak is the principal specie forming about 40% of the total growing stock[43].

The jungles of Rajpipla have been the homes of the tigers, though in last 200 years, their numbers have decreased considerably due to '*shikars*' by the government officials and the Maharajas along with the destruction of the jungles. Other animals like panthers, bison, black buck, and chital are found in the forests and the hills of Rajpipla.

Valsad: It is the southern most district of the Gujarat state. It lies between 20° 27' and 21° 05' north latitude and 72° 43' and 73° 30' east longitude. It is bounded in the north by Surat, in the south by Thane in Maharashtra, in the east by the Dangs and Arabian Sea in the west. The district can be divided into two main physiographical subdivisions;

1. The eastern hilly tract bounded by the Satpuda ranges in the north and the Sahayadri ranges on the south, and,
2. The fertile alluvial plains of the Purna and the Ambica rivers.

The Purna, the Ambica and the Damanganga are the major rivers of the district. The other smaller rivers are the Auranga, the Par and the Mindhola rivers. The Purna and the Mindhola rise in the hills between Valsad and Khandesh (Maharashtra), flowing through the Valsad district before joining the Arabian Sea. The Ambica originates in the hills of the Dangs and the Damanganga flows into the portions of Dharampur and Daman before it drains into the sea.

Dangs: Dangs was a heavily forested area during the times of the British. As the word 'Dang' suggests, it means a hilly village as opposed to '*desh*', the plain area[44]. This forest region is cited in Ramayana where the Rama and the Sita spent twelve years of their exile. Geographically

[43] *The Encyclopedic district Gazetteer of India*, pg.134.
[44] *Gujarat State Gazetteer, Dangs District*, Gujarat Govt. publications depot, Ahemadabad, 1971, pg.1.

the district is situated between the parallels of north latitude 20° 39' and 21° 5' and the meridians of east longitude 73° 29' and 73° 51'. This district starts from the rugged mountain chains of the Sahayadri in the east and descends on the western side extending to the edge of the plains of the Gujarat state. The tract varies in elevation from 105m (350 ft.) near Bheskatri to 1,317meters above mean sea level on the crest of Gaolan hill on the Khandesh border in the Pipalaidevi range. On the whole barring few high hills and low depressions most of the area in the Dangs is between elevations of 300m -700meters above the mean sea level.

The Ambica and the Purna are important rivers, which originate in the Dangs and flow through Valsad before meeting the Arabian Sea. The Khapri, the Gira, the Dhodhia and the Sarpganga are the other rivers flowing in the area. Besides these rivers, there are few catchment pools formed out of rocks in deep valleys of the district. These are Umara, Dhama, Kunda and Kasarpada. In addition to these, some small perennial streams also exist. These are Koshmal, Varnar, Ukhatia, Morzira, Don and Ambapada.

Black cotton soil is found in the valleys and low lands while the Red soil is found in the uplands. Black soil is a fertile soil composed largely of clay material. The Red soil is light, porous and is moderately fertile for the agricultural purposes.

The economy of the Dangs is based on the forests and its products as it has been a heavily forested area (though now the region is degraded). It was the forests, which became the bone of contention amongst the British, the Gaekwads and the native Bhil chiefs. The Bhils, because were alienated from the forest they had considered as their own were also involved in the damaging of the trees in order to break the

hegemony which the colonial rulers had established over the forest. This was done to protest against their alienation from and minimized ownership of the natural resources and decreasing incentives to regenerate the degraded resource base.

Following are the important species of trees in the Dangs forests[45];

1. **Overwood** : *Teak, Sadad, Kakad, Modad, Tiwas, Shisham, Khair* etc.
2. **Underwood** : *Ambada, Karui, Dhayati, Karvand, Nigodi*, etc.
3. **Undergrowth:** *Antedi, Karui, Dhayati, Karvand, Nigodi*, etc.
4. **Groundcover:** *Pular, Fulari, Serva, Sonaro*, etc.
5. **Grasses** : *Polado, Tokarbund, Bhatto, Dab Dhrawvao* etc.
6. **Climbers** : *Velanivala, Palasuel, Nandadevi, Kanguel* etc.
7. **Useful Ayurvedic:** *Amarvel, Vando, Mulsi, Sonari, medicine Burandu, Nagpheni* etc.

Dangs being a hilly country with rich forests was a center of wild life in Gujarat. Tigers, panthers, bear, chital were found in large numbers and so were the birds like green pigeon, jungle fowl, partridge etc. However with the heavy deforestation the number of animals and birds also declined.

Surat: Surat has been a commercial center since the past known for its industries and diamonds. The district of Surat lies between 20° 15' to 21° 28' N. and 72° 74' east[46]. Located on the shore of the Arabian Sea, where its waters begin to narrow into the Gulf of Cambay, the district stretches for about 80 miles from the river Damanganga in the south to the river Kim in the north. Geographically, the district of Surat belongs to the western coastlands of the Deccan peninsula. It is bounded in the North by the Satpura ranges and in the South by the Sahayadri ranges.

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[45] *The encyclopedic district Gazetteer of India*, pg.274
[46] *The Surat District Gazetteer*, Govt. of Gujarat, Ahemadabad, 1962, pg.1

The Kim, the Tapi, the Mindhola, the Purna, the Ambica, the Auranga and the Damanganga are the main streams which flowing parallel, drain the entire area of the district. These rivers emerging out from and beyond the Sahayadri Mountains have eroded the highlands, creating the alluvial plain of Surat. The river Tapi is the largest river in the district and the city of Surat is located at its bank.

The district has a total forest area of about 2699 sq kms with the southeast portion of the state, well covered with vegetation. There are:

1. Moist deciduous forests in Dharampur, Vansda, Vyara, Songhad and other southern talukas.
2. Dry deciduous forests in Mandari and the mangrol taluka. *Sadad* (Terminalia torentosa) is the dominant specie besides the teak, *Shisham* and the bamboo.

Amongst the wild animals, the number of tigers has decreased and is found only in the thicker portions of the forests of Mandavi and Vyara taluka. Panther and the Fox are the other animals found in the district.

The soils can be divided into three main types according to the three parallel belts (western, central and eastern belt) running from north to south, viz. The *Khar* and the *Karjan* lands in the western belt, the *Kyari* land in the central belt and the black soil in the eastern belt. The *Khar* and the *Kharjan* soil are found mostly in Olpad and Chorasi talukas. The *Kyari* soil is the mixture of black alluvial and light soil is found in the eastern part of Surat and the black soil is found in Kamrej, Palsana, and Bardoli talukas. *Goradu* is also found in the parts of Songadh, Vyara and Uchchhal talukas. Main crops that are grown are *jowar, bajri*, wheat, and rice.

Vadodara: In Central Gujarat, Vadodara district forms a part of the great Gujarat plains. The eastern portion of the district comprising the Chhota Udepur, Jabugam and Navsari areas are hilly, while the rest of the district is a level plain. The significant hills in the district are Pavagadh, Ghora hills and the Valley of Samdhi nullah in the Sankheda taluka.

The Mahi Narmada doab lie between the river Mahi and Narmada, which is well known for the black soil suitable for the production of cotton. This doab covers the Vadodara plain, which is drained by the tributaries of the Narmada, Mahi and Dhadhar. The western part of the doab is lowland often faced with the problem of drainage and water scarcity resulting in low productivity. The important types of the soil in the district are the sandy loam, *besar* and the black sandy loam soils. Sandy loam soil, because it is porous, there is plenty of subsoil water, which consequently has a developed well irrigation system. The black soil is suitable for the cultivation of cotton and is found in the taluka of Karjan, Sinor, Vaghodia, Dabhoi and Sankheda. However the water level in these areas is low and brackish. The besar soil is found in the admixture of sandy loam and black cotton soil found in the Padra taluka and in the parts of Vaghodia, Sauli, Jambugam and Sankheda. Chief crops of the district are *Bajri*, wheat, *jowar* etc.

The Narmada and the Mahi are the chief rivers, besides, the Jambuva, the Surva, Vishvamitri, and the Dhadhar. The Mahi rises near the village Gomanpura in the Vindhya hills of Madhya pradesh. In Baroda, the river passes through Savli, Vadodara district and Padra. The river Narmada is the largest river of Gujarat. It has as many as 15 tributaries and sub tributaries. The source of river Narmada is in the hills of river Amar Kantak in the Bilaspur district in M.P. The river traverses through six talukas in Vadodara, Chhota Udepur, Nasivadi, Tilkwada, Dabhoi, Sinor

and Karjan.

The district does not have a good forest cover. They are mainly on the eastern border covering Chhota Udepur, Sankheda, and apave Jetpur talukas. Timber and firewood are the major forest produce. Minor produce are Gum, Mohwa flowers and lac etc.

Ahmadabad: Lying between 21° 58', and 23° 30' north latitudes and 73° 02' east longitude, Ahemadabad has its own rich history. It was a cultural center during the rule of the Mughals and the commercial center during the British times. Later it played an important role during the Indian independence. Except for the few rocky features in the extreme southern portion, the district as a whole forms a level plains gradually rising towards the north and the east. There are no major hills to mark its landscape, although there are few small hills at Vasai, Miroli and Chandisar.

It is believed by the geologists that in the past, a portion of the district was under the sea[47]. Even today a part of the tract between the head of the Gulf of Cambay and Rann of Kutch is subjected to water logging during the high tides in the monsoon. In the south and west Ahmadabad, on the account of the brackishness of water, there is little irrigation. The plains round Dholera and from there along the coast to the Bavbai, creeks are muddy, saline and intersected by marshes. Water salinity is a problem feature of the Bhal region.

The Bhal region, covering 275 villages and occupying an area of 4,392 sq kms in the district of Bhavnagar, Surendranagar, Ahemadabad and Kheda, is a marine ingressive, flood affected, coastal region surrounding the Gulf of Cambay. It has been estimated that nearly 41 percent of the

[47] *Ahmedabad State Gazetteer,* Govt. of Gujarat, Ahemadabad, 1984, pg.7

area in the Bhal region is degraded due to physical hazards and human interference and negligence[48]. In this region, marine ingression in the coastal region has increased soil and water salinity. Irrigation with saline water and deforestation of coastal mangroves leading to marine ingression represent human mismanagement because of which many villages have become unproductive wastelands; the natural consequence is outward migration. Nearly 53 percent of the land in the Bhal region is not suitable for cultivation. However out of this 53 percent, much of the area is encroached upon for the purpose of agriculture, leading to further land degradation[49].

The soils of the district can be classified into black and medium black, goradu, kyari and rocky. Black and medium black soils are seen in the Bhal area (low lying flat lands) comprising the southern half of the Dholka taluka and eastern half of the Dhandhuka. The depth of the soil varies from 60cms.to 150cms. And the water underground is brackish.

Goradu soil varies from fertile brown to sandy loam and is found in Dehgam and deskroi talukas, eastern part of Sanand and Dholka and the northeastern portion of the Viramgam taluka. The soil is fertile and has a depth of about 3-5m, with good drainage system. Kyari soil is found in the southern half of the city and Deskroi, southeastern part of Sanand and Nalkantha tract of Dholka and Viramgam talukas. The soil is fertile with good moisture retentive capacity well suited for paddy cultivation.

Rocky soil is found in the western part of the Dandhuka area, which is known as the 'kaner tract'. It is shallow light in texture suitable only for the early maturing varieties of crops.

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[48] C.D. Deshpande, ed. V.S. phadke, S. Bannerjee, *Urbanization, Development and Environment*, Memorial Volume, Rawat Publications, New Delhi, 2007, pg.150
[49] *ibid*, pg.150

Sabarmati is the principal river of Ahmadabad, which rises in Rajasthan. The total length of the river is 258.49 miles (in Ahmadabad) before it enters Kheda. Sabarmati has a tendency to overflow over its banks. The other rivers are Khari, the Shelwa, the Ghela the Andhli etc.

Ahmadabad did not have a dense forest cover. The Gazetteer of Ahmedabad (1879) states that, "no land had yet been set apart for the forests". It further says, "Ahmadabad with no forests or large groves is on whole bare of timber". The district had an area of 6 square Kms of reserved forests on the bank of the Vatrak River. The forests were of dry scrub type and were not very productive economically. Disapperance of forests and the failure of storing rain water by the people have resulted in drying up or lowering of ground water level in many talks of Ahemadabad.

Kheda: Known as 'Kaira' by the British[50], it is located in Central Gujarat measuring 7,194sq kms and lying between 22° 7' and 23° 18' north latitudes and 72° 15' and 73° 37' east longitudes. Except for a small part of the northern parts of Kapadvang and Balasinor talukas along the lower reaches of the Mahi River where the bank is cut by deep ravines. Kheda is an unbroken plain sloping gently from the northeast towards the southwest. This area is famous for agriculture and is known as 'Charotar' so called because of its suitability for intensive and varied crop production.

Alexander Kinloch Forbes, a British, said of the Charotar tract in the 19th

[50] Change in nomenclature has been made according to the instructions received under the Surveyor General's letter no. T-11998/958, dated April 4, 1968. The State govt. had appointed a small committee consisting of 3 members including the Director of Languages as chairman for suggesting the correct names of some places in Gujarat and hence the name 'Kaira' was changed to 'Kheda'.

century[51],

> "The fields are, in richer parts of the province, enclosed with strong and high permanent hedges, which, with the noble trees that everywhere abounds, render the country so close, that the boundaries of a field circumscribe the view, and unless the hum of voices, whirr of the spinning wheel, or the barking of the dogs gives him notice of its vicinity, the traveler may enter a village almost unawares. Hedges and trees here swarm with birds of many varieties, from the peacock to the sparrow, game of all kind is in great abundance, and monkeys rove about in troops, or rather in armies".

It is the richest agricultural zone of Gujarat and extends for about 80kms along the railway line from Petlnd to Nadiad[52]. Although the river Mahi has eroded the region greatly, the water and the alluvial deposits of the river make the region suited to the growing of the variety of cereals, tobacco, oilseeds and garden crops. The tract of Charotar is bordered on its South and East sides by the River Mahi. The wealth of the Charotar tract can be measured by the value its rulers have placed on it. The sultans of Gujarat reserved the tract for themselves, and during the Mughal rule either the Emperor or the important nobles took the revenues of the state. Under the British rule the tract of Charotar was one of the most highly assessed areas in India, with revenue fixed at five times the amount paid on the best black soiled lands of the Deccan[53].

The other region of the Kheda district, which is of ecological significance, is that of the Gulf of Cambay. The gulf coast has a geographical setting in which the sandy belts and a greater rainfall than other parts of the plain is prominent. The surface of the region has minor variations due to the deposition of the marine nature. Agricultural development is

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[51] David Hardiman, *The Peasant nationalist of the Gujarat, Kheda district, 1917-34*, Oxford University Press, Bombay, 1981.
[52] *Geography of Western Gujarat*, pg.200
[53] KapadvanjTaluka Settlement Report, Govt. of India, Bombay, 1895, pg.5

hampered due to the sandy and swampy soils. On the coast, one could see the flourishing mangrove vegetation.

There are nine rivers flowing in the district and of these two, the Sabarmati and Mahi are perennial. The river Mahi with a course from 300-350miles, drain an area of about 15000-17000 sq miles. It is the third largest river after Narmada and Tapti in Gujarat. The highly rugged banks of river prevent its waters from being used for irrigation. Mahi has acquired religious sanctity through ages. The river is regarded as a mother river by some tribe of Gujarat like the Kolis, Patanvadas etc. They believe in the supernatural powers of the river Mahi and according to a tribal saying, a guilty person always hesitates to swallow the water of Mahi.

The river Sabarmati rises in the southwestern spurs of the Aravalli hills. It traverses through Sabarkantha, Ahemadabad and then into Kheda. After its entry in the district the water in the catchment area of Sabarmati increases rapidly during the heavy monsoon. The northern part between the Sabarmati and the Mahi called the Sabarmati-Mahi doab is agriculturally very productive, industrially well developed and displays an excessive concentration of capital forming enterprises.

The soils of the district are classified into five main types;

1. The *Goradu* - this kind of soil is found in the Charotar tract of Anand, Nadiad, Borsad, Petlad and parts of Thasra and Cambay taluka.
2. The Black soil - it is found in Cambay and the Matar taluka.
3. Medium Black soil - it is concentrated in the Mehmadabad taluka.
4. Rich Black soil - this soil extremely suitable for cotton is found in the Bhal tract and the parts of Kapadvanj, Balasinor and Thasra.
5. Sandy soil - this soil is found in Kapadvanj and Mehmadabad.

The chief crops of the region are, Cereals, *jowar, bajri*, paddy and wheat.

The district is not very heavily forested except some forests in Vadasinor and Kapadvanj talukas, where teak, babul, *neem, mohwa*, and mango are main species[54].

The land is sandy, isolated and rocky. The trees are scattered presenting a barren landscape of the district. Deforestation and unscientific management of the forests in the past have been the main reason for the unsatisfactory growth of the trees of the area.

Gujarat thus is a state, which is known for its long history and varied ecology. South and Central Gujarat are having been rich in ecological treasures with high rainfall, good soil and enough water as compared to the region of Kutch and Saurashtra. However it can be said that if the unsustainable use of resources in the region continues on the name of development, situation would not be far away when the region will begin to experience the changes and scarcity faced by the north and western Gujarat.

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[54] *Kheda State Gazetteer*, Govt. of Gujarat, Ahemadabad, 1977, pg.26.

Appendix I A

PHASES IN THE ECOLOGICAL TRANSFORMATION OF THE INDIAN SUBCONTINENT

1. 100,000 BC - 5000BC.

Subcontinent covered by a population of hunter-gatherers with well-defined territories in more productive localities and nomadism in semiarid and arid zones.

2. 5000 BC - 1500BC

Annual husbandry and agriculture slowly replace hunting gathering over many parts of the country. Intensive agriculture in flood plains of rivers in dry tracts comes to support in urban civilization. There is gradual deforestation of semiarid and arid tracts.

3. 1500 BC - 600 BC

Immigration of Vedic people with knowledge of iron permits the agriculture colonization of the wetter river valleys such as Gangetic plains. Per capita cattle holidays decline so that ritual sacrifice of cattle becomes burdensome.

4. 600 BC - 800 BC

Completion of agricultural colonization of the subcontinent produces large surpluses making possible empires covering the subcontinent. Levels of surpluses decrease over time leading to a decline in trade and breakdown of empires.

5. 800 BC - 1800 AD

The subcontinent fully saturated by agricultural and pastoral populations with acute completion for natural resources. This is accompanied by the crystallization of caste society, which regulates this completion for natural

resources. This is accompanied by the crystallization of a caste society, which regulates this completion in a fashion that promotes ecologically prudent use of the natural resources. The caste society remains in an approximate equilibrium with the resource base of the subcontinent.

6. 1800 A.D. - 1857 AD.

The British conquest of India opens up the natural resources of the country to exploitation by an industrial civilization dependent on much more intensive use of resources. The farmers are compelled to produce raw materials for British industry and the forests taken over from communal control and exploited in a totally unregulated fashion.

7. 1857 AD - 1918 AD

The resources of the subcontinent are exploited in a more systematic fashion in the British imperial interests with continuing alienation of rural population from access to resources traditionally managed by them.

8. 1918 AD to date

The urban industrial sector in India begins to develop and makes increasing demands on the natural resources of the countries, which are exploited, in a non-sustainable fashion. At the same time more and more land unfit for the sustained civilization is brought under the plough by a rapidly increasing population of the sub-continent net result is serious loss of productivity of land over more than one-third of the country's surface.

Sources

M. Gadgil, "Towards an Ecological History of India", *Economic and Political Weekly*, vol. XX, 1985, pg.1911