

URBAN SPRAWLING AND ENVIRONMENTAL DETERIORATION : A STUDY OF SOUTH MADRAS COASTAL ZONE

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ABSTRACT : The study discusses the environmental deterioration of the South Madras Coastal Zone by looking into the vital aspect of groundwater depletion, using perception analysis.

THE STUDY

At present, Madras city supports about four million people and is continuously expanding both along the coast and towards the interior.

The present study tries to bring out the adverse impact on the environment of growing human crowding and economic activities going on in the South Madras Coastal Zone. Deteriorating coastal environment is observed by looking into the various aspects : population increase, active house-building activities and promotion of housing colonies, lowering of water-table and changing water quality, and also by taking up a study of people's perception on the deteriorating environment.

STUDY AREA

South Madras Coastal Zone runs from the southern bank of Adyar river in the north to Mamallapuram in the south for a distance about 50 km. An arbitrary distance of 5 km from the shoreline is assumed as the landward limit of delimitation of the coastal zone. Spreading over an area of about 290 sq. km., the zone comprises of 51 villages and 8 municipal divisions of Madras Corporation (Fig. 1 : a).

LANDUSE CHANGES

Landuse changes in this zone have been quite rapid in the recent decades. About 60 per cent of the area in this zone is still under cultivation and two-thirds of this cultivated area receives irrigation. About

70 per cent of the irrigated area is well-irrigated. From the study of old topographical sheets (1917) it is seen that 1. Thiruvavanmiyur, Velacheri, Taramani, Perungudi and Injambakkam in the north, and Karapakkam, Kovalam, Thiruporur and Mamallapuram were the major rural settlements; 2. The fishing hamlets in the vicinity of sea were connected with these major settlements by foot-path; 3. Extensive casuarina plantation was found between the sea shore and Buckingham canal (Fig. 1 b). In recent years (1976), 1. The Madras urban agglomeration now includes Adayar, Velachery, Taramani and Thiruvavanmiyur, Kovalam and Mamallapuram have now grown into busy tourist centres; 2. There are two highways running along this coastal zone, carrying heavy traffic; 3. Settlements have now come up in the formerly noted flood-labile zone. Urbanisation being quite intensive in the areas near the city, development of roads and the availability of rich ground-water resources for fresh water have promoted large scale development of housing colonies by private entrepreneurs. 4. In the process of development of housing and tourism the casuarina plantations found extensively in the 1920s close to sea shore, have been almost cleared. Clearance of plantations seems to be promoting the development of sand dunes in the interior and the central part of the coastal zone. In the beginning of this century, sand dunes were found for a distance of about 14 km northward from Mamalla-

GROWING POPULATION

South Madras coastal zone supports a heavy concentration of population, especially in the areas (corporation divisions) adjoining the city, where the density of population is more than 900 persons per sq. km. This high concentration of population has been spreading southward from the city in the last three decades (Fig. 2 a, b and c). The total population in this coastal zone has increased three fold and the zone supported a population of 277, 027 in 1981. Likewise, the density of population has also increased three times, from 341 persons per sq. km.

to 946 persons per sq. km. Villages in the urban fringe too have witnessed a three times increase in their population. Industrial development is going on the areas of Taramani, Thoraipakkam and Neelangarai. In the last three decades, there seems to be a phenomenal increase of population engaged in the tertiary sector of the economy in this zone. The Madras Metropolitan region has been witnessing a rapid growth of population in the areas of good groundwater potential, as the municipal supply of fresh water is uncertain and undependable (Table 1) :

TABLE 1

South Madras Coastal Zone Population : Population Characteristics.

	Years		
	1961	1971	1981
Total population	99,954	2,08,519	2,77,027
Population density per sq. km.	341	712	946
Primary sector population per sq. km.	48	49	51
Secondary sector population per sq. km.	2	3	4
Service sector population per sq. km.	61	142	262
Households density per sq. km.	69	121	194
Average size of households	4.79	4.78	4.76
Number of houses per sq. km.	87	160	191

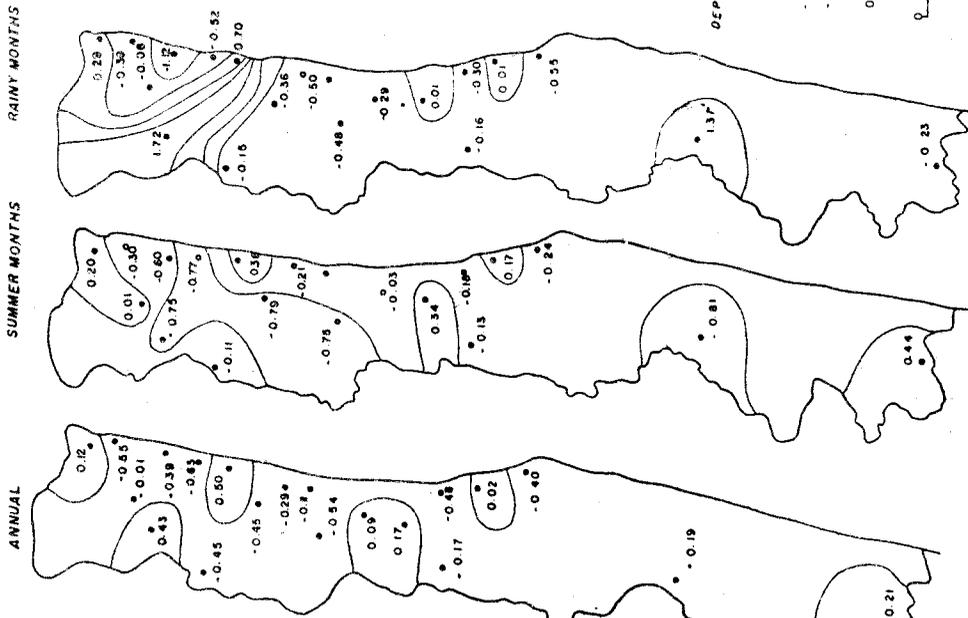
ENVIRONMENTAL DETERIORATION

The sensitive coastal environment in South Madras coastal zone gets rapidly deteriorated because of rapid urbanisation and its associated aspects. It is attempted here to indicate the environmental deterioration by looking into the water-table differences of ground water in this zone and by picturing the people's perception on deterioration of environment. Both secondary and primary information were gathered to evaluate the level of environmental deterioration.

DECLINING WATER-TABLE

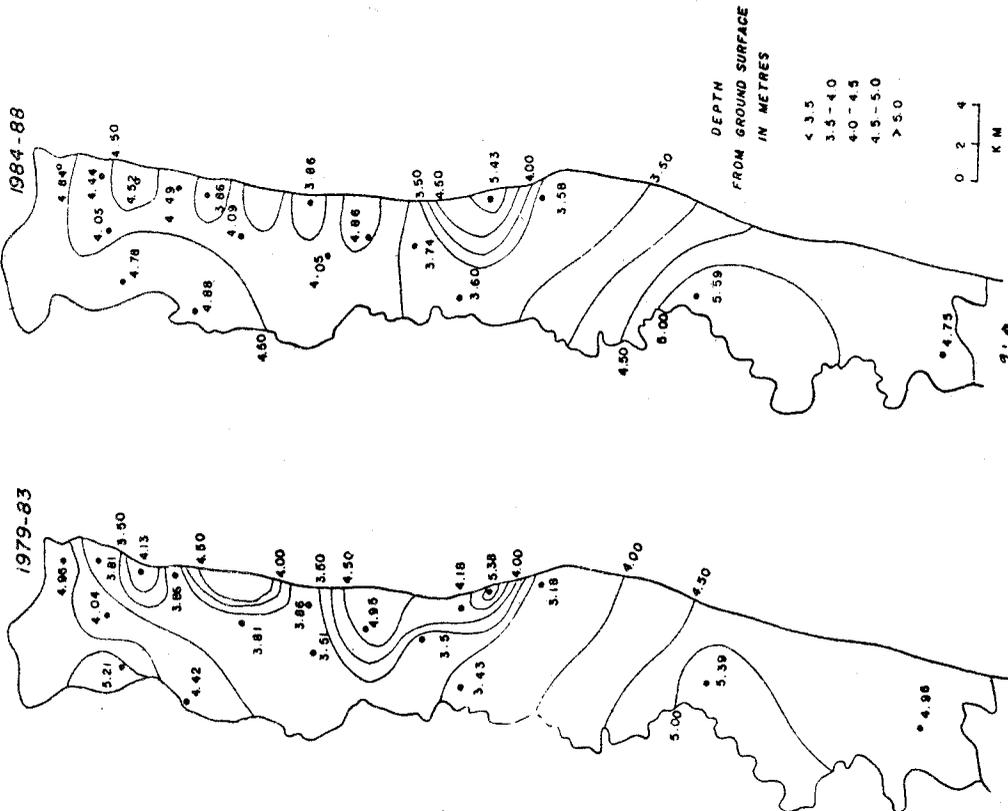
South Madras coastal zone is characterised by Quarternary alluvial deposits ranging from pure sand to clay, and backed in the west by Archaean crystallined rock. These geological variations result in the occurrence of a good ground water yield and recharge potential in the coastal zone. The coastal aquifer, occurring to the east of Chembarampakkam tank and from Adayar to Thiruvanniyur, is known as south coastal aquifer or Thiruvanniyur aquifer. Spreading over

SOUTH MADRAS COASTAL ZONE
WATERLEVEL DIFFERENCES 1979-83-1984-88



SOUTH MADRAS COASTAL ZONE

AVERAGE WATER LEVEL



2: e

an area of about 460 sq.km., it has a potential of about 320 m.cu.m. About 20 per cent of the water supply to Madras city comes from coastal aquifers and about one-fourth of it from the Thiruvanmiyur aquifer. The growing Madras city depends more and more on ground water resources and the demand for ground water gets further intensified by the wide-spread adoption of well-irrigation for agriculture.

With the data made available by the Ground Water Department of the Government of Tamil Nadu for 20 experiment wells in this zone for ten years from 1979 onwards, the analysis of water-table is made here. The mean water levels for annual, summer (dry) season (March to June) and rainy season (October to December) were worked out for each well. Further, with these means, five years averages for the annual, dry and rainy months were worked out for the initial period (1979-83) and the end period (1983-88). A five-years average is decided so as to smoothen the extremities and to make a generalisation. A comparison between initial and end periods help to identify the general behaviour of water-table over a point of time. Then isoline maps for showing average water-tables and changes in water level between initial period and end period (Figs. 2a and 2b).

Based on the data from 1978 to 1987 for the two rain gauge stations (Kovalam and Mamallapuram), it is seen that South Madras coastal zone received an average rainfall of 144 cm annually. The years of 1983 and 1987 received rainfall, less than 20 per cent of normal rainfall and these two years were thus drought years. The years of 1979, 1980 and 86 received rainfall, more than 20 per cent of the normal, and these three years were thus rainy years. In the rainy years, the annual mean water-table in this zone was at 3.9 m in 1979 and 3.98 m in 1980. In the drought years, water-table

was located at a depth of 4.8 m in 1982; 4.96 m in 1983, and 5.38 m in 1987. The decline of water-table during drought years may largely be due to the obvious reason of less incidence of rainfall, and the continued or increasing exploitation of ground water. Obviously the city depends more on ground-water during drought years.

The mean water-table in the initial period ranged from 3.43 m to 5.39 m and in the end period from 3.74 m to 5.59 m thereby indicating an overall decline of water-table (2. a). In the areas of population concentration and heavy growth-urban fringe and tourist spots, the decline of water-table seems to be significant. For instance, in the densely populated areas of Thiruvanmiyur, Kottivakkam, Pallavakkam, Neelanganarai and Injambakkam, the water-table was at 3.5 m to 4.0 m in the initial period and 4 m to 5 m in the end period.

Fig. 2. b gives the pattern of differences in water-table between 1979-1983 and 1983-1988 for the annual, dry and rainy periods. The differences in all the three periods are negative in sign, excepting in the central locations and the northwestern margin. The negative sign indicates a decline in water-table. The water-table differences with negative sign between annual means range from -0.01 to -0.63. In Velacheri, Injambakkam and North Neelanganarai areas, the differences are positive in sign. In the dry period, water-table differences with negative sign range from -0.03 to -0.81 and in the rainy months, from -0.01 to -1.37. On the whole, the sandy alluvial areas of Thiruvanmiyur, Kottivakkam, Palavakkam and Neelanganarai in the north-eastern part of this zone experience a decline of water-table. The decline is very much due to excessive pumping of groundwater. For instance, during January 1989, about 14,000 (as available from the record of licensing authority) lorry loads of water (5,000,000 litres per day) have been pumped

from this area to supply to the city. In this coastal zone, about 110 lorries are engaged daily by 35 agencies in the supply of water to the city. Three-fourth of these suppliers have relocated their wells because of change in quality and drop in the quantity of water. They report that the ground water has become saline in the old commercial wells at a depth of about 13 m and so they moved from Kottivakkam, Palavakkam and Thiruvanmiyur to Neelanagarai and Vetuvankoni.

PERCEPTION ANALYSIS ON DETERIORATION

There has been a wide-spread talk and impression that quality of water and civic conditions are getting deteriorated quite rapidly in this zone because of increasing urbanisation and associated land use changes. A study of the impression or thinking of the people on the environmental deterioration may further strengthen the study of environmental implications of urbanisation by physical measurements. As such, a perception analysis is attempted to assess the environmental deterioration as revealed by the mental image of the population living in this zone.

A sample of 100 households has been involved in the perception study. A stratified proportionate random sampling procedure was adopted to select these 100 sample households; the coastal zone was stratified into three different regions, based on the density of households, as high, medium and low (greater than 1000, 1000-100, less than 100 households per sq. km.); these three regions constitute 65, 18 and 17 per cent of households respectively. 100 samples were allotted proportionately to these regions and samples are randomly selected. From the sample households, necessary information was gathered by a questionnaire schedule.

Two-thirds of the sample respondents belong to the age group of 20-50 years.

Most of the samples hail from the medium and large size (3-5 and 5-7 members) families. About two-third of the sample families belong to the highly educated group. About two-third of the sample families have been living in this area for the last ten years. Perception on Population Density and Population Increase.

About 40 per cent of the sample households feel that the area is highly crowded and only one-fourth of the sample households perceive that the area is little crowded. In the middle age group, about 66 per cent of sample households perceive this area as a crowded one. Likewise, the medium size and large size family households too perceive it in the same way. Even the people living in government sponsored lay-outs, have expressed the same feeling.

About 60 per cent of the working sample respondents and one-half of the unemployed sample households think that the area is over crowded. Almost all the sample households (90 per cent) living in the area of dense population perceive that the area is much too crowded. Only one-fourth of the sample households living in areas of low density think that this area is crowded. About 80 per cent of sample households perceive that this area has rapid increase of population. About 80 per cent of sample respondents living in the houses on rent perceives an increase in population in this zone.

Perception on water-level and water quality.

To analyse the water-level and water-quality, the four point scale viz. 'very much', 'appears to be', 'don't think so' and 'not at all' have been used. It appears that every one of the sample households perceives that there is a decline of ground water level. About 44 per cent of the sample respondents feel that there is a great decline in the water-level and 45 per cent of sample households perceive that the

water-level appears to be declining. Water-level is perceived to be declining by the samples of middle age group, medium and large size—households, high income group, and residents living in owned or rental houses. The sample households perceive that water-quality is changing because of the disposal of large quantities of sewage and water also because of salinity due to the decline of water level or due to intrusion of sea water.

PERCEPTION ON BEACH ENVIRONMENT

With regard to beach degradation, about one-third of the sample households express the opinion of it being unbearable. The degradation of the beach may be because of over-crowding and wide-spread accumulation of waste materials. About 26 per cent of the sample respondents have the feeling of overcrowding and 57 per cent of the sample perceive that the beach seems to be dirty with rubbish and human wastes. About one-half of the sample households report that they do not get sea breeze.

PERCEPTION OF GENERAL QUALITY OF THE ENVIRONMENT

The perception level of the environmental quality was analysed in a five-point scale of 'excellent', 'good', 'O.K.', 'poor' and 'unbearable'. One-third of the sample seems to be unhappy with the quality of their environment while a fifth of the sample is not fully satisfied and they fall in the scale of 'O.K.'. In the high-population density areas, about two-thirds of the sample is unhappy with the quality of environment. But in the low population density areas, almost all the sample respondents perceive a good environment.

Population increase is the single most reason for a degradation of this coastal environment and population increase is effected because of the preference of the people for this region. The preference for the region for residence is analysed by getting the ranks of seven attributes assumed to be reasons for selection of this area. The attributes of no water problem, 'nearer to work place', 'own house' and 'neat locality' seems to be the dominant factors in the decision-making process of sample households. About one-fourth of the sample households rank 'no water problem' as the first attribute, and one-fifth of the sample households rank 'near to work place' as first. The general quality does not seem to be a satisfactory one for one-fourth of the sample.

CONCLUSION

South Madras coastal zone has been witnessing a rapid population growth accompanied by a wide-spread development of housing colonies. Continued urban sprawling has resulted in the decline of ground-water table and in the intrusion of sea water. Beach environment has been steadily deteriorating. People residing in this zone too perceive the growing population as over crowding, leading to the decline and change in the quality of groundwater, and deteriorating general and beach environment. Since urbanisation continues unabated in this fragile zone one foresees that deterioration will be more severe within a very short time. To stop further deterioration, and to save this beautiful and sensitive South Madras coastal zone a well co-ordinated approach in the form of government's intervention and people's participation needs to be worked out immediately.

REFERENCES

1. **Chandra Soysa. et al.** (1982) : Man, Land and Sea (Bankok : The Agricultural Development Council).
2. **Harvey A. Shapiro** (1980) : 'Two Approaches to coastal Area Planning in Japan' in Billy L. Edge (ed.) Coastal Zone 80 Vol. I (New York : American Society of Civil Engineers, pp. 741-76).
3. **Harvey A. Shapiro** (1984) : 'Coastal Area Management in Japan-An Overview', Coastal Zone Management Journal, 12 : 1956
4. **John Clark** (1974) : Coastal Ecosystems (Washington D.C. : The conservation Foundation).
5. **Mark J. Valencia** (ed.) (1981) : Proceedings of the Workshop on Coastal Area Development and Management in Asia and the Pacific (Hawaii : East-West Centre).
6. **Elango L., Manickam S., and Sakthivadivel R.** (1988) : 'Saline Groundwater in Heavily Exploited Coastal Aquifer a case study in Madras', National Seminar on Ground Water Development in Coastal Tracts (Trivandrum).
7. **Sakthivadivel R., Krishnaswamy U.V. and Manickam S.** (1987) : 'Management of Coastal Aquifers', Jal Vigyan Sameeksha, 2 : 62-63.

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