CHAPTER 6

CONCLUSION

Gujarat is doing in Kutch what it does best; seeking a solution to all its problems through industrialization and wealth creation. And these efforts could bear fruit in a short time, with rich natural resources and a relatively good base of infrastructure. Even the State Government is leaving no stone unturned in making the district an ideal destination for industrial development. Just as a coin has two sides; a positive and negative, development also has 2 side effects. This chapter which concludes the study is divided into three parts - first part looks at the infrastructure available which help in making this place leading in industrial investment during recent time. The second and equally important part deals with the changes in environment and the level of degradation, the last part looks at the restoration work by Government authorities and reiterates the measures that should be undertaken to make this development sustainable.

INFRASTRUCTURE IN KUTCH

Kutch is the host to five important ports of the state, including the major port of Kandla apart from Mundra, Mandvi, Jakhau, Koteshwar and Tuna. The National Highway 8A and 13 pass through the district. The major trading towns of Gandhidham and Bhuj are connected by the broad gauge rail links. Beyond this, two functioning airstrips enhance the proximity of the district to the world.

Industrial Estates: There are 8 industrial estates in the district in addition to a Special Economic Zones (SEZ) at Kandla. These estates are equipped with all amenities like fully developed port and industrial sheds, uninterrupted power supply with well-connected approach roads. Presently, land is available in the estates like Bhuj, Anjar, Mandvi and Nakhatrana for non-polluting industries. In addition, Gujarat Growth Center Development Corporation Ltd has also developed a growth center at Bhachau over a chunk of 130 hectares of land which could be a good location.

Power: At Panandharo, a 215MW lignite based thermal power station is located, with recent addition of 75 MW lignite based power generation capacity. A 500 MW power plant at

Mundra and a 250 MW lignite based power plant at Akrimota are being set up, on the top of 36 substations of the Gujarat Electricity Board for the distribution of power in the district.

Water: An average rainfall in the district though low is about 325 mm. Besides, the Government of Gujarat has conceived a drinking water supply project with the Sardar Sarovar Narmada Canal as a source of water. Additionally, the proximity of the district to the sea can lead to the availability of desalinated water in the future. Currently, there are check dams, percolation dams and irrigation schemes to take care of the demand for water.

Ports: Kandla port, the largest cargo handling port in the country is concerned is located in the district. Mundra, a state of the art private sector port to handle large vessels is being set up by the Adani group. Mandvi, the intermediate fair weather port, Jhakau, a fair weather lighterage port along with smaller ports at Koteshwar and Tuna also dot the sea coast as shown in Map No 10.

Road: The district has roads totaling 550 kms 87 percent of which, almost 4812 kms. are surfaced roads. Kutch has the road density per lakh of population of 436 km – the highest in Gujarat, against the state average of 176 Km.

Railways: The total length of railways in the district encompasses 345 kms, Bhuj and Gandhidham being connected by broad gauge and the rest by meter gauge. The broad gauge link covers Bhachau, Chirai, Anjar, Gandhidham, Bhuj and Samakhiali as shown in map no 10. Additionally, the Gandhidham – Bhildi - Palanpur route envisaged to be implemented through a Special Purpose Vehicle (SPV) will provide a direct link to the cities of Jodhpur, Delhi and Bhatinda in Punjab. Plans are in pipeline to connect Mundra with Bhuj by rail lines.

Airstrips: The airstrips at Kandla and Bhuj connect Kutch to the air routes. Indian Airlines operates regular flight from Mumbai.

Communication: With 85,966 telephone connection and 210 telephone exchanges covering 622 villages, the district is well connected. Mobile phone services are also available at centres like Adipur, Bhuj, Anjar, Gandhidham, Samakhiali and Rapar. Also coming up is the fiber optic lines all along the district for better connectivity.

Banking: There are 183 branches of various banks in Kutch, covering on an average about 8339 individuals per branch.

Healthcare Facilities: With 5 Government hospitals, 137 primary health centres, 12 community centres and 251 health centres, the state government has made all support systems available for providing medical facilities to the people in this district. A state of – the-art hospital with an investment of Rs.100 crores (1000 million) is coming up in Bhuj, on the site of the old civil hospital, which was reduced to rubble during the January, 2001 earthquake.

Educational Facilities: There are 1482 primary schools, 159 secondary and higher secondary schools. There are various colleges in the district offering courses in Arts, Science, Commerce and Law besides courses in Engineering. Also, plans are afoot for a medical college at Bhuj.

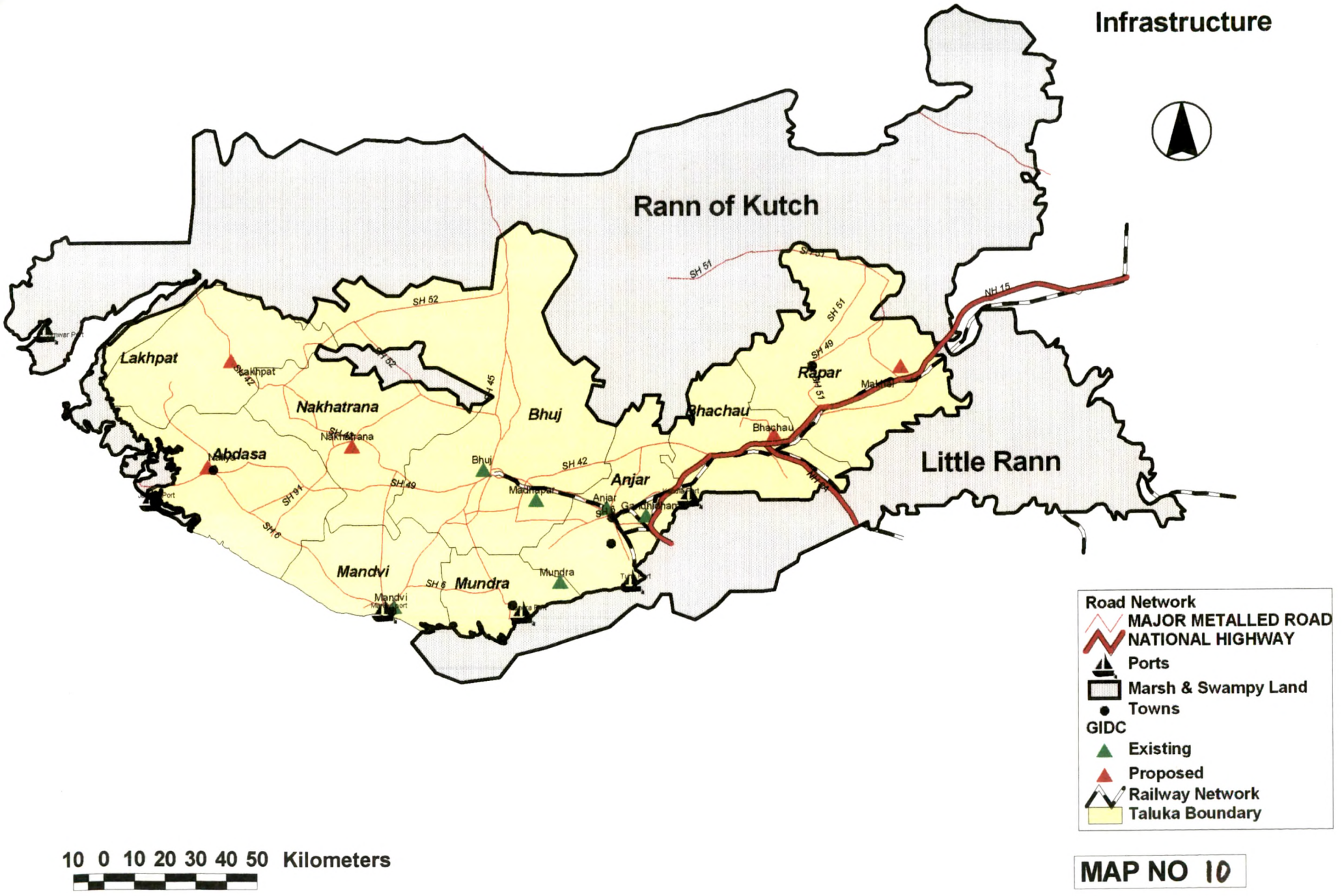
Industrial Development (Present Status)

Small Scale Sector: There are 4774 small scale units with an aggregate investment of Rs.121,140 million functional in the district of Kutch, engaged in the manufacture of food articles, paper and paper products, leather, rubber, chemicals, glass, ceramics, cement, non-ferrous metals, metallurgy, engineering etc as shown in the map no 6.

Medium and Large Sector: As on June, 2001, 25 industrial units entailing a total investment of Rs. 8830 million operate in Kutch. Most of these units are engaged in the industrial sector like minerals based products, chemicals, engineering, salt based, fertilizer, readymade garment, electricals etc. Besides, 89 projects with a total investment of Rs.92,400 million are at various stages of implementation. Once completed, these projects are expected to provide 17,115 employment opportunities through the manufacturing activities in the areas as diverse as alumina, cement and other mineral based products, salt and salt based products, liquid promine, soya oil etc.

TABLE 6.1 Potential Projects (An indicative list)

Engineering	Electrical	Chemicals (Subject to GPCB clearance)
Aluminum foils	Power & Distribution Transformer	Caustic Soda
Aluminum Wire rods	Turbines (Steam/Hydro)	Titanium Dioxide
Aluminum Rolled products	Telecommunication Cables	Pthalic Anhydride
LPG cylinders	Telephone Instruments	Acetic Acid
Wedded link chains	Switch Gear (Circuit breakers)	Paints, Enamel & Varnishes
Cranes	Insulated cables & wires	Organic Pigment
Lifts	Lighting, Fitting and Fixture	Reactive Dyes
Air & Gas compressor	Graphite Electrodes/Anodes	Toothpaste
Cutting Tools		Glycerine
Motorcycle	Pharmaceuticals	Phosphate Fertilizer
CI castings	Sulpha Drugs	
Hydraulic machines/Cylinders	Vitamin C	Leather Goods
Syringes (all types)	Vitamin A	Finished leather
Metallic utensils	Hair oil/Ayurvedic	Leather Garment
Monobloc Pumps	Contraceptives	Leather Goods
Medical/ Surgical Instruments		
		Plastic Processing
		Sheets (PVC/Rubber)
		Metalised BOPP Films


Infrastructure
Rann of Kutch
Little Rann
Lakhpat
Nakhatrana
Bhuj
Abdasa
Mandvi
Mundra
Anjar
Bhachau
Rapar
SH 52
SH 51
SH 49
SH 42
SH 45
SH 6
NH 15
Road Network
MAJOR METALLED ROAD
NATIONAL HIGHWAY
Ports
Marsh & Swampy Land
Towns
GIDC
Existing
Proposed
Railway Network
Taluka Boundary
10 0 10 20 30 40 50 Kilometers
MAP NO 10

Industrial Investment Opportunities

The district of Kutch offers ample opportunities for industrial activity in diverse areas. With one fifth of production of salt in India coming from Kutch, it offers bright prospects for salt based industries such as caustic soda, chlorine, soda ash, iodized salt etc. Similarly, abundance of minerals like Bauxite, limestone, lignite, etc. in the district, offers tremendous scope for promoting mineral-based products in the form of cement, alumina and host of other industrial products. Other industries and profitable activities which hold promise in this district include engineering, electrical, plastic processing, pharmaceuticals, chemicals, leather goods, port related activities, information technology and service sector.

Tourism Potential

Kutch with its resplendent beauty has major attraction for tourists across the world. With its rich heritage and handicrafts, Kutch harbours the remains of a bygone era at Dholvira. The "Vijay Vilas Palace" at Mandvi, the flamingoes of Kala Dunger and the revered temples of Narayan Sarovar, Koteshwar, Bhadreshwar etc. make the district a tourist attraction. There is an immense investment potential for hotels at important industrial and tourist centres in Kutch.

Thus, for an investor with sharp business acumen, Kutch is the ultimate destination for future investment plans, thanks to the blend of investor-friendly schemes and conducive business environment. Kutch - a land that has witnessed a glorious civilization in the past will also hold the same awe for business in the future.

And it appeals to investor "Come, explore the vast opportunities waiting to be tapped and be a part of Resurgent Kutch.

CHANGES IN COASTAL ENVIRONMENT: A SUMMARY

Introduction: The Gulf of Kutch (22 °15 to 23 °40 N) and (68 °20 to 70 °40 E longitudes) is the largest inlet of the Arabian Sea, about 60 km at its widest point, tapering north-eastwards for 170 km. The coastline and the intricate network of 42 islands in the Gulf form an assemblage of a unique sensitive ecosystem. The mangrove, coral reefs and other associated ecosystem in the Gulf support more than 800 species of different organisms.

Recognising the importance of the coastal marine diversity in the Gulf of Kutch, the Government of Gujarat has declared an area of 457 Sq. km. as Marine Sanctuary and 162 Sq. km. as Marine National Park, the first of its kind in India

The highly productive ecosystem of the coastal areas of Gujarat is critical for the economic development and the social life of the area. According to one estimate, during 1993-94 the export of fish and its products was worth around Rs.275 crores. However, the environmental degradation due to poor planning and resource management is rapidly destroying the ecosystem and threatening the resource for the present and future generations. Moreover, a number of ports and jetties are also being developed in coastal Kutch. It is therefore vital to ascertain their effects on the already fragile coastal ecosystems.

The expanding population, urbanisation and rapid coastal development would increase the pressure on the coastal resources, resulting in habitat destruction, marine pollution and diminishing resources. The loss or degradation of coastal ecosystem such as mangroves, coral reefs and sea grass will present more than just a loss of habitat problem. The ecological contribution of the habitat will be completely lost, leading to a negative effect on the other living resources linked to food chain of the ecosystem.

It must be stressed that sources of pollutants entering the coastal marine environment are not limited to direct discharge, but also include the inland 'catchment area'. For example, atmospheric fallout of pollutants such as lead, PCBs and nitrogen form major source of input into coastal water. Nutrient over-load from untreated sewage, agricultural run-off, erosion and other land-based sources have been identified as the serious cause of coastal pollution worldwide. Further, the direct correlation between poor land use and increased erosion has been clearly established. However, the potential deterioration of coastal habitats owing to the variations in the sediment and silt loads in coastal water may not have been fully realized. Despite this, it appears that increased turbidity of coastal waters and the consequent damage to coral reefs and mangrove is one of the gravest threats to the ecosystem of coastal Kutch. Marine habitat is also adversely affected by cutting of mangrove forest for fuel and fodder and by dredging for channels and ports.

A study of the major reasons for degradation of coastal area is warranted, before further analysis of its effects.


Administrative
Lakhpat
Nakhatrana
Bhuj
Bhachau
Rapar
Abdasa
Anjar
Mandvi
Mundra
SH 52
SH 42
SH 49
SH 51
SH 6
SH 91
SH 45
NH 15
Marsh & Swampy Land
Railway Network
Road Network
MAJOR METALLED ROAD
NATIONAL HIGHWAY
Taluka Boundary
10 0 10 20 30 40 50 Kilometers
MAP NO II

Large Population: It is observed that industrial development in recent years in Kutch has resulted in large demand for manpower in industrial houses and major ports leading to large-scale migration from other parts of Gujarat as also other states. This is in line with one of the objectives of the study as well. The impact on the already pressurised coastal area is significantly higher when the population is high as it adversely affects the landuse patterns, resulting in the degradation under certain conditions. The density of population in the desert region of Kutch (54 persons per sq.km.) is much lower compared to other coastal districts of Gujarat, but the coastal region has much higher population density compared to the district as a whole (28 persons). Moreover, the decadal population growth rate is also higher in this district (+20.22) compared to the State average. And Anjar Taluka witnessed a high decadal growth rate of (+38.58 persons) as already shown in the last figures given in third chapter.

Large Industrial Houses: A 2.5 million tonne-per-year integrated cement project, being put up by the Hyderabad –based Sanghi group, conceived at an estimated cost of Rs.664 crores has already jumped to Rs.775 crores. Additionally, the group plans to build a captive jetty and undertake limestone mining along the western coast of Kutch district, which has resulted in many controversies.

Examining the environmental viability and sustainability of the project, National Environmental Engineering Research Institute (NEERI), Nagpur is satisfied about the economic efficiency and endogenous choices of the project but "not satisfied" as regards to ecological harmony.

In a report submitted to the Supreme Court of India, the NEERI has taken strong exception to the different central and state government agencies - including the Central Ministry of Environment & Forest and the Gujarat Pollution Control Board for giving clearance to the project without undertaking a regional 'Environmental Impact and Risk Assessment' (EIRA) study.

At the same time, the report has taking strong exception to the denotification of a large part of the Narayan Sarovar Sanctuary, whose area was reduced from 765.79 sq km to 444.2 sq km by the Gujarat Government in July 1995 to allow the Sanghi project, observes 'the move is not conducive to the ecologically harmonious development of the region'.

A recent report prepared by the Office of the Conservator of Forests, Kutch Circle, Bhuj has also strongly objected to some of the construction activities undertaken by the Sanghi group in the 'ecologically vulnerable region' of Kutch district's Abdasa and Lakhpat taluka's. It observes: 'Several parts of the company's area fall within the boundaries of the reserved forest of Golai and Western Mangroves'. While pointing out that this amounts to 'large scale encroachment and irreversible damage by the Sanghi Cement Company within the boundaries of the reserved forest,' the report blames the 'non-cooperative attitude of the District Collectorate, Kutch, in the matter'*

The report further observed that the Sanghi Group has not produced 'any authentic document' to the Forest department to obtain the ecological clearance for undertaking any construction activity in the area. The only document that the company has produced is a 'copy of the order' allowing the construction of jetty related facilities, from the Bhuj Collector's office mentioning sanction of 250 hectares of land which is un-surveyed and out of coastal areas of Gunav village, Lakhpat taluka.

A detailed Report on the 'Unauthorized Encroachments on Reserved forest lands by the Sanghi Cement Company' points out that the forest department had to collect and collate ground-level information in view of the fact that the company had, 'not submitted' a copy of its Project report mentioning socio-ecological details to the forest department and 'no clearance was obtained from the competent authorities'. And the company is working within the reserved forest areas of Western Mangroves near Akri village.

The Report presents the following details of Sanghi Cement Company's alleged encroachment on the forest land:

- The main site at Moti Ber in Abdasa taluka is a 'Non Forest Area.
- The mining area (proposed) at Jadva village in Lakhpat taluka is also a 'Non Forest Area'.
- The road connecting the site, mining area and the jetty 'passes through the part of Golai reserved forest areas at several places' both in Abdasa and Lakhpat talukas.

*Shah,Rajiv,7 December 1996,*Forest Department Document indicts Sanghis for Encroaching upon reserved land,*Times of India,Ahmedabad.

- The jetty near Akri village in Abdasa taluka is 'situated within the boundaries of the Western Mangrove Reserved Forest'.
- And the platform 'right into the deep water of a creek also falls within the boundaries of the Western Mangroves Reserved Forest'.

NEERI has provided the following reasons for classifying the Sanghi Project 'ecologically unviable':*

The site clearance for limestone mining (captive mine for the Sanghi Cement company) was granted despite the fact that the mine is contiguous to the Narayan Sarovar Sanctuary.

The 1985 guidelines on siting of industries viz. minimum distance from the sanctuaries as 5 km, was overlooked by the Ministry of Environment & Forest, while granting the site to the Sanghi Cement plant on November 7, 1996.

The Department of Forests and Environment, Government of Gujarat granted the clearance for the jetty, approach road to the jetty, a pipeline, a captive power plant, transmission lines etc, 'despite the fact that the above activities are to be carried out on an island within Coastal Regulation Zone (CRZ) and is surrounded by thick mangrove forests which are ecologically sensitive'.

Regarding the failure on the part of the Sanghi Cement Company to carry out a Risk Assessment exercise, the report observes that while preparing for the jetty, hazards due to dredging, adverse cyclonic and weather events, seismic risks, collision, fire, machine sinking, accident due to navigation and communication, failure and sabotage have been overlooked and even disaster management and emerging preparedness was missing. The region is riddled with 'scarce groundwater resources and very low precipitation' hence cannot support project induced growth.

The observations in the NEERI Report appear reasonable and it is likely that the project as a whole is and would affect mangrove growth in the region. This study supports and agrees with the report when it observes that 'Premises, preconditions and agenda for sustainable development were overlooked by the concerned State and Central Government agencies'.
*Shah,Rajiv,18 December 1996,*Sanghi Project is Ecologically Unviable,*Times of India,Ahmedabad.

Private Jetties:

Kutch is home to six important ports, including the major port of Kandla, the other being Mundra, Mandvi, Jakhau, Koteshwar and Tuna are located. Despite this, the private companies are averse to utilize the Port trust jetties, mostly owing to the perceived bureaucratic problem which impede the movement of their vessels. There is a big plan by six cement companies – Sanghi, Anjan, DLF, ABG, ABIL & GLTC - to come up with private jetties along the coastline between Lakhpat and Abdasa taluka. The project by Sanghi industries at the Khauthar Island in Kharo creek is currently under implementation.

The site of the jetty on Khauthar is a 'rich ecosystem' with several rare species of flora and fauna, including 17 Schedule I species of the Wildlife Protection Act, 1991, and operation backup activities of the jetty are situated four kilometer into the Coastal Regulation Zone. Once the jetty is operational, dredging and desalination operations could be the source of the destruction of west Mangrove Reserve Forest Area. A Report by Saurashtra University titled 'Coastal Marine Ecosystems and Anthropogenic Pressure in the Gulf of Kutch' observes that a six kilometer patch of mangrove is barely 200 meters away from Khauthar, one of the largest patches of mangrove on the coastline, which makes up three percent of the total mangrove in the Gulf of Kutch.

The Survey of India toposheet map, satellite pictures and the physical verification of site as confirmed by local Maldharis show that "Khauthar is an island (that means island in Kutch). It indicates that the water at high tide travels through the Kharo creek and around the Khauthar and reaches the east of Khauthar, 4 km ahead of where the Sanghis have shown the high tide level (HTL).

The operations by Sanghi group have adversely affected the mangroves east of Khauthar Island. Further, their Project Report states that dredging operations will be carried out along Kharo Creek for 25 Km from the sea mouth to allow the transportation of vessels to the jetty. This is likely to affect the breeding pattern.

The report also states that waste-water having brine (salt) content of approximately 68,000 ppm is to be discharged from power plant and desalination plant into the Kharo creek after 'extraction of approximately 5500 (550 tankers) of potable water per day'. This will be diluted with sea water and not fresh water, which could lead to an increase in the salinity by

500 to 7000 ppm per day in the creek. This salinity build-up could be disastrous for the mangroves, only 200 meters away from the mouth of the discharge pipe.

Moreover, the jetty will provide employment to only 19 highly qualified persons, none of these locals as they are not qualified.

The conclusion that when Port Trust of India is planning to develop and upgrade the ports at Mundra, Mandvi and Koteshwar and Jakhau, there is no reason for private jetties to come up in areas involving 'destruction of mangrove forest' is supported by environmental scientist Asad R Rahmani, who chairs the prestigious center of Wildlife and Ornithology, Aligarh. He observes that not only the mangroves forest but also the scrub forest will be destroyed or degraded by the road from the industrial plants and the jetties with some of the 'rarest animals' of India, fully protected under the Wildlife Protection Act, being adversely affected.

It is however noteworthy that the Honourable Gujarat High Court has disagreed totally with findings of NEERI and has opined that neither the cement project nor its adjuncts (jetty and sea water desalination plants) constitute a threat to the ecological balance of the areas surrounding the project or to Kutch itself in any manner. Moreover, Kuwait and Dubai are also international geo-morphology Zones similar to Kutch. But both have become global economic centers through industrialisation of their oil reserves.

Adani Port:

Gujarat Adani Port Limited (GAPL) in Kutch was dedicated to nation on January 23, 2000. This is the approval of 'systematic degradation' of one of the last arid mangroves forest in the world, as per the scientists at the Gujarat Institute of Desert Ecology (GIDE), Bhuj. Already, a 100 sq.km. stretch of rare mangrove forest in the Kutch area has been destroyed in four years to facilitate the port and the container terminal.

The forest unique in India, are vital since they are one of the few remaining pockets of vegetation which can survive in arid and saline conditions. The mangrove, says the Marine and Water Resource Division (MRD) of Indian Space Research Organization's (ISRO) Remote Sensing Application Centre, are crucial for the following reasons.

They're the primary nursery area for several commercially - important fish species. They are also a vital nursery for other species that are key links in the food chain.
Mangrove stablises shorelines and the banks of rivers and estuaries, offering protection from ocean currents and cyclones.
At least 31 species of flora and fauna in the belt could be destroyed by the clearing of the mangroves.

ND Chaya, Ex-Commissioner, Fisheries, Gujarat, says the area generates some 8 lakh kg of fish per year in a 10 month season with a local value of Rs.45 crore. The entire market economy is estimated at Rs.1200 crore.

These were strong reasons for not granting clearance to the port. Various feasibility reports which largely went against the Adanis, one of the India's fastest growing industrial houses were ignored. So were the Environmental Impact Assessment reports that classified the area as CRZ-I (Coastal Regulation Zones) where Central Government laws prohibit land development.

Even ISRO with GIDE had pointed out the alarming decrease of mangrove cover in the proposed port area. But the report was ignored, says an ISRO official.

The Adani's vehemently deny that their company has had any role in the mangrove destruction but the feedback from locals is that vested interests were cutting them down and once a tract was made bare, the Adani's would move in and claim the land since it wasn't forested.

Similarly there is no explanation for the cement bunds that have sprung up along the Kutch coast that have starved the mangrove forest of vital seawater. As a result more forest land is wiped out, making it a bare tract ready for development. For this, the Adani's explanation is that 'most of the construction/operations are being carried out by our contractors. We don't have control over their decisions'.

The Adani's, it is alleged were penalised by the forest department in 1996 for cutting mangroves. In October 1998, it is further alleged mangrove were cleared on a large scale from Navinal island to meet the criterion that there was no vegetation in the area. ISRO's study, based on the images it has collated over the years from its remote sensing satellite reveals the mangrove cover has fallen over the years. Another allegation of human

displacement was also reported. In their zeal to remove all hurdles to the fast track project, it is said some 500 fishing families were evicted from Navinal Island to prove the development activity was being carried out in an uninhabited area. Locals said that 'officials' from Adani Group of companies ousted their families, almost overnight from the Navinal island where they had settled for decades. In fact, they first occupied the land under the Sultan of Kutch. The Adani official, however said that a 'few fisherman who were staying near the port have relocated themselves on their own'.

Earlier, arid mangroves forests yielded a rich collection of fish eggs and larvae. Now, there is no fish breeding at all around the land reclaimed by GAPL and a new road runs through the site of mangroves. It is not just fisher folk who are affected, farmers are equally concerned. Contrary to public perception, Kutch isn't only desert. There is a thriving green belt that produces mainly fresh dates - Kharik, the only one of its kind in the world. Horticulture, orchard and animal husbandry is also thriving.

There are allegations of indiscriminate reclamation and acquisition of farmland by the Adanis. Farmers tempted to sell out now find themselves without a sustainable means of livelihood, says Sandeep Virmanni* of Forum for Planned Industrialization of Kutch (FPIK). 'This is a battle of one economy versus another. Traditional economies are being destroyed in the name of industrialization'.

GIDE Director Y.D Singh *says, 'The kind of industrialization that is going on in the traditional mangrove regions offers no equity at all. If the forest were to be left as they were, the equity comes to all. Almost 1.4 lakh fishermen would have got a piece of the Rs.1200 crores that the area used to generate annually'.

*Virmani ,Sandeep,31 January,2001,*Industries have been Axing the Mangrove,*Outlook,Page 20.
*Singh,Y.D,31 January,2001,*One of the last Arid Mangrove Forest in the World,*Outlook,Page 18

However, locals are not against industrialization. While the FPIK identifies areas where salt pans, power projects, oil refineries, cement and other planned projects could come up

(closer to the Rann with some help from Railways), others hope new projects will also generate employment. They are concerned about the indiscriminate industrialization, which is environment unfriendly and could dry out the 20 percent green belt of Kutch. Since no local employment is generated, their means of livelihood could be completely destroyed.

Degradation of Coastal Area

A Coastal zone is the area of interaction between land and sea and also includes both terrestrial as well as marine resources, both renewable and non-renewable. Interactions between the various natural processes and human activities are also important factors in the coastal area.

The coastal stretches of bays, estuaries, backwaters, sea, creeks etc which are influenced by tidal action upto 500m from High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL have been declared as Coastal Regulation Zone (CRZ) by the Government of India.

Certain activities such as construction, mining, reclamation etc. as also setting up and expansion of certain industries have been restricted or prohibited in the CRZ to manage the development with a view to offset impact of growth. Research organisations are making efforts with the help of satellite imageries to evolve a long-term solution. These are discussed below.

Land-Use/ Wetland Mapping For Coastal Regulation Zones of Gujarat
(ISRO & Other Satellite Reports)

Space Application Centre, Ahmedabad is the nodal agency which provides necessary data and technical guidance in finalization of the maps, accuracy checking and final report preparation. The details given by these agencies are included in this study to demonstrate how the process passes through different phases. The participating agencies viz. Gujarat Engineering Research Institute (GERI) Vadodara, Directorate of Geology & Mining and School of Planning have been actively involved. The main objective of this project was to delineate wetland features between HTL and LTL and land use features upto 500 m from HTL on 1:25,000 scale using mainly IRS (Indian Remote Sensing) LISS II and SPOT data.*

The main emphasis was on vital/critical habitats, tidal wetland, industrial activity, built up land, reclamation, sand /rockmining and construction activities. Firstly they classified the CRZ into four catagories. The first two categories represent developed area close to the shore - mainly urban or built up area. Last two categories are undisturbed areas, which do not belong to either category I or II.

In this classification, vital/critical habitats, reclamation and built up land were the critical factors. Level III classes were identified mainly for built up land category (See Table 5.1)

The satellite data of Dec-February was chosen in most cases to take care of reproductive cycle of vegetation present in wetland areas. The scale of 1:25,000 was chosen so that an area of at least 0.25 ha (2X2mm) can be mapped. Another consideration was the mapping of land use features in 500m strip from HTL. A 500m strip will cover 2cm strip on 1:25,000 scale map and it would be easier to delineate various categories.

Table 6.2 Classification System for Land-use Mapping

Level I	Level II	Level III
Agriculture land	Natural	
Forest (Non Tidal)	Man Made	
Wet land	Estuary lagoon, Creek, Backwater, Bay, Tidal Flat, Mud Flat, Coral reef, Rock coast, Mangrove Forest	Dense/Sparse
Barren Land	Sandy area/ dunes, mining area/ dumps, other (rock out crops, gullied, eroded, badland)	
Built Up Land	Habitation, Habitation with vegetation, Open / Vacant land Transportation	Roads Railways Harbour Airport
Other Features	Reclaimed area, salt pans, Aquaculture ponds / lakes Rivers/ Streams Drains/ Outfall/ Effluent	
High/Low Waterline,		

*Nayak,Shailesh &Bahuguna,Anjali,*Land-use/Wetland Mapping for Coastal Regulation Zone of Gujarat,*Space Application Centre,Ahmedabad,Gujarat.

The Survey of India (SOI) topographical maps on 1:50,000 scale were used as base maps These maps were enlarged to 1:25,000 scale. Satellite data were enlarged to 1:25,000 scale using either a High Magnification Enlarger (HME) or PROCOM.

High Tide Line (HTL) was delineated first. The HTL has been defined as the farthest point of land where the tide reaches at Spring Tides. Apart from this, presence of mangroves/ mudflats, beach etc. was also taken into account. It is difficult to draw LTL from Satellite image, except where the image belongs to low tide conditions. So normally land water boundary is delineated. The CRZ boundary were delineated next .The various wetland categories were delineated between HTL and Land-water boundary and coastal land use categories in the adjoining strip of 500 m based on the image interpretation key.

Results:

About 238 coastal land use/ wetland maps at 1:25,000 scale, covering the entire Gujarat coast have been prepared. The entire coast is under pressure due to setting of large industries at many places. Mangroves and coral reefs are two vital habitats, which are threatened especially in the Gulf of Kutch area. Mangroves are existent in Gulf of Kutch and Kori creek region, though their distribution is sparse.

Mud flats occupying large area have been mapped in the Gulf of Kutch. They are the natural habitats of mangroves, marsh, algae and act as a nursery for various species of crabs, prawns, fishes etc and therefore are one of the important habitats of the coastal zone. Due to their water retention capacity, they have been exploited for agricultural purpose and for the construction of water brackish water Aquaculture ponds.*

They have also been converted into large scale salt manufacturing plants, in Kandla, Gandhidham and Mandvi. The coastal landuse mapping using IRS_LISS and SPOT data at 1:25,000 scale has helped in extracting detailed information of the coastal zone. And recently available IRS IC/ID Panchromatic and multi spectoral LISS data, more information can be extracted for built up land (industries, open space etc.) mangrove and coral reefs.

NOTE: As Kutch is a restricted area, the imagery has not been attached.

*Nayak et al 1992-Coastal Environment, Scientific Note, Space Application Centre, Ahmedabad. 114p.
Nayak et al, 1991, Manual for Mapping of Coastal Wetland landforms and shoreline changes using Satellite data, Technical Note, SAC, Ahmedabad.

Lack of Policies for Mangroves:

Environmental degradation leading to large scale changes would not have occurred, had appropriate policies been adopted in time. From interactions with rural folks and local people who were long-time residents of the region, it was clear that the lack of concrete policy framework had a negative impact.

Mangrove was cut not only for industrial uses, but also for firewood - they are good source of firewood and can be used as fuel even when wet.

Since their leaves are a major source of protein, mangroves started disappearing when camel owners found them as a useful fodder for the animal. And real destruction came when the trees started being cut by commercial interest as the soft wood is used for manufacturing different items, including toys.

The salt industry does not seriously follow any policy directive and large number of salt farms existed along the coastal area, particularly in Bhachau and Anjar.

Cutting of mangroves has also taken place because, says Naishadh Shukla* (A team member of study on 'Coastal Area Development Programme: Issues, Concerns and Action Plan' very little of coastal land is under the forest department. Most of it is revenue land and protecting the ecological quality of the land is not the mandate of the Revenue Department.

And Forest Department at most of the places has preferred growing the wild babul (or Gando bawal) which spreads like wildfire at the cost of other vegetation.

*Shukla,Naishadh, 5 june,1996,*Lack of Industrial Policy Framework Leads to Eco-Degradation,*Times of India,Ahmedabad.

While this tree is preferable where no other vegetation is possible, as it provides fodder to the buffaloes and goats besides fuel wood to the villagers, in other areas it has only affected the existing vegetation.

Table 6.3 Mangrove Area of Gujarat (By ISRO)

1980	400 sq.km.
1987	260 sq.km.
1992	158.8 sq.km.

Source: Times of India, Ahmedabad

It is clear that the fall has been sharp and has continued unabated and significant Government intervention for restoration could only give positive result.

Other Problems

Sea Ingress

Removal of mangrove trees along the coast has led to the sea- ingress in the land area in the immediate vicinity. The trees not only prevented sea- ingress, they allowed the coastal water to remain pristine allowing unique sea life to survive near the shore. The mangrove weedish roots in the sea coast helped brackish waters on the coastline where different species of fish would lay their eggs. However, because of the large-scale cutting, some of the rare species found along the coast have simply vanished. Also, large areas of grasslands including such useful medicinal plants as Piloo which grew naturally and once formed an important source of fodder for the cattle and goats next to the mangroves have been destroyed because of the sea-ingress suffered by different areas.

Government efforts to put barricades to stop sea ingress have been short-lived, as they are washed away whenever powerful sea waves lash the coast. Substantial sea invasion in coastal areas can be observed as despite repeated demands to built concrete barricades, only ad-hoc measures were taken. As a result, the saline land made productive after considerable effort once again became arid with another sea intrusion in early years.

Measures/Steps which should be taken to avoid further Damage:

- Development should be in consonance with the environment.
- All projects should follow Environment Impact Assessment.
- All private companies and concerned authorities should follow the norms, and check all the details and their after-effects before granting permission.
- Reforestation of the mangrove and the habitat in areas which are not completely destroyed
- In future, greater effort should be undertaken to prevent such cases of degradation
- Coastal Zone Management should be implemented to ensure a rational development of the region and judicious use of its resources, consistent with the surrounding ecosystem and environment. Environmentally effective coastal zone management depends upon accurate and comprehensive scientific data, based on which policy decisions can be made. One of the basic problems confronting our country is limited availability of geographic data on coastal area. Remote Sensing data is an effective tool owing to its repetitive multi- spectral and synoptic nature, and provides useful information like conditions, mangrove degradation, coastal landforms, shoreline changes, tidal boundaries, oil pollution, suspended sediments dynamics etc. The data is available in spatial as well as non-spatial formats and thus difficult to integrate conventionally. A powerful tool to assemble, analyse, store, utilize, retrieve, manipulate scientific and technical data is Geographic Information System (GIS). The data should be integrated along with secondary data using GIS to provide input for coastal zone management.
- A regional survey on environmental and social impact due to industrialization should mandatory before providing clearances.
- Integrated Coastal Zone management should be implemented. It is relatively a recent concept, which aims to utilize the natural resources in perpetuity, by periodically taking stock of the environmental response to use and harvest pressure and incorporate such indices in planning and implementing economic development. It is a dynamic process by which a coordinated strategy is developed and implemented for the allocation of environmental socio-cultural institutional resources to achieve conservation and sustainable multiple use of the coastal zone. It involves an integrated, multi-disciplinary approach requiring trained personnel.
- Restoration is the need of the hour, as large-scale degradation has taken place. There are many areas which have been identified for restoration and regeneration. Mundra mangrove reserve forest and the Jakhau area in the Gulf of Kutch have been identified

as specific mangrove sites, by Gujarat Ecology Commission (GEC) and would be supported by the India-Canada Environment Facility (ICEF), subject to the approval of the Government of India. Unfortunately, as observed by an NGO working in the Mundra forest, opposite is happening. The State government has recently de-notified an area as mangrove and has in fact allowed construction activity; thereby further destabilizing the ecological balance of the area. Thus, effective and positive Government intervention is necessary to ensure that the area remains either a reserve forest or barren land.

CONCLUSION

During the last two decades or so, the contribution of different sectors has undergone a striking structural transformation in Gujarat state as a whole. The contribution of agriculture sector to State's GDP declined from 41 in 1980 to 26 percent in 1995, while the share of industrial sector has increased from 27 to 35 percent and that of the tertiary sector from 32 to39 percent. In Kutch region, the proportion of non-irrigated land still remains 'as high as 60 percent' and cultivable waste land is 66 percent in this region. This being a desert region, the area not available for cultivation is also 72 percent of the total area of the coastal region around the gulf.

At the same time, Kutch is leading the industrial development also, not withstanding the recent earthquake of January 2001. In fact, post- earthquake the industrial activity has become stronger and more vigorous. As on July 1995, there were 2258 projects under implementation worth Rs.89,973 crores in the state and 29 percent of the investment was to be located in the coastal talukas around the Gulf of Kutch and was expected to generate direct employment for 58024 persons.Given in Annexure 1.

The study *Hypothesis* that the development of Kutch is due to its large coastline can be considered as proved. As discussed earlier, the region of Kutch which was perceived as barren or dark zone due to its natural conditions is now developing due to its coastline.

Another *Hypothesis* that all development is unviable is not proved. It is felt that though a few projects like Sanghi, Adani (discussed in detail earlier) have contributed to large-scale destruction of patches of mangroves and have disturbed the only means of livelihood of local people, these projects can be boon for local people. However, these industrial houses would need to adopt ways and methods which lead to sustainable development for future

generations to enjoy the fruits of development without destroying the natural resources and eco-restoration project should be implemented with full strength so that lost forest canopy can be achieved and it should be maintained. As it is already started with the World Bank in Kutch.Gujarat has been selected by the World bank for implemantation of Rs 40 crore project on environment.And half the cost, ie Rs 20 crore has been already provided to the Gujarat Ecology Commission(GEC).The main thrust would be restoration of the Rann of Kutch by undertaking study and experiments that included bio-diversity,management of coastal areas and wet land .This WB aided programme would also cover environment and public awareness aspects.*

And Development should be like as in Kuwait and Dubai which are also geo-morpholgy zones similar to Kutch.But both have become global economic centres through industrialisation of their oil resources.

* Shah,Hasmukh,Eco-Restoration Project in Kutch with WB help,Times of India,Ahmedabad.

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