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PLANNING FOR ENVIRONMENTALLY SENSITIVE NATURAL HABITATS IN A METROPOLIS : A CASE STUDY OF MUMBAI

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ABSTRACT : The deterioration of the city habitat has reached an alarming situation in recent years, given the polarisation of population in metropolitan centres. The converging forces of population, urbanisation, technology and environment have come into serious conflict. This is particularly relevant in a crowded urban environment like Mumbai, a city with an area of 437.71 sq.km. and an estimated population of 9.91 million in 1991. Brihan Mumbai (Greater Bombay) comprises Mumbai City Island and a greater part of Salsette Island. The City Island has developed to its full potential with no extensive tracts of natural habitats. In Salsette, however, such areas still account for 41.7% of the region and include large portions of inter tidal coastal stretches and the national park located in the central Salsette hill complex, both of which sustain precariously balanced ecosystems and are of vital significance for the physical sustenance of the urban eco-system. The paper examines the changes that are taking place in these areas, the associated problems and suggests measures that may be adopted for conservation.

INTRODUCTION

Mumbai, the Urbs Primus of India has grown from a number of small dispersed fishing hamlets to the largest metropolis in the country in a span of about three hundred years. The rapid growth of population has been accompanied by radical changes in its physical attributes. The city has been built on two groups of seven islands each, southward of the Ulhas estuary. The southern group of islands was known to Ptolemy in AD 150 as Heptanesia while the northern group was called Salsette. The development of Mumbai as a commercial centre began in 1668 when the British who gained control of the islands from the Portuguese appreciated the importance of its strategic location on the shortest route from the West and accurately gauged the potential of its excellent harbour facilities. By 1686 they had shifted the trading headquarters of the East India Company from Surat to Mumbai. The nucleus of the modern city was founded in the exrtreme south of the southern group of islands from where it spread northwards. Associated functions such as shipbuilding were added to the city. This resulted in a rapid growth of population and the city expanded from 10,000 around 1629 to 70,000 in 1744. Reclamation played an important role in the enhancement of land resources in the city as it gained in population and functions. The original seven islands were slowly merged into a composite large island. The construction of the railway line connecting the port with its hinterland in 1853 not only gave an impetus to the port activities but also laid the foundations of industrial development in the city. The first textile mill was established

following year, in the low-lying central area which has since been reclaimed. The expansion of the functional base resulted in large scale immigration into the city.

The development of an efficient rail transportation system also spurred the horizontal spread of the city. Large scale suburbanisation resulted in the amalgamation of the Salsette group of islands. Thus pressure on land and demand for space resulted in a change in the very character of the city from an archipelago to a consolidated extension of the mainland.

Continued accretion of functions in the city resulted in a continuous stream of inmigration which continues unabated even today. The tremendous and explosive growth has resulted in a host of environmental problems which is threatening the sustainability of the metropolis.

STUDY AREA

The study area is restricted to the coastal zone and the verdant central hill complex of Salsette, both extensive areas of natural habitats. The coastal zone which comprises 23.2% of Salsette has been demarcated as the area from the low tide line to the major transport artery, while the central hill complex, comprising 18.5% of Salsette has been delineated along the 40m. contour above which there is a marked increase in gradient and which coincides with the forest cover.

OBJECTIVES

The present study attempts to

1. Examine the physical characteristics of the study area highlighting their ecological significance.
2. Determine the changes in land use/land cover that have taken place over time.
3. Bring out the deviations in land use patterns from those designated as per the development plans.
4. Identify the problems associated with development in these areas.
5. Suggest remedial measures which could be applied to contain further environmental degradation.

METHODOLOGY

The methodology followed is a systematic analysis of maps and imageries in a temporal framework coupled with field surveys.

PHYSICAL ENVIRONMENT

The relief of Salsette is dominated by a central hill complex with two southward protruding ridges, enclosing a horse shoe shaped valley; a foothill debris slope extending into the tidal lowland which is mostly reclaimed; alternating rocky headlands and pocket beaches along the western front breached by Malad and Manori creeks and an intertidal belt on the eastern fringe adjoining Thane creek.

The major transport arteries have a north-south orientation on either side of the central hill complex. The built up areas are aligned along these transport axes leaving the land use/land cover of the central hill complex and large parts of the coastal zone relatively less disturbed.

The coastal zone

The features dominating the coastal zone are :

- Vast intertidal areas characterized by a gentle gradient and a wide tidal range (spring tide : 3.6m, neap tide : 1.5m) situated along both eastern and western coasts with a small patch to the south. Mangroves, mudflats and salt-pans are observed here.

- Rock shores and sandy deposits along the sites open to marine action giving rise to wave-cut platforms and beaches.
- Network of creeks and drainage channels in the vast littoral zone.
- Hilly areas in the eastern coastal zone which are generally forested and have steep slopes on the eastern flanks.
- A few settlements comprising the gaothans of old fishing villages, e.g. Vesave, Madh, Marve, Manori, Eksar, Charkop in the western coastal zone.

The central hill complex

The central hill complex rises to elevations beyond 450m. terminating in conical peaks at Kanheri and Shendur. The central horse shoe valley was drained by Mahim river. This has been dammed in its upper reaches to accomodate three fresh water lakes-Tulsi, Vihar and Powai. Climatically the area enjoys an equable, maritime thermal regime ranging between 23 and 32 deg. C. Precipitation received during the South West monsoon is about 2000 mm. As a sequal to the short humid period of water surplus and a longer dry period with a pronounced water deficit, the natural vegetation of the area comprises moist deciduous forests interspersed with pockets of the semi-evergreen variety. Both these areas are fragile, delicately balanced eco-systems.

ECOLOGICAL SIGNIFICANCE

The coastal zone

- has mangroves that act as a life support system for a key group of detritus consumers which in turn are food for crustaceans, fin-fish, filter feeders and higher order animals. The region is an ideal nursery for species which are brought in with the ideal currents and grow repidly here because of abundant food supply, before returning to the sea for spawning. They are also areas where some species return to spawn. They serve as feeding, roosting and breeding grounds for several birds such as kingfishers, herons, egrets, cormorants, flamingos etc. A variety of products are of economic value tannin, fodder, fish crabs, prawns etc. Mud from mangrove swamps is periodically removed and used as manure in paddy cultivation and coconut plantations. Mangroves are also useful for treating effluents, as the plants absorb excess nitrates and phosphates thus preventing eutrophication of sea water. In addition, mangroves act as wind and wave shock absorbers thereby providing a buffer zone against erosion and as shore propagators since they trap sediments resulting in the formation of new land extending into the sea. The local population depends on this precariously balanced ecosystem for fishing, boat building and related activities. Though mangroves were earlier considered as wastelands and used as dumping ground or were reclaimed, today their importance has been realised and all mangrove habitats in India are incuded under the Coastal Regulation Zone-1 to prevent ecological imbalance and degradation caused by development activities.
- has mudflats which provide the substratum for mangrove colonisation.is a zone where erosion and deposition are delicately balanced.
- Is a zone where erosion and deposistion are delicately balanced. Anthropogenic disturbances are likely to have an impact on the flow of currents and sediment supply along the coast. For example, reclamation at some point is likely to initiate erosion elsewhere.

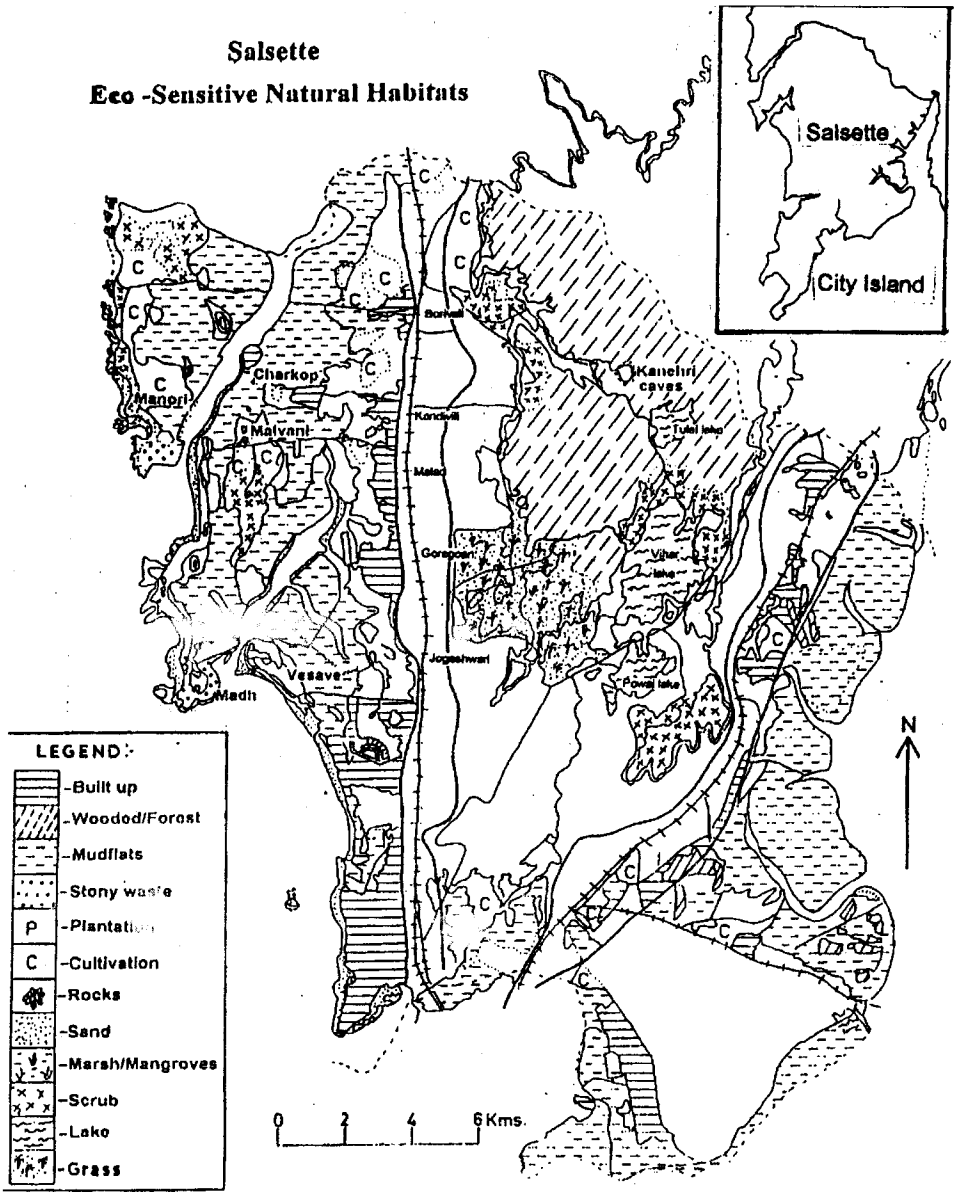

Fig. 1 : Salsette Eco-Sensitive Natural Habitats

- has a network of creeks which are inlets of the sea allowing the free flow of tides. The regular flushing of tidal waters is vital for the sustenance of mangroves. They also function as storm water channels in areas which lack necessary infrastructure. In Mumbai during spells of excessive rainfall they play a significant role in prevention of floods.

The central hill complex

- has most of the faunal species occuring in the north - Western Ghat region. These include 59 species of mammals, 299 species of birds, 52 species of reptiles, 13 species of amphibians, 155 species of butterflies, 24 species of ants, hordes of insects, moths etc. (Econet, 1997).
- is the catchment area for Vihar and Tulsi lakes which provide 10% of the water supply to the city.
- improves the micro-climatic condition as it acts as a carbon sink, heat ameliorator, dust and pollution filter. This is particularly relevant in an industrial / urban environment.

Both the above areas are of vital significance in a city which suffers from an acute shortage of open spaces. Published figures for the city read as 0.3 hectares/1000 persons, as against 4.0 hectares/1000 for London and 1.7 hectares/1000 for Delhi; whereas actual figures are probably lower as massive encroachments and dereservation of offically designated open spaces have taken place.

It is pertinent to note that substantial parts of these areas were designated as **No Development Zones (NDZ)** in the 1981 Municipal Development Plan for the city. These are "areas reserved green except ancillary to existing uses." However, their designation as NDZ was probably not due to their eco-sensitive character. In fact, earlier plans suggested that NDZ areas were earmarked as potential sites for future development.

In February 1991 a notification was issued under the Environment (Protection) Act, 1986, and Environment (Protection) Rules, 1986, declaring coastal stretches as Coastal Regulation Zones (CRZ) thereby regulating activities within them.

CHANGES IN LAND-USE OF THE ENVIRONMENTALLY SENSITIVE AREAS

The original islands of Salsette had a knoll core, fringing wave cut platforms and sandy beaches covered by coconut palms and other tropical vegetation. The inhabitaants lived in small hamlets and grew a variety of tropical fruits and rice. Salt panning was an important activity. Towards the close of the 18th century, growth of population led to draining of swamps and marshes and cutting of trees. Large cultivated estates were developed which provided fruits and vegetables to the inhabitants of the City Island. Subsequently suburban Salsette emerged as a zone of recreational activities for the urban elite, a function which remains significant even tpday.

The post independence era witnessed the influx of refugees and a continuous stream of immigrant working population into Mumbai. Due to the high population densities in the City Island the municipal jurisdiction was extended to include Southern Salsette in 1950. A further extension in 1957 brought the city to its present limits.

The horizontal spread of the city was characterised by ribbon development along the transport axes with the railway stations functioning as the focal points of development. Gradually, dispersal of upper class residential areas towards the western waterfront resulted in the encroachment of the fragile coastal zone. Industrial development took place to the east of the Western Railway and along the Central Railway accompanied by the proliferation of lower income workers' residences adjoining these areas. Slums mushroomed in depressions, low lying areas and creek sites.

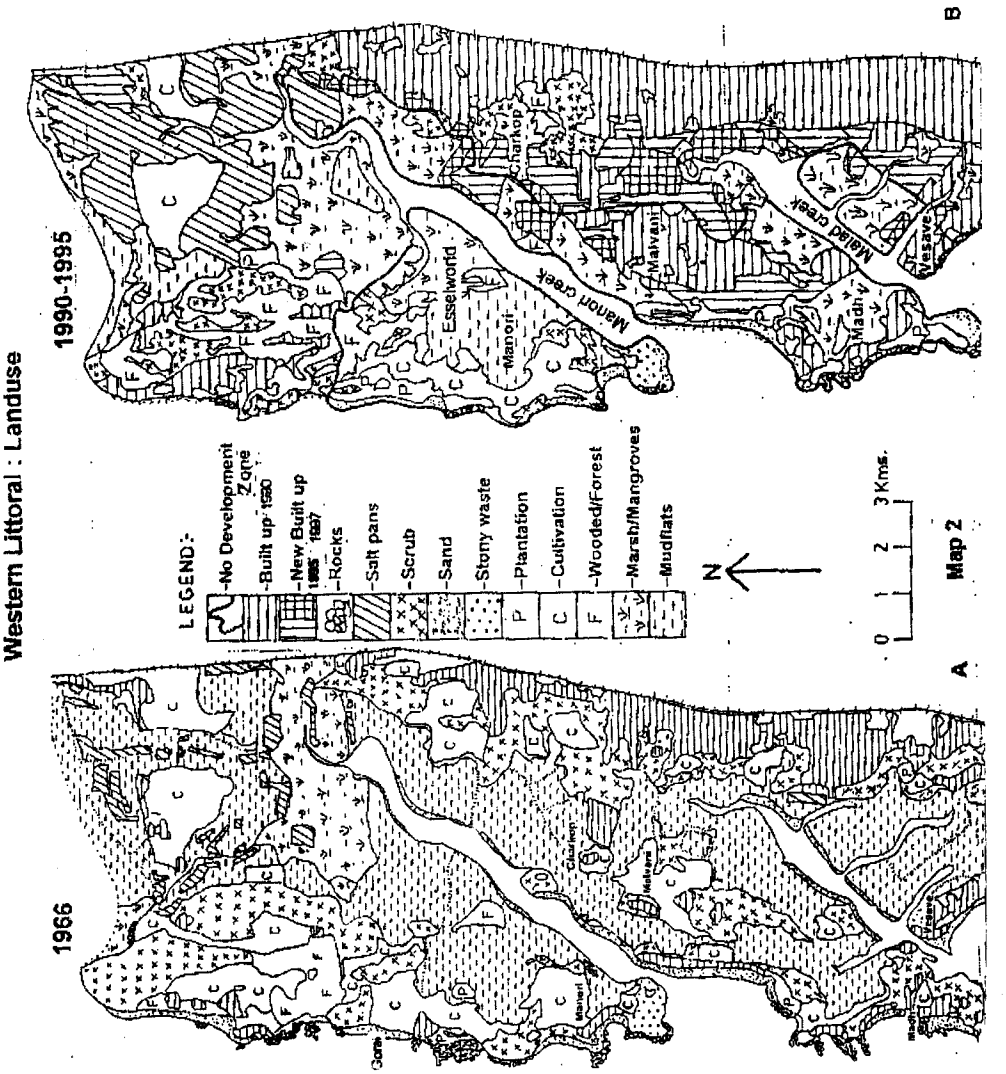

Fig. 2 : Western Littoral -Landuse

Changes in land-use (1962-97)

This period is marked by dynamic population growth, Salsette having experienced a much faster growth rate than the Island City and spiralling property prices.

The coastal zone :
The topo-sheet of the area surveyed in the sixties shows that in the western coastal area development activities were concentrated along the transport axes away from the ecologically sensitive areas (Map - 2A). Substantial areas were under cultivation and plantations while the hills in this zone were covered with scrub. The inter-tidal belt was dominated by mud-flats with only limited patches of marshes and mangroves. Indication of devegetation was already evident. Salt panning was an important activity.

The satellite imagery of the early nineties brings out the changes that have occurred. Massive reclamation took place in the western inter-tidal zone for construction of housing complexes (Map - 2B). There was also a marked increase in recreational activities with the setting up of resorts and holiday homes as well as an entertainment park (Esselworld) which had encroached into the cultivated and plantation areas. Slums sprouted along new roads, nallas and small creeks. In the eastern zone the inter-tidal belt widened considerably (Map - 3A, 3B). An increase in area to the tune of 4.5 sq.km. occurred. Large portions of this zone were under active mangroves and marshes, more so near inlets and the previous low tide line. The outer limit of mangroves in the east was fringed by fresh mud-flats. Development of Navi Mumbai and transport lines across Thane Creek may have promoted siltation. Salt panning continued as a major activity in this zone.

Despite the CRZ and NDZ regulations, reclamation followed by construction continued unabated as seen in the satellite imageries of 1997. Areas where significant development had taken place included the southern shore of Malad creek in the west (Map -2B), Vikroli, Tromaby and the areas north of Bhabha Atomic Research Centre (BARC) and Govandi in the east (Map -3C). While slums accounted for some of this growth many of these violations were government sponsored e.g. in Charkop huge plots were demarcated for public housing and in Gorai the Esselworld entertainment park occupied an area of 64 acres. In addition, considerable narrowing of the creeks was a result of the high rate of sedimentation in the region. However on the positive side a mangrove conservation project was initiated by Godrej industrial group at Vikhroli.

Central hill complex : A large part of this region comprises the Sanjay Gandhi National Park (SGNP) which forms a crucial link in the Protected Area network that consists of 533 national parks and sanctuaries. The National Park was formed to preserve for posterity the picturesque natural environment and luxuriant vegetation, to provide healthy outdoor recreation and to protect the catchment areas of Tulsi and Vihar lakes. It is a natural asset which needs to be protected as a national heritage. Aarey Milk Colony (AMC), the main dairy industry of the city, which is located in a conserved grassland interspersed with trees, also lies within the region. The extensions of the Colony have been given to Film City, Royal Palms Golf and Country Club and an education centre of the Bombay Natural History Society (BNHS).

The land-use map of the sixties shows that the decline in the forest cover had already begun

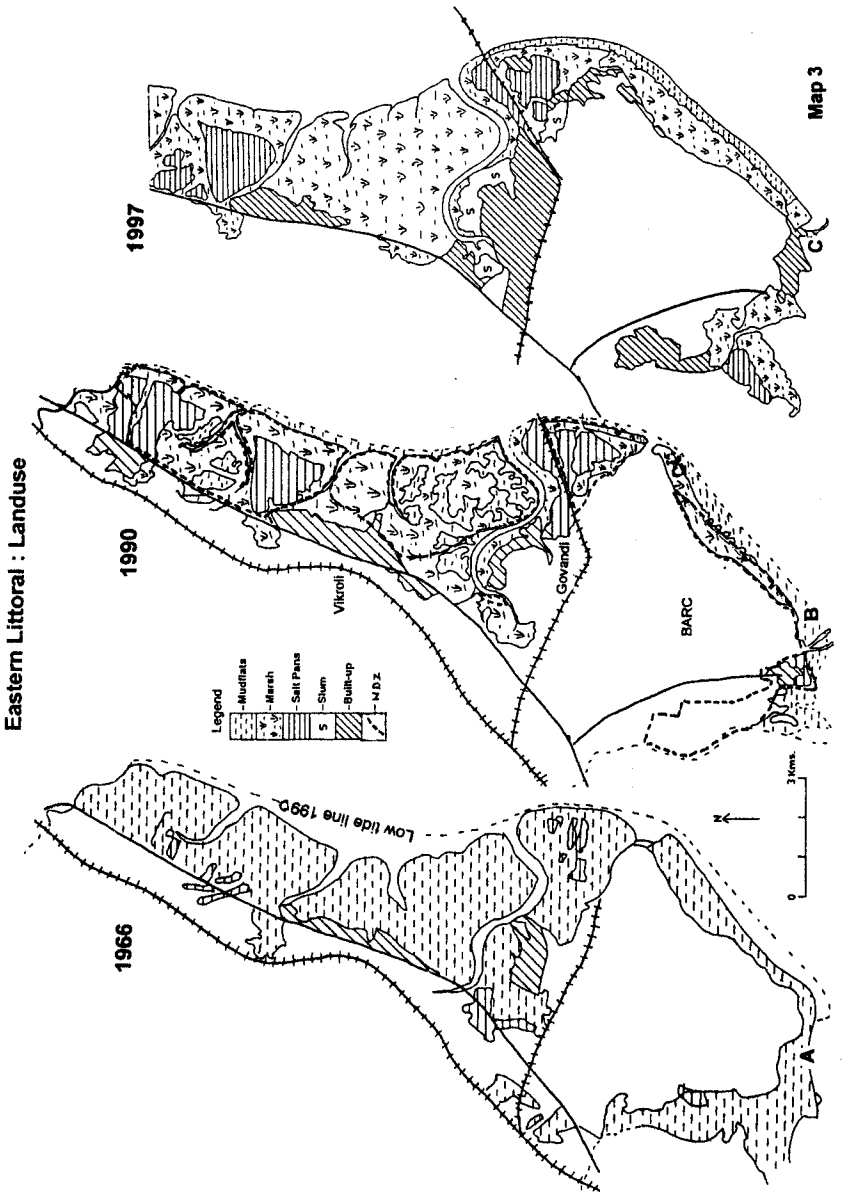

Fig. 3 : Eastern Littoral - Landuse

(Map-4). Patches of scrub, an indicator of degradation, were observed around Vihar lake. In the north west, where the area is below 40 m., pockets of cultivation and scrubland were seen.

The imagery of the early nineties shows core areas of luxuriant forest growth along the nrothern fringe and to a limited extent to the south (Map -5). Vast areas in the centre appeared to be less luxuriant than

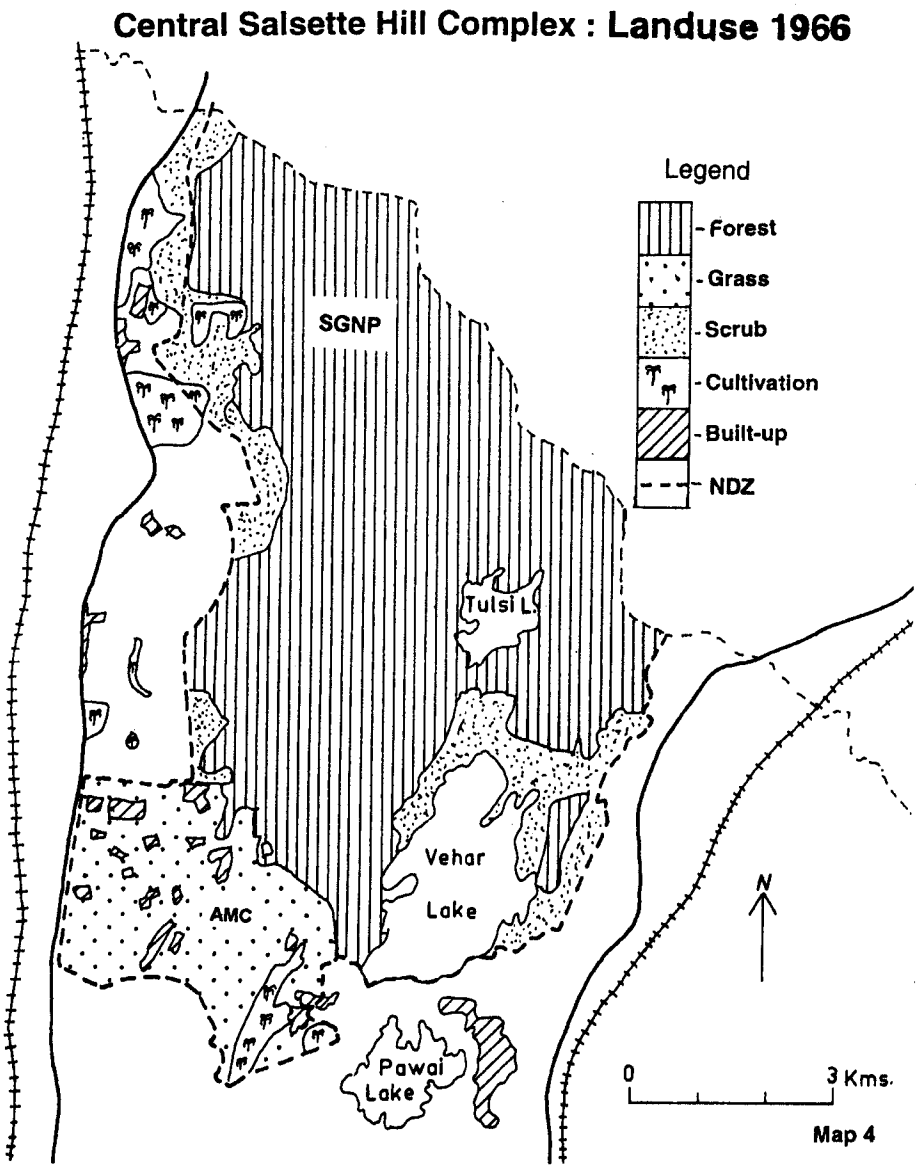

Fig. 4 : Central Ssalsette Hill Complex - Landuse 1966

and inferior to the forests of the core area. These were areas of easy accessibility along Magathane road and in the vicinity of Kanheri caves. Encroachment by slums to the north west was probably due to proximity to the industrial area. In the south west and east in the vicinity of Mulund and Bhandup pockets of built up areas sprouted. Bare rocks were a testimony to quarrying within the limits of the national park.

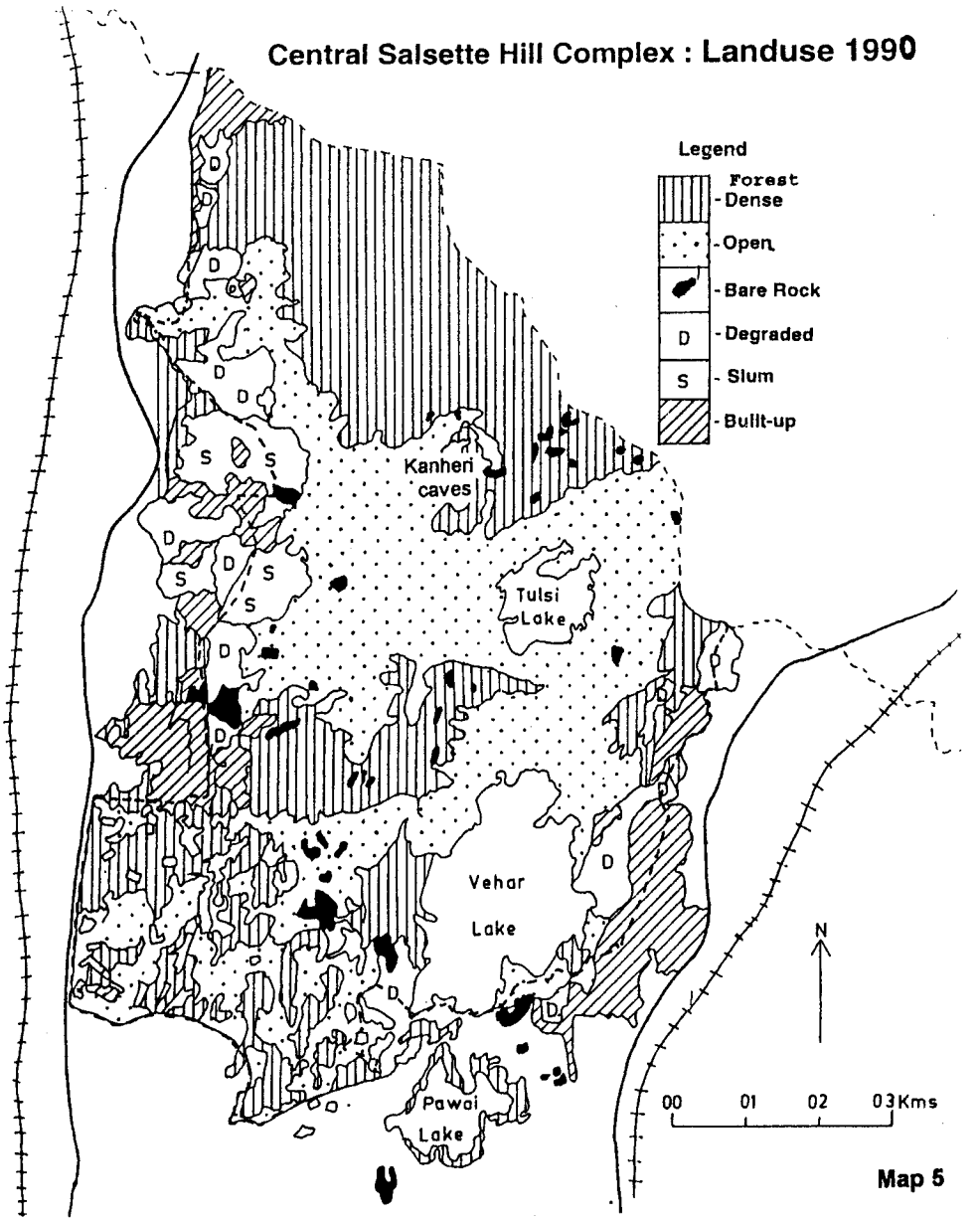

Fig. 5 : Central Salsette Hill Complex - Landuse 1990

Satellite pictures of 1997 reveal that degradation of the area had reached alarming proportions (Map-6). The core areas of dense forest had dwindled in extent specially along the northern firnge where they were restricted to the steeper slopes and in the interior to the inaccessible areas. Together they constituted only 7.12 sq.km. roughly 10% if the total national park area. This was reflected in an increase in the area under moderately dense and open forests. Total de-vegetation occurred in the peripheral

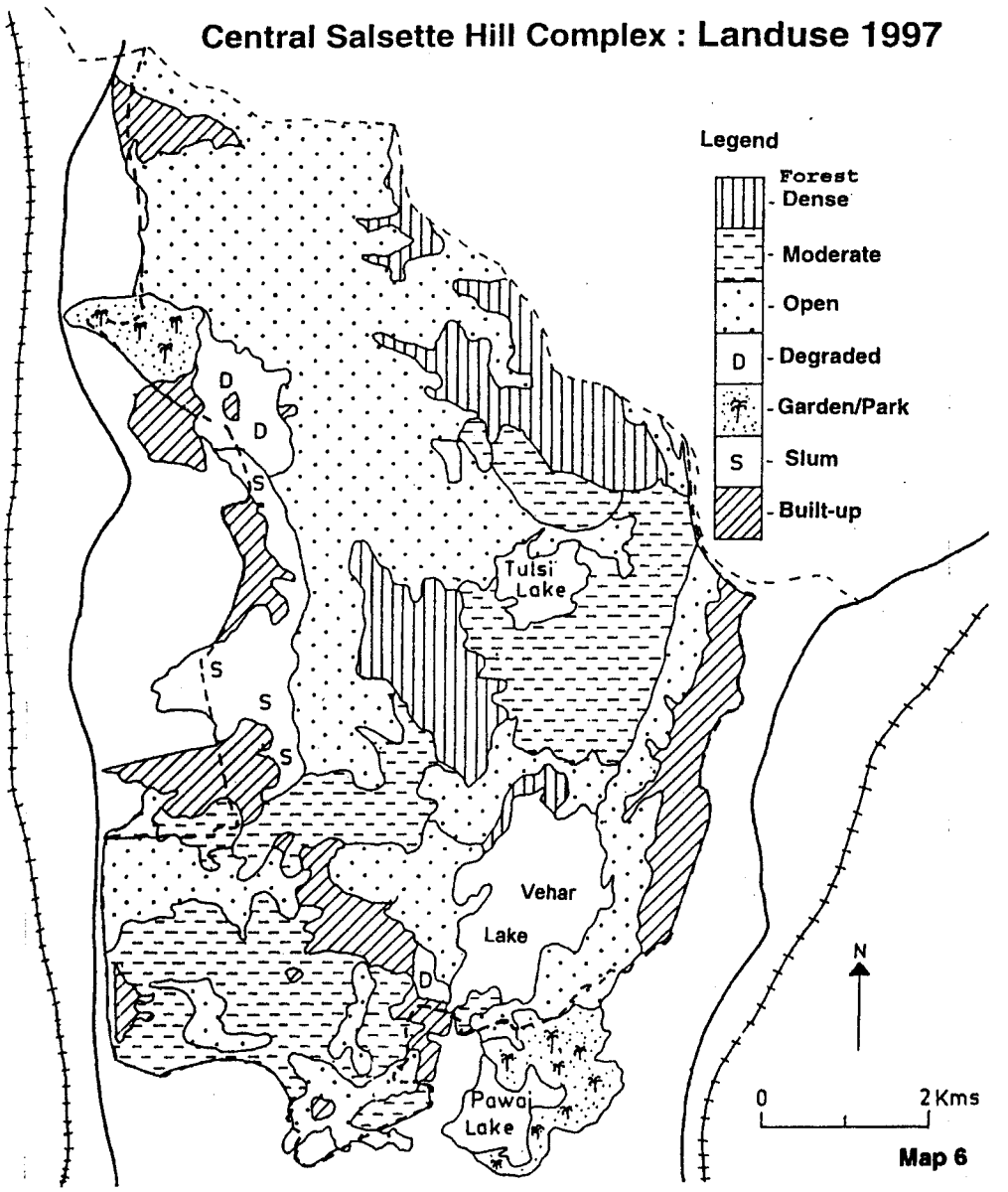

Fig. 6 : Central Salsette Hill Complex - Landuse 1997

areas. Field visits today ascertain that this degradation is mainly an outcome of the activities of the population living near the fringe of the national park. Initially small tracts are cleared which are later encroached upon. Thus, a steady and gradual advance of these slums into the inner higher grounds of the national park is taking place. It has been calculated that in 1997 built up areas and slums within the national park occupied 6.5 sq.km. in 1991.

Problems associated with the above developments.

The coastal zone :

1. In a city starved for space, reclamation was seen as a panacea to the problem of land shortage. Today, Mumbai is said to have the highest porportion of reclaimed land compared to any other metropolis in the world. However, reclaiming land from the sea is a major cause for concern as it leads to a wide range of problems related to changes in the coastal regime, loss of mangroves, upstream flooding of rivers, changes in undercurrents and tidal wave pattern, and loss of fishing ground. Reclamation has generally been intentional but has also been caused by wanton quarrying (as observed in Utan), dumping of municipal waste (2 sq. km. at Deonar) and industrial waste (at Trombay industrial ash is being spread over low-lying areas). Sedimentation due to deforestation in the upper reaches of streams has resulted in the narrowing of creeks which act as natural drainage outlets. This has accentuated the city's flodding problems particularly during the monsoons.

   Reclamation at one point interferes with the natural marine processes often resulting in erosion at some other point. Massive reclamation at Backbay about 30 years ago has had a ripple effect 25 km. north along the sandy stretch at Vesave. The Madh island protrusion acts as a lens focusing the impact of the waves at this point. Professor V.Subramanyam from the Department of Earth Sciences at the Indian Institute of Technology, Powai has identified this as the cause for collapses of compound walls and erosion extending upto the plinth level of high rise buildings and sucking out of entire playgrounds in Vesave. During the monsoon the synergy created whenever intense rainfall coincides with high tide is particularly devastating. In areas of recent reclamation, sinking of buildings has sometimes occurred. In the course of field visits it has been noted that some buildings are surrounded by sea water at high tide. The absence of planned, systematic reclamation has led to piecemeal development resulting in stagnation of water in undeveloped plots which provide breeding grounds for mosquitoes. The prevalence of marlaria in these areas is a case in point.

2. Fish catch has been steadily declining in recent years. The release of untreated sewage and toxic waste into the sea, construction of unauthorised bunds (reportedly by Esselword), which block the natural flow of sea water and affect the spawning activity of fish, tearing of fishing nets by boats which transport visitors to Esselworld have been cited as reasons for the decline.

3. In the vicinity of Esselworld, destruction of mangroves has occurred due to the construction of a road through the marsh and allegedly also due to spraying of chemicals. Stumps of dead trees seen during field visits are evidences of the callous attitude of developers towards the environment.

4. Shortage of water is another problem being faced by the settlements in the coastal zone. Esselworld has been removing 60-75 tankers of water from the surrounding villages. There are reports that well water in Gorai is already muddy and saline. Indiscriminate removal of underground water from the intertidal belt may lead to large scale salinity ingress in the near future. To augment the water supply the

municipality is currently supplying 200 tankers per day (each of 10,000 litre capacity) to Esselworld while the villagers are supplied less than 10 litres per head per day. In addition, water provided to the villagers is not regular and is often not potable.

The central hill complex

1. Encroachment into the national park is the major problem it faces today. Econet estimated that by 1997 approximately 400,000 persons had encroached the park boundaries. In addition, due to populist policies slum dwellers in the national park have been provided with ration cards, telephone lines, public distribution services and water connections.

2. Deforestation is also associated with the large number oif forest fires along the road to Kanheri Caves every year on Mahashivratri and Mahavir Jayanti. This problem continues to date as more than 300,000 piligrims visit the ashram behind the caves on these festivals.

3. Due to the destruction of 7.5 sq.km.of forestland the top soil in these areas has been eroded resulting in laterization of the basalt. Thus, regeneration of the erstwhile natural vegetation is rendered difficult in these stretches.

4. De-vegetated, concretised landscapes produce local climates, especially thermal regimes, that are in striking contrast to those of the surrounding natural landscapes, for example the urban heat island effect. Since the central hill complex forms a substantial part of Salsette and contains most of the tree cover, its de-vegetation would lead to an accentuation of the problem.

5. Areas that are encroached upon are experiencing problems related to environmental degradation such as solid waste disposal. This encourages breeding of scavengers such as rodents with disease vectors and stray dogs infected with rabies in these localities. The natural fauna of the area would be highly susceptible to these newly introduced diseases as they have not developed the necessary immunity.

6. Apex species like leopards, and raptors like osprey and white bellied fishing eagle, are facing extinction as their prey population has been decimated due to human interference in the national park. In fact, several species like the mouse deer and sambhar have reached dangerously low levels.

7. If encroachments in the national park continue at the current pace they are likely to cross the ridge sloping to Vihar lake resulting in contamination of the water due to untreated faecal and other waste matter as well as liquid effluents. As mentioned earlier, a significant amount of the city's water supply is obtained from the lake.

RECOMMENDATIONS

1. Environmentally sensitive areas in Salsette have been covered by legislation well before development in the region took place. Degradation, however, of these areas has been due to the lack of implementation of existing policies which can be attributed to the politician-builder-quarry-owner nexus and the populist policies of the State Government. The coastal areas are covered not only by the NDZ but are also under the ambit of CRZ since 1991. Nonetheless continued infringement of the inter-tidal areas is taking place. This problem is likely

to get more acute in the next few years. The state government has already dereserved 32 sq.km. of land in Gorai, given permission for the development of an additional 3.05 sq.km. to Esselworld and has also undertaken the ambitious Shiv Shahi Punarvasan Prakalp to rehabilitate slum dwellers in the city who account for 52% of the city's population. A major constraint for the implementation of this scheme is the acute shrotage of land. These natural habitats, therefore become the most attractive sites for such projects. Currently, there are 55 slum rehabilitation schemes in operation in the coastal areas where Floor Space Index (FSI) has been increased from 1.3 to 2.5. However, on 31 December 1998 the Centre constituted the National Coastal Zone Management Authority which has issued a notification freezing the FSI permissible to constructions near the coastline at 1991 levels. Though the state government has asked the Centre to relax the FSI ruling in the coastal stretches of Mumbai, their request has not been acceded to as yet. If granted, not only will the fragile ecosystem be destroyed but the pollution load on the sea will also be increased. It is recommended that development plans should be strictly implemented and the dilution of the CRZ notification should be discouraged.

2. Construction of transport arteries across ecologically sensitive areas have had a profound impact on the local ecosystems e.g.many animals have been killed while crossing the Thane-Borivili road that runs through the forest area. There is a proposal to construct a Light Rail Transport system for Thane upto Borivali which would pass through the national park. This is against the ethos of conservation. Similarly the expressways scheduled to be constructed at Vikhroli and Kanjurmarg cutting across the mangroves in the coastal zone will lead to degradation of the region and should not be permitted.

3. Recreational activities should be permitted in the natural habitats of the city considering the paucity of open spaces. The National Park alone constitutes 76.6% of the total open space of BrihanMumbai. The development of recreational activities however, should be strictly monitored to ensure that it is carried out in a sustainable manner thereby preventing conflicts with the local population. Impact assessment reports should be prepared on a priority basis to include the environmental dimension in the planning process. Eco-recreation is the need of the hour.

4. The national park today has achieved the dubious status of a "bio-diversity hotspot". The root of the problem is uncontrolled encroachment. Despite political presssures demolition of unauthorised structures within the park is currently being carried out. This move must be strongly supported if we are to preserve the only national park in the world which is within the municipal limits of a metropolitan city. The area cleared should be replanted with hardy species that can survive the degraded conditions. Gradually vegetation succession would set in resulting in the climax forest.

5. Construction of a wall along the boundary of the park to protect it as suggested by some agencies does not seem feasible. Instead these areas can be leased to institutions which will act as buffers. In this comtext, the role of Indian Institute of Technology, Powai and the BNHS educational centre located along the fringe

of the park, in preserving its environment, preventing encroachment and spreading environment awareness is commendable and worth emulation.

6. Mining and quarrying activities in the park should be strictly prohibited.

7. Despite its coastal location and prevalence of strong sea breeze that helps disperse air pollutants, pollution levels in the city are very high and are likely to increase further due to the increase in vehicular traffic. In this context it is mandatory to preserve and enhance the green cover of the city.

8. Recently Mumbai's celebrated architect Hafeez Contractor proposed the creation of additional open space as a green zone along a 17.5 km. long, 300 m. wide area by reclaiming land on the western coast of the City Island. Massive land filling would be required for the project. It may be noted that due to the landfill at the Gateway of India during the 1860's, silting of the Indian Navy's base at Uran is still taking place. It is also reiterated that reclamation at one point often results in erosion at some other point. In view of the severe erosion in Vesave caused by the Backbay reclamation any disturbance to the coastal stretch in South Mumbai should be strongly opposed.

A point worthy of note is that the administrative boundary of Brihan Mumbai cuts across the natural physical units. This has an implication in their management, as these areas, through contiguous, come under different administrative bodies. Thus in the case of the western coastal zone the activities permissible in different areas of the CRZ along the coastal tract vary according to their designation as urban, fringe or rural areas. Administrative units should more or less coincide with natural physical units for formulation and effective implementation of uniform plans and policies.

CONCLUSION

In view of the above it may be concluded that integrated resource management is crucial for the sustainable development of the region. This assumes greater significance in a metropolis starved for space and burdened by intense population pressure. Here, it is the few vacant pockets of land that become the potential targets for development. However, when these comprise precariously balanced systems their degradation may have a destabilising effect. Natural assets need to be conserved as they are vital for the physical sustenance of the urban ecosystem.

REFERENCES

Anon.: "Mangroves and the Mangrove Eco-system", Encology, Vol. 7, no.8, pp 15-17, 1993.

Damle Nisha: "Environmental Geomorphology of Salsette", Unpublished M.A. dissertation, University of Mumbai, 1992.

Express news services : Express Newsline, Mumbai, June 14, 1999.

Express news services: Express Newsline, Mumbai, June 15, 1999.

Econet: Comprehensive Environmental Assessment o SGNP, 1997.

Gazetteer of Greater Bombay, Govt. of Maharashtra, 1986.

Mid-day: Mumbai, April 7, 2000.

Mid-day: Mumbai, May 4, 2000.

Navalkar, B.S.,: "Geographical Distribution of the Halophytic Plants of Bombay and Salsette Islands", Journal of the Bombay Natural History Society, Vol.53, pp 335-345, 1955.

Silas, E.G.: Mangroves and fisheries-Management Strategies", Proceedings of the National Seminar on Estuarine Mangement, Trivandrum, June 4-5, pp 258-261, 1987.

The Indian Express : July 11, 1999.

The Times of India : Bombay Times, June 3, 1999.

Untawale, A.G. & Jagtap, T.G. : "Mangroves: No wastelands", The Hindu Survey of the Environment, pp 71-74, 1998.

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