

STATE OF ENVIRONMENT REPORT OF TAMIL NADU

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1. Introduction

There is an awakening the world over to have a clean and healthy environment. Environment is influenced by a variety of factors; the multiplicity of factors makes environmental management a complex issue. To formulate an appropriate policy for environmental management and implement the programme, a base line or benchmark survey of the present status of various factors that govern the environment is a pre requisite.

The **State of Environment (SoE) provides a general picture of the state of the bio- physical and socio-economic condition** and an understanding of how human activities affect the environmental conditions and its implications on human health and economic well being. It also provides an overview of the outcome of responses such as policy initiatives, legislative reform and changes in policy behaviour. The SoE report has a large pool of potential users for both the monitoring and reporting functions of the system. The SoE prepared for the State of Tamil Nadu covers the priority issues pertaining to the environment

This study on “SoE for Tamil Nadu State” is intended to provide a benchmark for future environmental reporting and also to serve as the database for policy making and preparation of environmental management plans. At present the required data lies scattered in the archives of various government departments and agencies. This report is intended to bring all the data available to one place from which the required data can be accessed and collected.

Tamil Nadu, the southern most state of the Indian peninsula is, spread over 1,30,058 Sq.Km; it lies between 8° 5" to 13° 35" N and 76° 15" to 80° 20" E and accounts for about 4 percent of the total area of the country. The topography of Tamil Nadu broadly consists of the coastal plains in the east; uplands and hills as one proceeds westwards; the plains account for more than half the area of the state.

Tamil Nadu has number of rivers that are relatively small and not perennial. Barring the hills, the climate of Tamil Nadu can be classified as semi–arid tropic monsoonic. **The maximum temperature in the plains is about 45°C in the summer and the minimum goes to about 10°C during the winter; the normal rainfall in the state is about 950mm with an average number of 50 rainy days.**

Analyzing the land use pattern of the state, it is found that 43% of Tamil Nadu’s geographical area is under agriculture with a per capita figure of 0.0982 ha. of agricultural land. While agriculture and allied sectors account for nearly 62% of the total employment of the state, their contribution to economy is only 22%. In order to increase the productivity we have relied too much on improved crop varieties, fertilizers and pesticides. The residues of these have affected soil structure and polluted the water through leaching. India is the leader in fruit production in the world. The horticulture and plantation crops occupy a total of 7,53,985 ha. of area. However, there is need to improve the productivity of these crops on sustainable basis without affecting the overall land and water environment.

For the well being and prosperity of a country, atleast about one third of her geographical area should be under good forest cover. **In Tamil Nadu we have only 17.5% of the area under forest cover a sizeable area is under degraded of which condition.** Tamil Nadu is extremely rich in bio diversity but adequate attention has not been paid in the past to assess it effectively; as a result many species have become endangered. Bio diversity conservation assessment and monitoring needs greater fillip in the coming years.

Water is the most important resource for the livelihood of the human beings; Tamil Nadu is water deficient state despite receiving approximately 950 mm of rainfall per year. **Tamil Nadu has number of seasonal rivers; the, surface water resources are almost fully harnessed by impounding the available water in 61 major reservoirs and also in 39,202 big and small tanks.** As per the estimates, 60% of the ground water resources have also been utilized. So the management of available water resources on a sustainable basis becomes quite imperative.

Tamil Nadu has a long and glorious tradition of maritime activities. The tropical climate is conducive for the breeding varieties of fishes throughout the year. The total fish production in the inland fishing was 1.01 lakh tonnes during 1996-97. However the marine fish products were in the order of 3.56 lakh tonnes. Moreover, the potential for inland fishing has not been utilized completely; pollution of coastal water is resulting in decreased catch per unit effort.

The long coastline of over 1000 Km. forms a major natural resource with immense value for commercial, recreational and aesthetic purposes. Wetlands are transitional zones that occupy an intermediate position between dry land and open water. This term encompasses a diverse and heterogeneous assemblage of habitats ranging from rivers, flood plains and rainfed lakes to mangrove swamps, estuaries and salt marshes. Wetlands are one of the most productive eco systems. They perform useful functions of flood control, water storage purification and stabilization of shorelines etc. Agricultural run off with pesticide residues and indiscriminate destruction of mangroves for fuel wood are posing a threat to this ecosystem.

The growth in human population over the years has had both the positive and negative impact on overall quality of environment. As the demand for energy has increased the potential for electrical energy production has also been tapped to a great extent. Apart from that we have also realized the importance of non-conventional energy sources to minimise the pressure on the conventional energysources.

Growth in population has led to the enhanced growth in tourism. It is now considered to be one of the fastest growing industries in Tamil Nadu. Tamil Nadu is especially fortunate in having its ancient and rich heritage preserved, which serves as a main tourist attraction throughout the state. But coupled with promotion of tourism, the problem of environmental degradation, particularly the worsening sanitary condition in tourist spots needs to be addressed.

The ever-increasing population migration leads to the problem of urbanization and human settlement. Urbanisation is an inevitable challenge, which has to be faced and handled properly in the right perspective. The sanitation facilities, hygiene, sewerage, water supply and above all proliferation of slums are the important concerns.

Being one of the most industrialised states of the country, the growth of factories and the number of persons employed in the industrial sector is quite high. Industrialization though important as the back bone of the development, leads to several adverse effects on the environment through discharge of untreated effluents, emission of the green house gases and noise pollution.

This SoE report is divided into nine chapters. It begins with human resources and demographic transition in Tamil Nadu. This is followed by land resources, which include land use, agriculture, forest and wildlife besides the land degradation and efforts to ecologically restore the wasteland.

The chapter on water resources includes fresh water resources and ground water potential in the state. It also explains coastal areas and wet lands. The environmental concerns in water resource

include dearth of fresh water, depletion of ground water, water pollution, reduction in fish catch and seawater intrusion.

Tamil Nadu is the third industrialised and the most urbanised state in the country. The impact of Industrialisation and urbanisation on environment is substantial as evidenced from rise in hazardous and biomedical waste generation, increasing vehicular population and consequent increase in energy demand and air pollution.

The environmental challenges in Tamil Nadu and efforts to tackle them through institutional mechanism, increased public awareness and legislation are explained towards the end of the report. Strict improvement of environmental legislation coupled with environmental consciousness among the public at large alone can bring better environmental future for the present as well as future generation.

I acknowledge with thanks the tremendous spadework done by the AIMS research, consultant in collection of base data from diverse agencies and bringing out the draft report. I also place on record the committed and sincere work of Thiru Ashish Kumar, I.F.S, Joint Director, Dr.Thiyagesan, Former Joint Director for Research and Training, Thiru Deivasigamanai, Deputy Director, Thiru Mohan, Junior drafting officer, Tmt. Chitra, Steno Typist and Thiru Kanagaraj, Console Operator in incorporating the comments of the HODs/experts in the final draft report. Dr. C. Thomson Jacob, Programme Officer, Envis deserves complement for organising the data and editing it in the present format.

The Department of Environment (DOE) as the nodal agency concerned with Environment Policy of the Government of Tamil Nadu has realized the necessity for building a strong database and has brought out this study to facilitate the formulation of an Environmental Management Plan for the State. I am sure this SoE report, brought out through the pioneering effort of DoE will be useful to all the departments of the government, researchers and students.

I welcome comments and suggestion for improving the report further. It is proposed to update and improve this report during the tenth plan period with the financial support of government of India.

Dr. S. Balaji, I.F.S.,
Director of Environment

2. Human resource and Demographic transition

Tamil Nadu is one of the states in the country that has grown fairly fast during the 1990's and forged ahead in almost all the economic sectors. Tamil Nadu has also done well in terms of human development. The performance of the state as a whole is commendable. **The total population of Tamil Nadu is 6,21,10,839 as per the provisional results of the Census of India 2001** (Table 2.1). In terms of population it holds the sixth position among the States and Union territories in the country. As against all India decadal growth rate of population 21.34% during 1991-2001, in Tamil Nadu this has further slipped to 11.19% from 15.39% during 1981-1991 (Table 2.2). The sex ratio (i.e., the number of females per thousand males) of population in the State has improved from 974 in the previous census to 986 in the present census. The literacy rate in the State has shown remarkable improvement. This has increased to 73.47% (40,624,398 persons) when compared to 62.66% ten years back during 1991 Census (Table 2.3 & 2.4).

Table 2.1 Population

| | |
|---------|------------|
| Persons | 62,110,839 |
| Males | 31,268,654 |
| Females | 30,842,185 |

Sex Ratio: 986

Table 2.2 Decadal Growth 1991 - 2001

| | |
|---------|-------------|
| Persons | (+) 11.19 % |
| Males | (+) 10.49 % |
| Females | (+) 11.91 % |

Table 2.3 Number of Literates

| | |
|---------|------------|
| Persons | 40,624,398 |
| Males | 22,847,735 |
| Females | 17,776,663 |

Table 2.4 Percentage of Literates to Total population

| | |
|---------|---------|
| Persons | 73.47 % |
| Males | 82.33 % |
| Females | 64.55 % |

I. DEMOGRAPHIC ASPECTS

Tamil Nadu had a population of 55.9 million according to the 1991 census, which rose to 62.1 million in 2001 making it the sixth most populous State in the country. Tamil Nadu is not only one of the most populous states of India but also densely populated. Density of population in Tamil Nadu is 478 persons per sq. km. whereas the national average is 324 persons per sq. km., and is the sixth highest among the major states of India (Table 2.5).

Table 2.5 Density of Population in Tamilnadu and India

| States | Density of Pop / sq. km. | |
|------------|--------------------------|------|
| | 1991 | 2001 |
| Tamil Nadu | 429 | 478 |
| All India | 267 | 324 |

Source: Census of India 2001

II. GROWTH RATE

The population growth rate has declined during 1991-2001 as compared to 1981-1991 in practically all the major states except Bihar (excluding Jharkhand). The southern states have shown a decline in growth rate from their already relatively lower levels. In Tamil Nadu the growth rate between 1981 and 1991 was 15.39 percent whereas growth rate between 1991 and 2001 was only 11.19 percent. The decadal growth rate of Tamilnadu was lower than the national level. At the national level it is 2.50 percent point lower than the previous decade whereas in Tamil Nadu it is 4.20 percent point lower than the previous decade.

III. RURAL – URBAN POPULATION

Tamil Nadu is also relatively more urbanised than the other major states of India. **According to the 2001 Census, 43.86 percent of the population of Tamil Nadu lives in urban areas** whereas the level of urbanization at the national level is less than one-third (27.78%). According to 1991 census also the level of urbanization of Tamil Nadu (34.15%) was high; however, in 2001 it became the state having the highest percentage of urban population in India (Table 2.6).

Table 2.6 Level of Urbanization in Tamilnadu and All-India

| States | 2001 | | | 1991 | | |
|------------|----------------------|-----------------------|-------------|----------------------|-----------------------|-------------|
| | Total Pop (in crore) | Urban Pop. (in crore) | % Urban Pop | Total Pop (in crore) | Urban Pop. (in crore) | % Urban Pop |
| Tamil Nadu | 6.21 | 2.7 | 43.86 | 5.58 | 1.9 | 34.15 |
| All India | 102.70 | 28.5 | 27.78 | 84.63 | 21.8 | 25.71 |

Source: Census of India 2001

The increase in level of urbanisation in Tamil Nadu over the period 1991-2001 is related to the emergence of a large number of statutory towns. In the 2001 census, all statutory towns and places that satisfy certain demographic and economic criteria are treated as urban. All Town Panchayats have been included in the urban frame irrespective of whether they satisfy the demographic and economic criteria.

The urban population of Tamil Nadu is about 16 million, around of 33 percent of the total population in the state. The state has 434 urban centres. Of these 21 centres have population over 1,00,000(Class I), consisting of about 8 million people. While Chennai metropolitan area has a population of 4.3 million, each urban agglomeration of Maduarai, Coimbatore, Thiruchirapalli and Salem covers a population of 2.9 millions. There are 41 urban centres with a population of 50,000 to 1,00,000 (Class II), accomodating 3 million people and 90 towns with population between 20,000 to 50,000 (Class III) have 3 million people. The urban population is distributed in 6 municipal

Corporations, 102 Municipalities, 9 Municipal townships and 635 town panchayats. The rural population is distributed in 12,584 village Panchayats

IV. EMPLOYMENT SITUATION IN TAMIL NADU

The Worker Population Ratio (WPR) in 1993-94 and 1999-2000 is given in Table 2.7. WPR is expressed as the Number of Workers Per 1000 Population according to usual status (Taking both Principal and Subsidiary Status). The WPR has declined in rural and urban areas in 1999-2000 as compared to 1993-94 both in Tamil Nadu and All-India.

Table 2.7 Worker Population Ratio in Tamil Nadu and All India

| States | Rural | | | | | | Urban | | | | | |
|------------|------------|-----|-----|------------|-----|-----|------------|-----|-----|------------|-----|-----|
| | 55th Round | | | 50th Round | | | 55th Round | | | 50th Round | | |
| | M | F | P | M | F | P | M | F | P | M | F | P |
| Tamil Nadu | 594 | 430 | 513 | 602 | 478 | 539 | 563 | 215 | 393 | 575 | 230 | 402 |
| All India | 531 | 299 | 417 | 553 | 328 | 444 | 518 | 139 | 337 | 521 | 155 | 347 |

Source: NSSO 50th Round (1993-94) and 55th (1999-2000) Round

However, the Worker Population Ratio is higher in Tamil Nadu compared to the national average both in 1999-2000 and 1993-94 in rural as well as in urban areas. Compared to the other major states work force participation ratio is higher in Tamil Nadu especially in urban areas. **The sectoral composition of workers of rural Tamil Nadu reveals that about 70% of the worker population in such areas is engaged in the agricultural sector.** The Worker population ratio engaged in agricultural sector has decreased in rural Tamil Nadu from 1993-94 (705) to 1999-2000 (679). But in rural Tamil Nadu secondary and tertiary sector employment is also important. WPR in primary sector is lower than the national average. There is an increase of worker population in the service sector and also in construction. The sectoral composition of workers is different in urban Tamil Nadu. In urban Tamil Nadu 90% of the worker population is engaged in the secondary and tertiary sectors (Table 2.8).

Table 2.8 - Distribution of usually working persons by broad industry division

| Sectors | Rural | | | | Urban | | | |
|-----------------------------|---------|-------|-----------|-------|---------|-------|-----------|-------|
| | 1993-94 | | 1999-2000 | | 1993-94 | | 1999-2000 | |
| | TN | India | TN | India | TN | India | TN | India |
| Agriculture | 705 | 784 | 679 | 763 | 122 | 123 | 89 | 88 |
| Mining & Quarrying | 4 | 6 | 5 | 5 | 3 | 12 | 4 | 8 |
| Manufacturing | 126 | 70 | 139 | 74 | 299 | 236 | 282 | 227 |
| Electricity | 2 | 2 | 2 | 2 | 7 | 10 | 7 | 7 |
| Construction | 23 | 24 | 40 | 33 | 75 | 63 | 73 | 80 |
| Wholesale Retail Trade etc. | 48 | 43 | 56 | 51 | 186 | 194 | 253 | 269 |
| Transport Storage etc. | 20 | 14 | 26 | 21 | 76 | 79 | 88 | 87 |
| Financial Insurance | 8 | 3 | 6 | 3 | 30 | 34 | 41 | 41 |
| Community services | 62 | 54 | 47 | 49 | 202 | 248 | 163 | 195 |

Source: NSSO 50th Round (1993-94) and 55th (1999-2000) Round

V. STATUS OF EMPLOYMENT

Table 2.9 - Distribution of Usually Employed Persons by Status of Employment
Rural

| Classification | Tamil Nadu 55th Round | | | India 55th Round | | |
|----------------|-----------------------|------------------|---------------|------------------|------------------|---------------|
| | Self Employed | Regular Employed | Casual Labour | Self Employed | Regular Employed | Casual Labour |
| Male | 358 | 153 | 489 | 550 | 88 | 362 |
| Female | 380 | 69 | 551 | 573 | 31 | 396 |
| Persons | 367 | 118 | 515 | 558 | 68 | 374 |

Urban

| Classification | Tamil Nadu 55th Round | | | India 55th Round | | |
|----------------|-----------------------|------------------|---------------|------------------|------------------|---------------|
| | Self Employed | Regular Employed | Casual Labour | Self Employed | Regular Employed | Casual Labour |
| Male | 330 | 454 | 216 | 415 | 417 | 168 |
| Female | 394 | 407 | 199 | 453 | 333 | 214 |
| Persons | 347 | 441 | 212 | 422 | 400 | 178 |

Source: NSSO 55th (1999-2000) Round.

In rural Tamil Nadu percentage of workers engaged in casual labour is high compared to the national level. In rural Tamil Nadu more than 50 percent worker population is in casual labour category compared to only 37.4 percentage at the all India level. Percentage of self-employed persons (36.8%) is lower than the national average (55.8%). In urban Tamil Nadu, percentage of regular employment (44.1) is higher than the national average (40%) while percentage of self-employed is consequently lower. Percentage of self-employed persons in Tamil Nadu is 34.7 per cent whereas the national level is 42.2 per cent (Table 2.9)

VI. POVERTY

There has been a significant reduction in the proportion of population below the poverty line during the last two decades. The Expert Group of the Union Planning Commission estimated that the proportion of people living below poverty line has declined from 54.86 percent in 1973-1974 to 35.97 percent in 1993-1994, while in the case of Tamil Nadu poverty has declined from 54.94 percent in 1973-74 to 35.03 percent in 1993-94. There has been a sharp decline of percentage of population below poverty line through out the country between 1993-94 and 1999-2000. **The Percentage of population below poverty line has decreased from 35.97 to 26.10 percent at the national level and 35.03 to 21.12 per cent in Tamil Nadu (Table 2.10).**

Table 2.10 People Living Below Poverty Line (Rural and Urban)

| Year | Rural | | Urban | | Combined | |
|-----------|-------|-------|-------|-------|----------|-------|
| | TN | India | TN | India | TN | India |
| 1973-74 | 57.43 | 56.44 | 49.40 | 49.01 | 54.94 | 54.88 |
| 1977-78 | 57.68 | 53.07 | 48.69 | 45.20 | 54.79 | 51.32 |
| 1983-84 | 53.99 | 45.65 | 46.96 | 40.79 | 51.66 | 44.45 |
| 1987-88 | 45.80 | 39.09 | 38.64 | 38.20 | 43.88 | 39.86 |
| 1993-94 | 32.46 | 37.27 | 39.77 | 32.36 | 35.03 | 35.97 |
| 1999-2000 | 20.55 | 27.09 | 22.11 | 23.62 | 21.12 | 26.10 |

Source: Planning Commission, GOI, New Delhi

VII. UNEMPLOYMENT IN TAMIL NADU

In 1999-2000 the unemployment rate was higher in rural Tamil Nadu compared to the national average but unemployment rate in urban areas was lower than the national average (Table 2.11)

Table: 2.11 - Unemployment Status in Tamil Nadu and India

| States | Rural | | | | | | Urban | | | | | |
|------------|------------|---|----|------------|----|----|------------|----|----|------------|----|----|
| | 50th Round | | | 55th Round | | | 50th Round | | | 55th Round | | |
| | M | F | P | M | F | P | M | F | P | M | F | P |
| Tamil Nadu | 18 | 6 | 13 | 27 | 10 | 20 | 43 | 68 | 50 | 36 | 51 | 40 |
| All India | 14 | 8 | 12 | 17 | 10 | 15 | 40 | 62 | 45 | 45 | 57 | 47 |

Source: NSSO 50th Round (1993-94) and 55th (1999-2000) Round

3. Land Resources

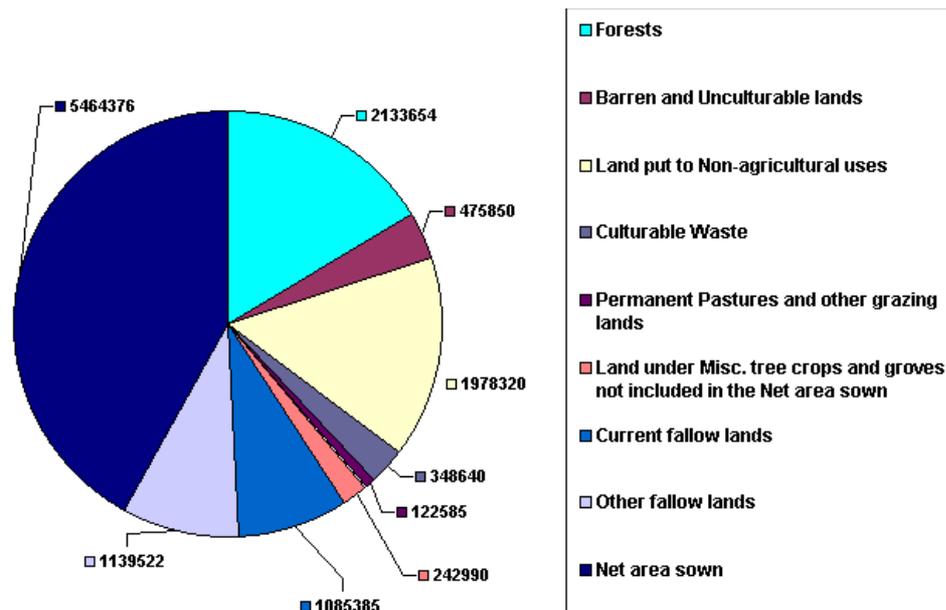
A. LAND USE

The geographical area of Tamil Nadu is 13 million ha. According to professional survey and also village records, the land use pattern during 2000-2001 is indicated in the following Figure & Table 3.1.

Table 3.1 Land use pattern (2000-2001)

| Classification | | Area (Hec.) |
|----------------|--|-------------|
| | Geographical Area | |
| A | By Professional Survey | 12991322 |
| | By Village Papers | 12991322 |
| B | 1. Forests | 2133654 |
| | 2. Barren and Unculturable lands | 475850 |
| | 3. Land put to Non-agricultural uses | 1978320 |
| | 4. Culturable Waste | 348640 |
| | 5. Permanent Pastures and other grazing lands | 122585 |
| | 6. Land under Misc. tree crops and groves not included in the Net area | 242990 |
| | 7. Current fallow lands | 1085385 |
| | 8. Other fallow lands | 1139522 |
| | 9. Net area sown | 5464376 |
| C. | Area sown more than once | 1054733 |
| D. | Total Cropped Area | 6519109 |

Figure: 3.1 Land Utilization in Tamil Nadu- 1999-2000 (in Hectares)



1. FORESTS

In Tamil Nadu Dharmapuri district ranks the first with a forest cover area of 3,66,226 hectares. This works out to 17.2% of the state's total forest area. This is followed by Erode district with 2,28,750 hectares (10.7%). **The Nilgiris district has about 56.3% of the total area as forests**

followed by Dharmapuri with 38.0%. Dharmapuri, Erode, Vellore, Coimbatore, Thiruvannamalai, The Nilgiris, Dindigul, Salem, Thirunelveli and Theni Districts account for 79.8% of the total forest area of the state.

2. BARREN AND UNCULTURABLE LAND

In Tamil Nadu, an extent of 475850 hectares of land comes under barren and unculturable land category, which represents 3.7% of the total geographical area of the state. Villupuram district alone accounts for 57297 hectares which is 12.0% of the state's barren and unculturable land and about 7.9% of its geographical area is under this category. The area under this category is very meagre in Thiruvarur district with 0.2% of the total geographical area.

3. LAND PUT TO NON-AGRICULTURAL USES

The lands occupied by buildings, pathways, roads, canals and land put to uses other than agricultural purposes are brought under this category. **Area under this classification is 1978320 hectares accounting for 15.2% of the state's geographical area.** The extent under this category has increased by 10555 hectares during the year under report as compared to 1998-99. In Kancheepuram district about 141750 hectares of land are put to non-agricultural uses, which is the highest in the state (7.2%) followed by Pudukottai with 128103 hectares (6.5%). In Chennai district about 98.3% of its geographical area is put to non-agricultural uses.

4. CULTURABLE WASTE

The total area under culturable waste is 3,48,640 hectares or 2.7% of the total geographical area of the state. Thirunelveli, Karur, Thoothukudi, Sivagangai, Dharmapuri, Tiruchirapalli, Thiruvannamalai, Villupuram, Pudukkottai and Thanjavur districts account for nearly 72% of the area under this category. The area of culturable waste is very meagre in Kanyakumari district with 0.04% of the State's geographical area.

5. PERMANENT PASTURES AND OTHER GRAZING LANDS

All grazing lands, whether they are permanent pastures or meadows are considered as permanent pastures. An extent of 122585 hectares or 1.0% of the geographical area of the state falls under this category. The extent under this category is the highest in Kancheepuram district with 18317 hectares followed by Dharmapuri district with 13,668 hectares.

6. LAND UNDER MISCELLANEOUS TREE CROPS

Lands under casuarina trees, thatching grasses, bamboo bushes and other groves for fuel etc., which are not included under orchards are classified under this category. The extent is 242990 hectares or 1.9% of the geographical area of the state. Thoothukudi district with 34223 hectares under this classification ranked first contributing 14.1% of the total area of the state under this category.

7. CURRENT FALLOW LANDS

The cultivable lands, which are kept fallow during the entire period under review is known as current fallow. The area under current fallow during 1999-2000 constituted 8.4% of the total geographical area of the state with an extent of 1085385 hectares as against 955507 hectares during the previous year. The extent is the highest in Coimbatore and Erode districts with 135802 and 131500 hectares of land respectively. Coimbatore and Erode districts together accounted for 24.6% of the total area of the state under this category.

8. OTHER FALLOW LANDS

All lands which are taken up for cultivation but have temporarily put off cultivation for a period of not less than one year and not more than five years are treated as other fallow lands. An extent of

1139522 hectares, which is 8.8% of the total geographical area, has been recorded under this category as against 1110728 hectares during the previous year. There is an increase of 2.6% under this category of land as compared to the previous year. The land under other fallow land is the highest in Thirunelveli district with 24.5% of the total area under this classification and ranked first contributing 14.7% of the total area of the state under this category.

9. NET AREA AND GROSS AREA SOWN

Net area sown represents the area sown with crops during the year only once. Out of the 12991322 hectares of geographical area 5464376 hectares of land constituting 42% was cultivated once with various crops during the year 1999-2000. Of the total net area sown in the State, the share of Dharmapuri district was 7.2% followed by Villupuram district with 6.2%. Thiruvarur district ranked first contributing 72.7% of its geographical area towards this category followed by Cuddalore with 62.7%, Thanjavur district with 59.8%, Perambalur with 58.4%, Namakkal with 58%, Nagapattinam with 55.9% and Salem with 49.8% respectively.

The gross area sown represents the total area cultivated under all food and non-food crops including the area sown more than once. The gross area sown during 1999-2000 is 6519109 hectares as against 6627125 hectares during 1998-99, registering a decrease of 1.6%. The area sown more than once during 1999-2000 is 1054733 hectares as against 992611 hectares in 1998-99, the increase being 6.3%. The area sown more than once is 16.2% of the gross area sown in the state during 1999-2000.

10. CROPPING INTENSITY

The intensity of cropping in T.N (Ratio of gross area sown to net area sown) is 1.19 in 1999-2000. The cropping intensity is the highest in Nagapattinam with 1.7. The ratio is 1:6 in Thiruvarur, 1:5 in Salem, 1:4 in Thiruvallur and Namakkal, 1:3 in Cuddalore, Thanjavur and Thiruvannamalai, 1:2 in Kanyakumari, Thirunelveli, Erode, Dharmapuri, Vellore and Kancheepuram districts. The ratio is 1:1 in Villupuram, Coimbatore, Thiruchirapalli, Perambalur, Madurai, Theni and 1:0 in The Nilgiris, Thoothukudi, Sivagangai, Virudhunagar, Ramanathapuram, Dindigul, Pudhukkottai and Karur districts.

II. RAINFALL

The estimated rainfall in the state is about 1050 million hectare metres. The maximum rainfall of 470.3 mm was recorded during the northeast monsoon season for the year 2000-2001 (Figure 3.2). The southwest monsoon and northeast monsoon determine the rainfall of Tamil Nadu though some rains are received during the winter (January and February) and also during hot weather (March to May) seasons. The State depends mainly on the northeast monsoon rains, which are often accompanied by low pressure formed in the south Bay of Bengal. The Western ghats act as a barrier denying the state the full benefit of southwest monsoon. Only Nilgiris and Kanniyakumari districts are benefited fully by both monsoons.

Figure 3.2 Rainfall by season in Tamil Nadu 2000-2001

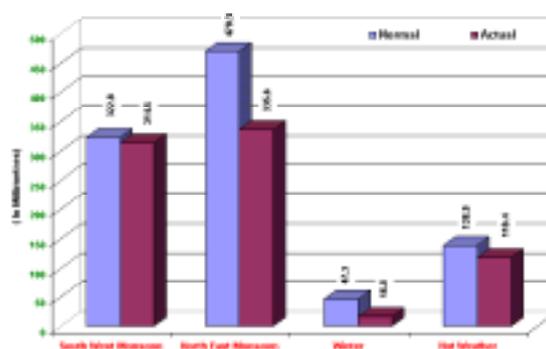


Table 3.2 Rainfall Pattern in all the districts 1998-99

| Range of Rainfall | Districts |
|-------------------|--|
| Below 800-mm | Namakkal, Erode, Coimbatore, Karur, Theni, Thoothukudi |
| 801 to 1000 –mm | Vellore, Dharamapuri, Tiruchirapalli, Pudukkottai, Madurai, Dindigul, Ramanathapuram, Virudhunagar, Sivagangai and Tirunelveli |
| 1001 to 1200 –mm | Tiruvallur, vilupuram, Thiruvananthapuram, Salem, Thanjavur, Perambalur, Thiruvarur and Kanyakumari |
| 1201 to 1400 –mm | Chennai, Cuddalore, Kanchipuram and Nagapattinam |
| 1401 to 1800 –mm | The Nilgiris |

Source: Indian Meteorological Department, Chennai

B. AGRICULTURE

I. GENERAL SCENARIO

The production of food-grains during the year 2001-2002 was 8842400 tonnes. Rice is the dominant crop constituting 85.2% of the total food-grains production. About 43% Tamil Nadu's area is under agriculture with a per capita figure of 0.0982 ha. of agricultural land. The size of operational holdings is going down fast and sub-marginal holdings below 0.5 ha constitute the majority with cropping intensity of 118% and irrigation intensity of 119%. **Tamil Nadu has roughly 7% of the country's population, 4% of the land and 3% of the water resources.** Surface irrigation has been exploited to an extent of 97.5%. While agriculture and allied sectors account for nearly 62% of the total employment of the state, their contribution to the state's economy is only 22%.

II. AGRICULTURAL POLICY

State Policy

The objective of Tamilnadu Government on the agriculture front is to achieve the goal of "Doubling Food production" in the immediate future. To achieve this goal, the State Government has formulated an agricultural policy, which aims at

1. Scientific approach taking efforts for upliftment of the rural economy and preservation of ecological balance based on the requirements of agro climatic zones.
2. To march towards second green revolution by increasing productivity, production and profitability.
3. Implementation of farmers welfare schemes such as integrated watershed development, land management, development of water resources, organic farming especially use of green manure, bio fertilizers, bioconversion of agricultural wastes, bio pesticides and parasites, integrated pest management, remunerative price to agricultural produce, processing, value addition to agricultural produce, promotion of crops with export potential, with a view to ensure economic improvement, besides rural prosperity.

III. CLASSIFICATION OF TAMIL NADU SOILS

In Tamil Nadu soils are classified in to six orders, 12 sub-orders, 20 great groups, 44 sub-groups and 94 soil families in the hierarchy. The six orders are Entisols, Inceptisols, Alfisols, Mollisols, Ultisols, Vertisols. Inceptisols cover about 50% of the State's total geographical area followed by Alfisols (30%), Vertisols (7%), Entisols (6%), Ultisols (1%) and negligible area by Mollisols. About 5% of the area are miscellaneous land types, which include rocklands, marshes, urban areas and water bodies. (Map 3.1)

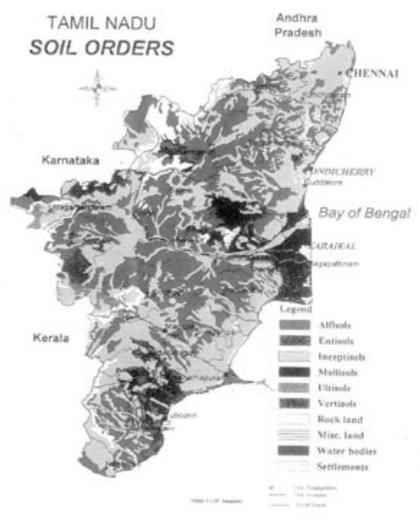


Table 3.3 Classification of Tamil Nadu Soils

| Type of Soil | Place of occurrence |
|---------------------------------|--|
| 1. Red loam | Parts of Kancheepuram, Cuddalore, Salem, Dharmapuri, Coimbatore, Tiruchirappalli, Thanjavur, Ramanathapuram, Madurai, Tirunelveli, Sivagangai, Thoothukudi, Virudhunagar, Dindigul and Nilgiris districts. |
| 2. Laterite soil | Parts of Nilgiris district. |
| 3. Black soil | Parts of Kancheepuram, Cuddalore, Vellore, Tiruvannamalai, Salem, Dharmapuri, Madurai, Ramanathapuram, Tirunelveli, Sivagangai, Thoothukudi, Virudhunagar, Dindigul and Nilgiris districts. |
| 4. Sandy coastal alluvial soils | Along the coasts in Ramanathapuram, Thanjavur, Nagapattinam, Cuddalore, Tiruvarur, Kancheepuram and Kanniyakumari districts. |
| 5. Red sandy soils | Small patches in Coimbatore and Nilgiris districts. |
| 6. Riverine alluvial soils | Parts of Kancheepuram, Tiruvallur, Villupuram, Cuddalore, Thanjavur, Nagapattinam, Tiruvarur, Ramanathapuram and Thoothukudi district. |

Source: Directorate of Agriculture and Department of Economics and Statistics, Chennai.

IV. LAND CAPACITY

Based on rainfall, land slope, erosion, drainage, soil texture, depth, pH, etc. of the soils, seven land capability classes have been identified for Tamil Nadu. The details are given below (Map 3.2)



Table 3.4 Land Capability

| Capability Class | Description | Area '000 ha. | Percentage |
|------------------|------------------------------------|---------------|------------|
| II | Good cultivable lands | 4487.0 | 34.5 |
| III | Moderately good cultivable lands | 3836.7 | 29.5 |
| IV | Fairly good cultivable lands | 1898.9 | 14.6 |
| V, VI, VII, VII | Areas not suitable for cultivation | 2457.7 | 21.4 |

Table 3.5 area, production and productivity of principal crops 1999-2000

| Sl. No. | Crops | Area ('000' Hec.) | Productivity (in Kg./Hec.) | Production (in '000' tonnes) |
|---------|----------------------------|-------------------|----------------------------|------------------------------|
| | A. FOOD GRAINS | | | |
| | a. CEREALS | | | |
| 1. | Paddy | 2164 | 3481 | 7532 |
| 2. | Cholam (Jowar) | 351 | 984 | 346 |
| 3. | Cumbu (Bajra) | 158 | 1531 | 241 |
| 4. | Maize | 88 | 1609 | 137 |
| 5. | Ragi | 123 | 2004 | 246 |
| 6. | Small Millets | 56 | 893 | 50 |
| 7. | Total Cereals | 2940 | 2908 | 8552 |
| | B. PULSES | | | |
| 8. | Bengal gram | 8 | 633 | 5 |
| 9. | Red gram | 65 | 667 | 43 |
| 10. | Black gram | 270 | 389 | 105 |
| 11. | Green gram | 130 | 467 | 60 |
| 12. | Horse gram | 104 | 513 | 53 |
| 13. | Other Pulses | 116 | 203 | 24 |
| 14. | Total Pulses | 693 | 420 | 290 |
| 15. | Total Foodgrains (1 to 15) | 3633 | 2434 | 8842 |
| | C. OIL SEEDS | | | |
| 16. | Groundnut | 759 | 1736 | 1318 |
| 17. | Gingelly | 112 | 589 | 66 |
| 18. | Castor | 29 | 309 | 9 |
| 19. | Coconut (in Nuts) | 304 | 10204 | * 32220 |
| 20. | Other Oil Seeds | 19 | — | — |
| 21. | Total Oil Seeds | 1223 | — | — |
| | D. OTHER CROPS | | | |
| 22. | Cotton | 178 | 324 | **339520 |
| 23. | Sugarcane | 316 | 10835 | 3429 |
| 24. | Tobacco | 8 | 1506 | 12 |
| 25. | Chillies | 86 | 648 | 56 |
| 26. | All other crops | 1075 | — | — |
| 27. | Total (Other Crops) | 1663 | — | — |
| 28. | Total Crops (15+21+27) | 6519 | — | — |

Source: Department of Economics and Statistics (* = in lakh nuts ** = in bales of 170 kg. lint each.)

V. AGRICULTURAL ENGINEERING

The agricultural engineering department is actively engaged in the ‘Conservation, management and development’ of the soil and water resources of the State. The agricultural engineering department helps farmers in:

- i. The conservation of moisture and the protection of soil from erosion and degradation.
- ii. Creation and stabilisation of irrigation potentials through Minor Irrigation activities:
- iii. Optimization of water use by introduction of Micro Irrigation System.
- iv. Providing farm power to carry out timely agricultural operations and reclamation works

The major schemes and projects carried out by agricultural engineering are as follows.

VI. SCHEMES

1. Minor irrigation schemes
2. Micro irrigation systems
3. Installation of drip irrigation systems
4. Soil and water conservation schemes in the hills and plains
5. River valleys projects
6. Hill area development program
7. Western Ghats development programme
8. Comprehensive water- shed development project
9. Command area development programme
10. Remote sensing

VII. PROJECTS

1. Soil conservation in the catchments of Kundah and Bhavani River Valley Projects
2. Drip Irrigation System for fruits, flowers and coconuts
3. Comprehensive watershed development project
4. Comprehensive watershed development project in Tirunelveli and Thoothukudi Districts
5. Comprehensive Watershed development project in Viruthunagar, Sivaganga and Ramanathapuram Districts

VIII. SEED CERTIFICATION AND INSPECTION

The seed certification and Inspection department implements the following schemes to ensure the availability of quality seeds to the farmers.

- Seed certification
- Seed inspection
- Seed testing and
- Training

To ensure the quality of the seeds distributed to the farmers, selling points are inspected periodically, seed samples drawn and analyzed in the notified seed-testing laboratory. Based on the test results legal actions are initiated against defaulters.

IX. WOMEN IN AGRICULTURE

Tamil Nadu Women in agriculture (TANWA) (aided by DANIDA) is a special scheme exclusively targeted towards women. The objectives of this scheme are,

- Training small and marginal farm women on the skills of latest agricultural technology,
- Increasing the production and improving the food security in small and marginal holdings
- Recognition to farm women in productive role and
- Full utilization of the potential of farm women

This is being implemented as an externally aided project in all districts except Chennai at a cost

of Rs. 33.92 crores to train 68,900 farm women spread over a period of seven years. The components of this project are skill based training, net working conference and group formation training.

X. HORTICULTURE

Tamil Nadu is endowed with varied agroclimatic conditions suitable for the cultivation of varied horticultural crops. The fruit crops suitable for tropical conditions viz. mango, banana, acidime, guava, grapes, vegetables like onion, tomato, brinjal, bhendi, greens, gourds, spices and plantation crops like cashew, betelvine and flowers are being cultivated extensively in the districts of Chengalpattu, Vellore, Salem, Dharmapuri, Coimbatore, Trichy, Nagapattinam, Dindigul, Madurai, Virudhunagar, Tirunelveli and Kanyakumari. Sub tropical crops like pineapple, cardamom, pepper, clove, arecanut etc. are grown in large areas in Salem, Coimbatore, Dindigul, Nilgiris and Kanyakumari districts. Temperate fruit crops like pear, plum, peach and vegetables like carrot, potato, beans, cabbage, beetroot and plantation crops like tea and coffee are cultivated in Dindigul and Nilgiris districts. To promote the cultivation of these horticultural crops, several development schemes are being formulated and implemented by horticulture department.

XI. MISSION FOR HORTICULTURE DEVELOPMENT

The mission of the horticultural department is to involve integration of various aspects of horticulture development from plantation to marketing with special emphasis on dry land horticulture, conservation of water through drip irrigation and establishment of Agro-economic and Export Processing Zones for post harvest storage and marketing of horticultural produce.

XII. POLICY THRUST FOR 2002-2003

1. Thrust would be given to develop wastelands by raising appropriate horticultural crops with micro irrigation management.
2. Increasing the production and productivity of horticultural crops by better nutrient management and by utilising the bio diversity of Tamil Nadu.
3. Production of vegetables round the year will be ensured thereby maintaining continuous flow of vegetables to markets.
4. Concentrating on post-harvest management to reduce the loss of perishable horticultural produce.
5. Conducting training to farmers and field functionaries on latest technologies.
6. Popularise organic farming and IPM technologies with a view to offset the problems arising out of the indiscriminate use of chemical fertilisers and pesticides, thereby ensuring eco-friendly environment and sustainability.
7. Mass scale production of pedigree planting materials in state horticultural farms to meet the increasing demand.
8. Intensifying Hi-tech horticulture and promotion of micro-irrigation system for horticultural crops on a larger scale for obtaining better productivity and quality of the produce.
9. A special thrust would be given for the development of commercial flowers and cut flowers not only to meet domestic demand but also export demand.

Table 3.6 Area under different horticultural crops 97-98

| S.No. | Crops | Area in ha. |
|-------|-----------------------|-----------------|
| 1. | Fruits | 2,06,850 |
| 2. | Vegetables | 1,76,540 |
| 3. | Spices and Condiments | 1,67,820 |
| 4. | Flowers | 16,745 |
| 5. | Plantation Crops | 1,86,030 |
| | Total | 7,53,985 |

XIII. HORTICULTURAL PARKS , FARMS AND FOOD PROCESSING

Two well laid-out popular parks and a reputed botanical garden are maintained by the Directorate of Horticulture as indicated below:

Table 3.7 Horticultural Parks in Tamil Nadu

| Name of the park | Place |
|------------------------------|----------------|
| Bryant Park | Kodaikanal |
| Sim's Park | Coonor |
| Government Botanical Gardens | Udhagamandalam |

In Tamil Nadu there are 48 horticultural farms, which have been established by the Directorate of horticulture to produce and distribute grafts, layers, seedlings and seeds to farmers. Ninety-one licensed fruit processing industries are operating in the State. Fruits and vegetables are collected and marketed from 95 centres and 30 regulated markets. Sixteen cold storage plants are functioning in the private section. Sixty two state warehouses with a capacity of 6,20,019 tonnes and 30 central warehouses provide storage facilities for the fruits and vegetables.

XIV. IRRIGATION

Irrigation is the artificial application of water to the soil for normal growth of plants. Water is an important determinant factor for production of crops in agriculture sector. Intensive and extensive cultivation of land depends mainly on the availability of water. Medium and minor irrigation schemes are implemented in the state for augmenting the water supply for agriculture. The various sources of irrigation are canals, tanks, tube wells, ordinary wells, springs and channels.

a. Area irrigated

The net area irrigated by different sources of irrigation during 1999-2000 is 2971662 hectares as against 3018839 hectares in 1998-99 showing a decrease of 1.6% over the previous year. The net area irrigated during 1999-2000 constitutes 54.4% of the net area sown in the state. The highest percentage of the net area irrigated to the net area sown is recorded in Thiruvavur district with 97.08% whereas the lowest percentage is recorded in the Nilgiris district with 0.6%. The following table shows the net area irrigated by various sources compared with 1998-99.

Table 3.8 Distribution of net area irrigated

| Sl.No. | Source | Net area irrigated (in hectares) | | Percentage | |
|--------|----------------|----------------------------------|----------------|--------------|---------------|
| | | 1999-2000 | 1998-99 | 1999-2000 | 1998-99 |
| 1. | Canals | 867224 | 834006 | 29.2 | 27.6 |
| 2. | Tanks | 633052 | 689749 | 21.3 | 22.9 |
| 3. | Tube wells | 222121 | 223842 | 7.5 | 7.4 |
| 4. | Ordinary wells | 1231378 | 1252759 | 41.4 | 41.5 |
| 5. | Others | 17887 | 18483 | 0.6 | 0.6 |
| | TOTAL | 2971662 | 3018839 | 100.0 | 100.00 |

XV. FERTILIZERS AND MANURES

The use of chemicals N, P, K fertilizers in conjunction with organic manures is a must for stepping up productivity and high yield. **The importance of the role of chemical fertilisers in supplying the essential macronutrients viz. Nitrogen, Phosphate and Potash need be over emphasized.** On account of the widespread demand for these fertilisers, the department is monitoring

the production and supply of these fertilisers in the market in order to control the supply, quality and prices. The total consumption of chemical fertilizer in Tamil Nadu Since 1970-71 is 2.96 lakhs tonnes and for the year 2001-2002 is 9.63 lakhs tonnes per hectare. Consumption of fertilizers for cropped area on an average is about 140 kg (NPK) while the all India average is about 70Kg only. The total quantity of micronutrient production is 1023MT for the year 2001-2002.

XVI. ORGANIC FARMING

The use of quality compost, bio fertilisers, green manure, green leaf manure and application of enriched farm yard manure are the methods of organic farming techniques that are popularised to ensure economic and integrated plant nutrition management. The Department of Agriculture has a specific role to perform in production and distribution of Biofertilisers and green manure seeds besides enthusing the farmers on the use of compost and farmyard manure application. The organic green manure used widely includes green manure, green-leaf manure, compost, farmyard manure etc. Nitrogen fixing blue green algae are also used widely. Green manure seeds are being distributed to farmers at subsidized prices. Six bio-fertilizers production units functioning at Cuddalore, Salem, Ramanathapuram, Kudumaimalai, Sukkottai and Tirichurapali produce about 1,400 tonnes of bio-fertilisers annually for distribution among the farmers.

XVII. INTEGRATED PEST MANAGEMENT AND BIOLOGICAL CONTROL

This is a component of sustainable agriculture with a sound ecological foundation. It aims at maximizing production at minimal cost and obviating the ill effects like environmental pollution, pesticide residues in food, resurgence of pests etc. At present integrated pest management (IPM) is adopted for rice, cotton and pulses and likely to be extended to groundnut also. Parasites, entomophagous fungi and nuclear polyhedrous virus, which attack the pests and destroy them are raised departmentally and released into the fields. This is an eco-friendly measure of pest control.

C. FORESTS AND WILDLIFE

Forests are nature's renewable resource essential for environmental stability and food security. **The Forest department in Tamil Nadu is custodian of 22,845 sq. kms of forest land, which constitute 17.56% of the geographical area as against 33% targetted under the National Forest Policy, 1988.** Nearly half of the forest area is subjected to heavy degradation on account of biotic pressure. Various schemes and programmes of Government are aimed at restoring the degraded forest and expanding forests outside the Reserve Forest area.

I. NATIONAL FOREST POLICY OF 1988

The forests of Tamil Nadu are governed by National Forest Policy of 1988. In Tamil Nadu, the Tamil Nadu State Forest Act 1882, Wild Life Protection Act 1972, Forest Conservation Act 1980 and a host of rules formulated under these acts are implemented by the Forest Department. The principal aim of the National Forest Policy 1988, and the State Forest Policy is maintenance of environmental stability and restoration of ecological balance through conservation, upgradation and increase in the forest cover. Forests in Tamil Nadu are being managed with the following main objectives:

- Increasing substantially the forest/tree cover in the State Ensuring environmental stability and restoration of ecological balance
- Conservation of bio-diversity for the benefit of present and future generations
- Mitigating floods and droughts and also retarding siltation of reservoirs by checking soil erosion and denudation in catchment areas of rivers, lakes and reservoirs
- Meeting the genuine requirement of fuel, fodder, non-wood forest produce and small timber to the extent possible on a sustainable basis through Joint Forest management
- Extension of improved forest technology to farmers for creating alternative sources of forest produce outside the Reserved Forests

- Improving the habitat for all living beings including micro organisms, insects, birds and animals
- Making available the traditional forest produce to be used rightfully by the tribal people living inside forests

II. TAMIL NADU FOREST POLICY

Tamil Nadu Forest Policy takes into account all the objectives envisaged by the Government of India in their National Forest Policy. Conservation of bio-diversity enhances bioproductivity besides ensuring environmental stability. The forests are managed in accordance with scientific principles of silviculture and with due emphasis on the preservation of natural forests for protection of aesthetic, ecological and environmental reasons, giving due importance to wildlife preservation and its development.

III. BIOSPHERE RESERVES

Tamilnadu has the distinction of a wide range of habitats in different sanctuaries, National Parks and Tiger reserves. The habitats extend all over the state. Most of the important mammals of India are found here. Among the rare and endangered animal species are the Elephant, Tiger, Leopard, Wilddog, Striped Hyena, Jungle Cats, Jackals, Indian Pangolin, Slender Lories, Lion tailed Macaque, Sloth Bear, Bison or Gaur, Blackbuck, Nilgiris Taur, Grizzled Giant Squirrel Dugong and Mouse Deer.

Tamil Nadu has also the unique distinction of having a marine biosphere reserve viz., the Gulf of Mannar Biosphere Reserve and also a hill biosphere reserve, the Nilgiri Biosphere Reserve. It is noteworthy that the Nilgiri Biosphere Reserve is not only the first to be set up in India under the Man and Biosphere Programme, but also the only Indian biosphere reserve that has been included in UNESCO's global network of biosphere reserves.

A) *Nilgiri Biosphere Reserves*

Nilgiri is the first internationally designated biosphere reserve in India, representing a unique and threatened ecosystem in the tropics within the western Ghats system. It is one of the world's biodiversity hotspots and provides habitat for the largest south Indian population of tigers, elephants and other large Mammals. **The Nilgiri Biosphere Reserve was the first biosphere reserve in India established in the year 1986.** It is located in the Western Ghats and includes 2 of the 10 biogeographical provinces of India. A wide range of ecosystems and species diversity are found in this region. Thus, it was a natural choice for the premier biosphere reserve of the country. The Nilgiri Biosphere Reserve was established mainly to fulfill the following objectives:

- To conserve insitu genetic diversity of species
- To restore degraded ecosystems to their natural conditions
- To provide baseline data for ecological and environmental research and education
- To function as an alternate model for sustainable development



Map 3.3 -Showing Nilgiri Biosphere

The total area of the Nilgiri Biosphere Reserve is 5,520 sq. km. It is located in the Western Ghats between 76°- 77°15'E and 11°15' - 12°15'N. The Nilgiri Biosphere Reserve encompasses parts of Tamilnadu, Kerala and Karnataka. The annual rainfall of the reserve ranges from 500 mm to 7000 mm with temperature ranging from 0°C during winter to 41°C during summer.

The Nilgiri Biosphere Reserve falls under the biogeographic region of the Malabar rain forest. The Mudumalai Wildlife Sanctuary, Wyanaad Wildlife Sanctuary Bandipur National Park, Nagarhole National Park, Mukurthi National Park and Silent Valley are the protected areas present within this reserve. The Nilgiri Biosphere Reserve comprises of substantial unspoilt areas of natural vegetation ranging from dry scrub to evergreen forests and swamps thus contributing to highest biodiversity. The altitude and climatic gradients support and nourish the different vegetational types.

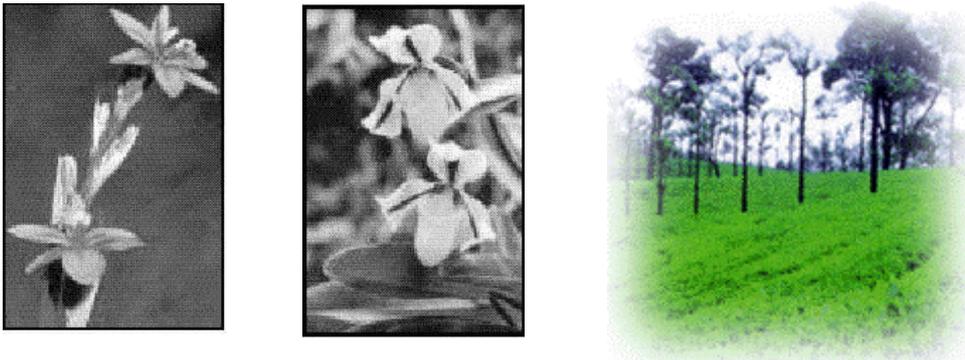


Figure 3.4 Sholas, Grasslands and Evergreen forests

A. FLORA

The Nilgiri Biosphere Reserve is very rich in plant diversity. **About 3,300 species of flowering plants can be seen here. Of the 3,300 species 132 are endemic** to the Nilgiri Biosphere Reserve. The genus *Baeolepis* is exclusively endemic to the Nilgiris. Some of the plants entirely restricted to the Nilgiri Biosphere Reserve include species of *Adenoon*, *Calacanthus*, *Baeolepis*, *Frerea*, *Jarodina*, *Wagatea*, *Poeciloneuron*, etc.



Figure 3.4 - Flora of Nilgiri Biosphere

There are 175 species of orchids found in the Nilgiri Biosphere Reserve, 8 are endemic to the Nilgiri Biosphere Reserve. These include endemic and endangered species of *Vanda*, *Liparis*, *Bulbophyllum*, *Spiranthes* and *Thrixspermum*. The sholas of the Nilgiri Biosphere Reserve are a treasure house of rare plant species.

Table 3.9 Floral species of Nilgiri Biosphere

| Plant type | Numbers of Species |
|---------------|--------------------|
| Angiosperms | 3238 |
| Gymnosperms | 71 |
| Pteridophytes | 134 |

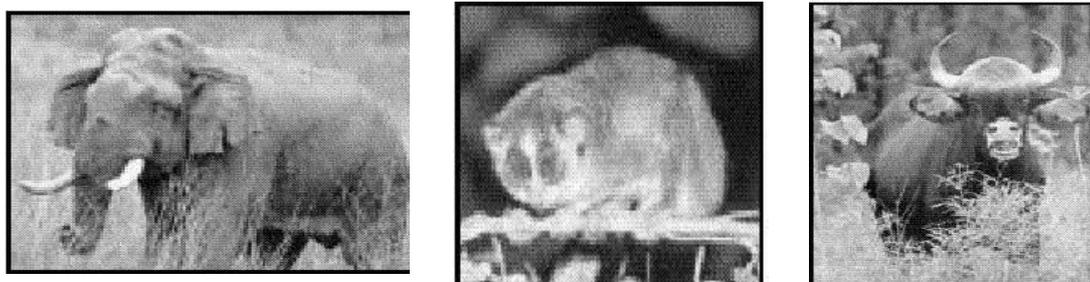


Figure 3.5 - Fauna of Nilgiri Biosphere

B. FAUNA

The fauna of the Nilgiri Biosphere Reserve includes over over 100 species of mammals, 350 species of birds, 80 species of reptiles and amphibians, 300 species of butterflies and innumerable invertebrates. **39 species of fish, 31 amphibians and 60 species of reptiles endemic to the Western Ghats also occur in the Nilgiri Biosphere Reserve.** Fresh water fish such as *Danio neilgheriensis*, *Hypselobarbus dubuis* and *Puntius bovanicus* are restricted to the Nilgiri Biosphere Reserve. The Nilgiri tahr, Nilgiri langur, slender loris, blackbuck, tiger, gaur, Indian elephant and marten are some of the animals found here.

B) THE GULF OF MANNAR MARINE BIOSPHERE RESERVE (GOMMBRE)

Gulf of Mannar situated in the southeastern coast of India extending from Rameswaram in the north to Tuticorin in the south along with its marine environment has been declared as **India's first Marine Biosphere Reserve**. Gulf of Mannar covers approximately an area of 10,500, there are **21 islands covering an area of 623 ha. The islands are occurring in 4 groups namely Mandapam group, Keezhakarai group, Vembar group and Tuticorin group. About 3,600 species of flora and fauna have been known to occur in this area.** This area is facing severe threat due to destruction of sensitive ecosystems like corals and seagrass through indiscriminate and intensive trawling, dynamite fishing etc, commercialized fishing of specific fauna such as sea fans, chanks, sea cucumber, sea horses and endangered species like dugongs and turtles. These activities have depleted the resources and reduced the biological wealth of this region.

The GOMMBRE lying between India and Srilanka (Map 3.4) is one of the biologically richest coastal regions of India. One of the Islands, namely, Krusadi island is called as "Biological Paradise" as it holds the maximum genetic diversity. Gulf of Mannar is rich in seaweeds, seagrass, coral reef, pearl bank, sacred chank beds, fin and shellfish resources, mangroves and number of endemic species and endangered species including the Dugong dugon commonly referred to as the sea cow.

The GOMMBRE was set up in 18.02.1989 by the government of India and the state of Tamil Nadu. The government of Tamil Nadu in G.O Ms.No.962 dated 10.09.1986 notified under section 35(1) of the wildlife (protection) Act 1972 the intention to declaring the 21 island as Marine national park for the purpose of protecting marine wild life and its environment. The main objective of GOMMBRE are:

- Conservation and management of representative marine eco-system.
- Protection of endangered and important marine living resources
- Provision of long -term conservation of genetic diversity
- Promotion of basic and applied research work and its monitoring
- Dissemination of experience of education and training.

3.4 Map of the Gulf of Mannar Region between Southern India and Sri Lanka



a. Biodiversity

The Gulf of Mannar is the first marine Biosphere Reserve not only in India, but also in South and Southeast Asia. The global significance of the Gulf of Mannar coastal biodiversity is evidenced by the area being designated a “priority area” under the authoritative reference work published by the World Bank, the Great Barrier Reef Marine Park Authority, and the World Conservation Union (IUCN) entitled “A Global Representative System of Marine Protected Areas”. The IUCN Commission on National Parks and Protected Areas with the assistance of UNEP, UNESCO and WWF, identified the Reserve as being an area of “particular concern” given its diversity and special, multiple-use management status. **The Reserve was one of six areas chosen on the basis of its threatened status and richness of biological wealth for inclusion into an action programme to save India’s protected areas for future generations.** In addition, as the first marine Biosphere Reserve declared in India, this area has long been a national priority.

The island harbours three species of seagrasses endemic to the Gulf of Mannar. Representatives of every animal phyla known (except amphibians), occur in this island. The island harbours a unique, endemic organism called “balanoglossus” (*Ptychodera fluva*), a taxonomically unique “living fossil” which links vertebrates and invertebrates. The island is referred to in the region as a “biologist’s paradise”. Supporting the Gulf’s extensive biodiversity are its extensive and diverse assemblage of seagrasses. **Six of the world’s twelve seagrass genera and eleven of the world’s fifty species, occur in the Gulf.** The Gulf harbours the highest concentration of seagrass species along India’s 7,500 kilometres of coastline. **These seagrass beds are some of the largest remaining feeding grounds for the globally endangered dugong (*Dugong dugong*)** and are responsible for making the Gulf the most important area in the region for the Dugong, according to the publication, “A Global Representative System of Marine Protected Areas”. The seagrass beds also provide feeding areas for all five species of marine turtles - the Green (*Chelonia mydas*), the Loggerhead (*Caretta caretta*), Olive Ridleys (*Lepidochelys olivacea*), Hawksbills and Leather backs

(*Dermochelys coriacea*). Many species of crustaceans, mollusks, gastropods and fishes have been observed to inhabit the seagrass beds.

The Gulf of Mannar harbours a total of 117 species of coral belonging to 7 genera. Coral reefs serve as the spawning grounds for fisheries, seagrass beds as nursery grounds and mangroves as shelters form a unique component of life-support systems of coastal biodiversity that relates to global benefits and local needs. Seventeen different mangrove species occur within the Biosphere reserve area. The coastal mangrove *Pemphis acidula*, is endemic to Gulf of Mannar, and the coastal mangroves are important nursery habitats and biodiversity reservoirs in coastal areas.

b. Economically important species

The Gulf's seagrass communities are valuable habitats for commercially harvested species, particularly the green tiger prawn *Penaeus semisulcatus*, which is extensively harvested for the export market. Halothurian, an endemic echinoderm found in abundance in Gulf of Mannar, is extensively exploited for export to Japan and other Southeast Asian countries as a highly priced food item for human consumption. The economically viable species of seaweeds such as *Hypnea*, *Gelidiella*, *Gracelaria*, *Stiechospermum*, *Hydroclathums*, *Clathatus*, *Padina*, *Caulerpa* are largely distributed in the Gulf of Mannar. In addition, ornamental shells, chanks, and pearl oysters are exploited in the Gulf. Sea fans and seaweeds are exported for industrial and decorative purposes.

IV. WILD LIFE SANCTUARIES AND NATIONAL PARKS

The Following Table 3.10 and Map 3.5 shows the list of Wildlife and bird sanctuaries and the National Parks in Tamil Nadu.

Table 3.10 Wildlife Sanctuary and National Parks

| Sl. No | Name of Wildlife Sanctuary | Area in ha | G.O.Ms.No. in which declared | District in which located | Major animals found | Wildlife (Protection) Act in which declared |
|--------|--|---|--|---------------------------|--|--|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | SANCTUARIES Mudumalai Wildlife Sanctuary | 21776.00 | 193 Development Department dated 27.1.1940 | Nilgiris | Elephant, Gaur, Sambar, Chital. Panther, Tiger, Birds & reptiles | Madras Forest Act 1882 |
| 2 | Indira Gandhi Wildlife Sanctuary | 84149.00 | 288 F & F Department dt.14.10.76 | Coimbatore | Elephant, Gaur, Tiger, Panther, Sloth bear, Wild boar | 18(1) |
| 3 | Mundanthurai Wildlife Sanctuary | 56738.00 | 2556 Food and Agra Department dt.2.8.62 | Tirunelveli | Tiger, Bonnet Macaque, Langurs, Slender Loris, Sloth Bear, Sambar, Chital, Wild Dog. | Wildlife Birds and animals protection Act 1912 |
| 4 | Kalakad Wildlife Sanctuary | RF=22358.00 | 183 F & F Department dt.6.3.76 | Tirunelveli | Lion Tailed Macaque, Nilgiri Tar, Sambar, Sloth Bear, Elephant, Panther, Tiger | 18(1) |
| 5 | Grizzled Giant Squirrel Wildlife Sanctuary | RF=40943.11 RL=7576.89 Total=48520.00 | 399 E&F Department Dated 26.12.88 | Virudhunagar | Grizzled Giant Squirrel, Flying Squirrel, Nilgiri Tahr, Elephant Lion Tailed Macaque | 18(1) |

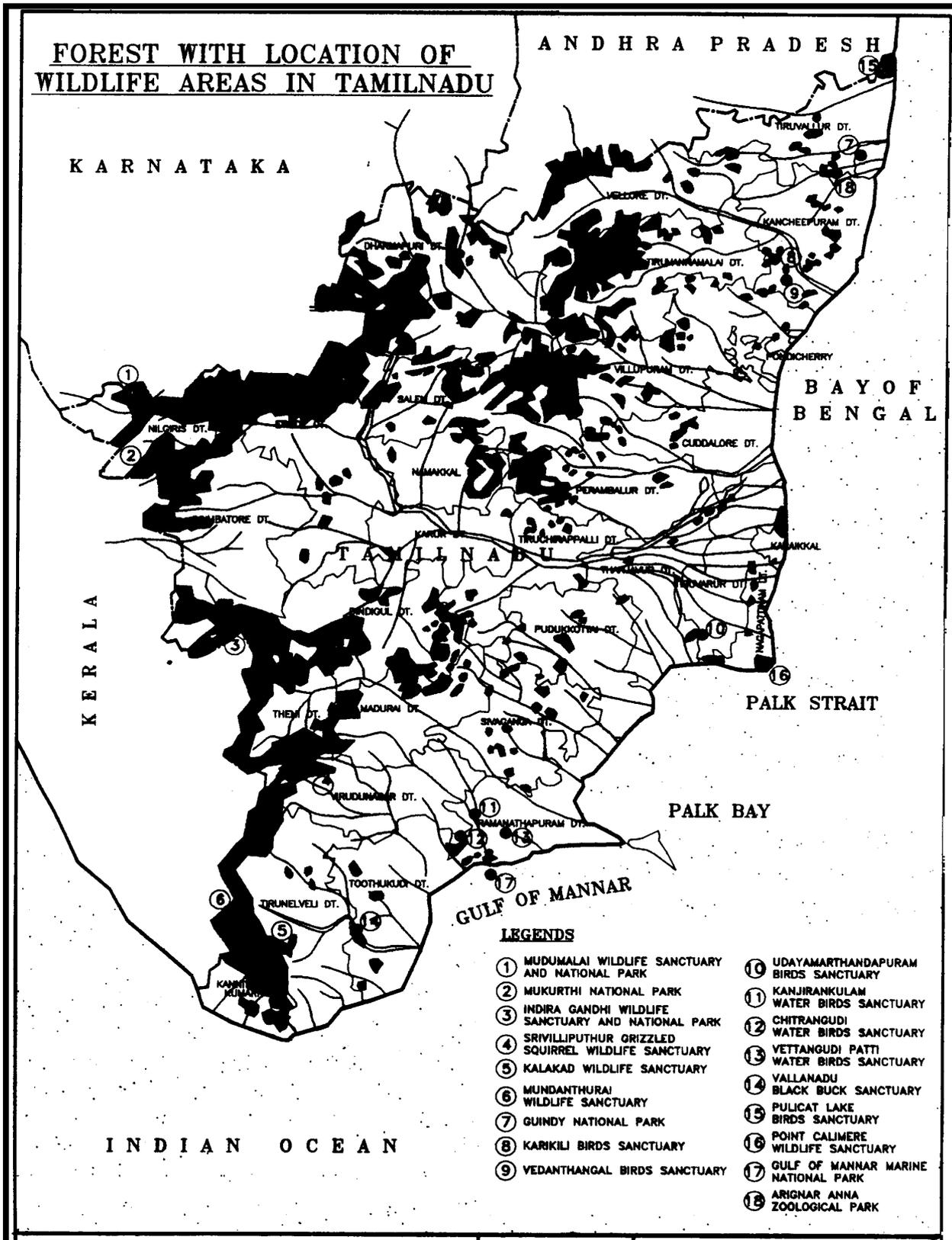
| Sl. No | Name of Wildlife Sanctuary | Area in ha | G.O.Ms.No. in which declared | District in which located | Major animals found | Wildlife (Protection) Act in which declared |
|--------|------------------------------------|-------------------|-------------------------------------|---------------------------|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6 | Point Calimere Wildlife Sanctuary | RF=1726.00 | 1821 Agri Department dt.13.6.67 | Nagapattinam | Black Buck, Bonnet Macaque, Wild Boar, Flamingoes variety of birds such as Teals, Gulls | Sec.62 of Madras Forests Act 1882 |
| 7 | Vallanadu Black Buck Sanctuary | RF=1641.00 | 1028 E & F Department dt.28.9.87 | Tuticorin | Black buck, Spotted deer, Macaques, Jungle cat, Mongoose, Hares | 18(1) |
| 8 | Kanyakumari Wildlife Sanctuary | R.F=45777.57 | 152 E & F Dept Dated 16.7.2002 | Kanyakumari | | 18(1) |
| | Total | 282685.570 | | | | |
| | <u>BIRDS SANCTUARIES</u> | | | | | |
| 9 | Vedanthangal Birds Sanctuary | 30.00 PWD tank | 199 E & F Department dt.3.7.98 | Kancheepuram | Cormorants, egrets, gray heron, spoon billed stork, mirgratory birds like garguney, teals, shovallers | Final notification issued U/s 26A(1) |
| 10 | Karikili Birds Sanctuary | 61.21 PWD tank | 332 E&F Department dt.23.5.89 | Kancheepuram | Cormorants, egrets, grey heron, spoon billed stork | 18(1) |
| 11 | Pulicat Lake Birds Sanctuary | 15367.00 Lake | 1247 E & F Department dt.22.9.80 | Tiruvallur | Flamingoes, ducks, osprey, avocet, cormorants, herons, spoon bills, gulls and other migratory birds | 18(1) |
| 12 | Vettangudi birds Sanctuary | 38.40 | 574 E & F Department dt.3.6.77 | Sivagangai | Cormorants, egrets, herons, teals, pelicans | 18(1) |
| 13 | Kanjirankulam Birds Sanctuary | 104.00 PWD tank | 684 E & F Department dated .21.9.99 | Ramanatha-puram | - do - | 18(1) |
| 14 | Chitragudi Birds Sanctuary | 47.63 PWD tank | 684 E & F Department dt.21.9.99 | - do - | - do - | 18(1) |
| 15 | Udayamarthandpuram Birds Sanctuary | 45.28 PWD tank | 379 E & F Department dt.31.12.98 | Tiruvarur | Little cormorant, darter, spoon bill, Indian Reef Heron, Grey heron, white necked stork | Final notification issued u/s 26A(1) |
| 16 | Vaduvloor birds Sanctuary | 128.10 PWD tank | 169 E & F Department dt.22.7.99 | - do - | Cormorants, egrets, ibis, herons and many variety of birds | Final notification issued u/s 26A(1) |

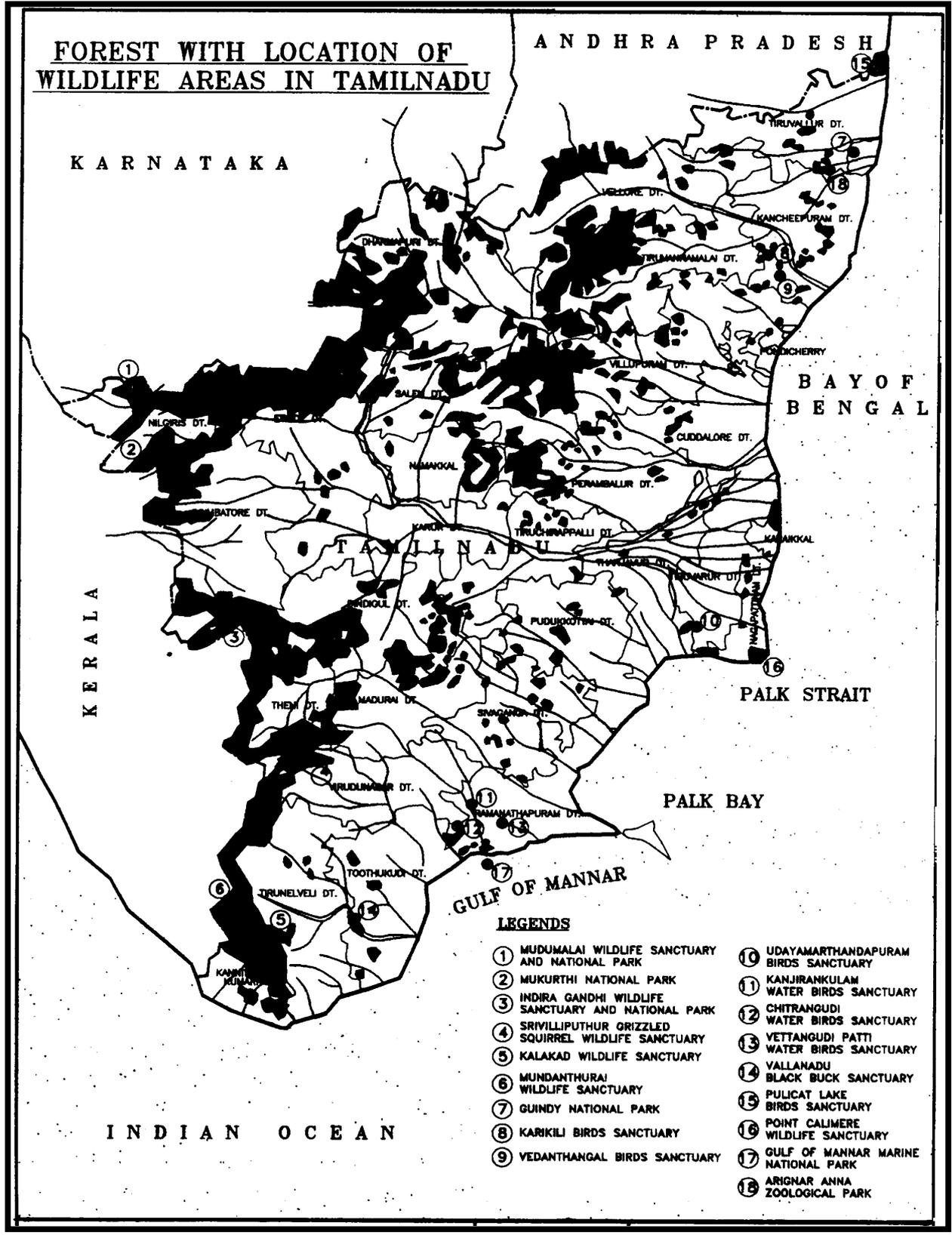
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----|---|--------------------|---|-----------------|--|--------------------------------------|
| 17 | Kunthankulam-Kadankulam Birds Sanctuary | 129.00 PWD tank | 301 E & F Department dt.30.11.94 | - do - | Grey pelican, painted stork, white Ibis, jackal, rat snake | 18(1) |
| 18 | Karavetti Birds Sanctuary | 453.71 PWD tank | 92 E & F Department dated 5.4.99 | Perambalur | Egrets, pelican, gray heron, white ibis, spoon bill | 18(1) |
| 19 | Vellode Birds Sanctuary | 77.18 PWD tank | 44 E & F Department dt.29.2.2000 | Erode | Spoon bill, teals, pintail ducks, darter | Final notification issued u/s 26A(1) |
| 20 | Melaselvanur-Kilaselvanur Birds Sanctuary | 593.08 PWD lake | 57 E & F Department dt.10.3.98 | Ramanatha-puram | Grey pelican, painted stork | 18(1) |
| | Total | 17074.59 | | | | |
| | <u>NATIONAL PARKS</u> | | | | | |
| 21 | Mudumalai National Park | RF=10323 | 2 E & F Department dt.2.1.90 | Nilgiris | Elephant, Gaur, Sambar, Chital, Tiger, Birds, and reptiles | 35(1) |
| 22 | Indira Gandhi National Park | 11710.00 | 58 F & F Department dt.23.1.89 | Coimbatore | Elephant, Gaur, Tiger, Panther, Sloth Bear, Wild Boar | - do - |
| 23 | Mukurthi National Park | 7846.00 | 193 E & F Department dated 12.12.2001 | Nilgiris | Nilgiri Tahr, Jackal, Otter, Jungle cat, Sambar, Barking deer. | Final notification issued u/s 35 (4) |
| 24 | Guindy National Park | 282.00 | 773 E & F Department dated 4.9.78 | Chennai | Black Buck, Chital, Jackal, Pangolin and variety of birds | Final notification issued u/s 35(4) |
| 25 | Gulf of Mannar Marine Park (21 Islands) | 623.23 | 962 E & F Department dt.10.9.86 | Ramanatha-puram | Characteristic tropical flora & fauna of coral reefs, Dugong, Turtles, Dolphins and Balano glossus | |
| | Total | 30784.230 | | | | |

ABSTRACT

| | <i>HECTARES</i> |
|----------------------|------------------|
| Wildlife Sanctuaries | 282685.57 |
| Birds Sanctuaries | 17074.59 |
| National Parks | 30784.23 |
| Total | 330544.39 |

Map 3.5: Location of Wild Life Sanctuaries and National Parks in Tamil Nadu





VI. MINI ZOO

The zoos in the state are under the control of chief wildlife warden and functioning under the guidance of central zoo authority. Mini Zoos are maintained in the following centers of Tamil Nadu

1. Amirthi Zoo in Vellore Division
2. Kurumbapatti Recreation centre in Salem Division
3. Deer park at Nilgiris.

VII. CROCODILE FARM

There are 3 Crocodile farms in Tamil Nadu under the control of Forest Department. They are

1. Crocodile farm at Hogenakkal in Dharmapuri Division
2. Crocodile farm at Amaravathi in Wildlife Warden, Pollachi Division
3. Crocodile farm at Sathanur Dam, Tirupattur Division.

4. Bio Diversity Conservation

Tamil Nadu has a geographical area of 13 million ha. which constitute of about 4% of the total area of the State is 1,30,19,000 ha covering 4.08% of the country. **Tamil Nadu shares the Western Ghats Biodiversity (one of the 12 Global mega biodiversity Hotspots)** with Western Ghats States of Kerala, Karnataka, Maharastra and Goa. It shares the Eastern Ghats with the States of Andhra Pradesh and Orissa. It also shares the East-coast with the States of Andhra Pradesh, Orissa and West Bengal.

I. FOREST TYPES IN TAMIL NADU

Forest Biodiversity in the State is mainly confined to Western Ghats and Eastern Ghats. It includes a Recorded Forest Area of 22.6 lakh ha. covering 17.4% of geographic area of the State. However area under forest cover according to FSI is only 17.07 lakh ha covering 13.13% of the Geographic Area. There are about 3,072 hamlets bordering the forest areas of the state.

There are nearly 47 Forest Types in the state of which 13 types are Climax formations, 8 types are Edaphic formations and 6 types are Seral stages and the rest are degradation types. Tropical dry Deciduous Forest covers an area of 12.23lakh ha constituting 54.30%, Tropical Thorn Forest covers an area of 5 lakh ha constituting 22.10%, Tropical Moist Deciduous Forest covers an area of 2.60 lakh ha constituting a percentage of 11.10%. The Biodiversity rich forest types are the Tropical Wet Evergreen Forest covering an area of 0.60 lakh ha constituting 2.67%, Tropical Semi Evergreen Forest covering a area of 0.23 lakh ha constituting 1.01%, Subtropical Broad leaved Hill Forest covers an area of 1.14 lakh ha constituting 5.04%, the Tropical Dry Evergreen Forest which is a unique type of **Tamil Nadu covers an area of 0.26 lakh ha constituting 1.16%, the mangrove forest covers an area of approximately 0.23 lakh ha constituting 1.01%.**

Table 4.1 - Distribution of Important Forest Types in Tamil Nadu

| | | |
|-----|--|---|
| 1. | Southern Hill Top Tropical Evergreen Forests | Western ghats, Upper slopes |
| 2. | West Coast Tropical Evergreen Forests | Anamalais, Karianshola |
| 3. | West Coast Semi-Evergreen Forest | Western Ghats |
| 4. | Tirunelveli Semi-Evergreen Forests Ghats between 250 and 550 m | Eastern slopes of the Southern Western |
| 5. | Secondary Moist Bamboo Brakes | Western Ghats in Mount Stuart Coimbatore District |
| 6. | Slightly Moist Teak Forests | Small patches in Nilgiris District |
| 7. | Southern Moist Mixed Deciduous Forest | |
| 8. | Mangrove Scrub | |
| 9. | Dry Teak Forest | Outer Slopes of Western Ghats in kamarajar District |
| 10. | Southern Dry Mixed Deciduous Forest | Western Ghats thrugh Peninsular India, Salem District |
| 11. | Hardwickia Forest | Scattered Blocks in Salem and Dharmapuri Districts. |
| 12. | Southern Thorn Forests Pasumpon, Thevar districts. | Chengupet, North Arcot, South Arcot, Trichy, |

| | | |
|-----|--|--|
| 13. | Carnatic Umbrella Thorn Forest | Anna, Madurai, Pasumpon, Thevar, Ramanathapuram and Tirunelveli Districts. |
| 14. | Southern Euphorbia Scrub | Salem, Dharmapuri and North Arcot Districts. |
| 15. | Tropical Dry Evergreen Forests Pasumpon Thevar and Tirunelveli. | Coastal Districts of chengulpet, Thanjavur, |
| 16. | Tropical Dry Evergreen Scrub Chengulput District. | Unique to Tamilnadu. Occurs only in |
| 17. | Southern Sub-Tropical Hill Forest | Mostly in Nilgiris / Palani Hills |
| 18. | South Indian Sub-Tropical Hill Savannah (Woodland) | 1100 m to 1700 m in Nilgiris / Palani Slopes |
| 19. | Montane Wet Temperature Forests | Nilgiris / Anamalais / Palanis and Tirunelveli Hills |

The aquatic biodiversity of the State includes 33 river systems covering a length of 8,957 Km. Tamil Nadu shares the watershed with Karnataka, Andhrapradesh and Kerala. The Coastal Biodiversity covers a length of 938 Km along the East Coast. The ecologically sensitive areas along the East Coast are the Mangrove forest area of Pichavaram near Parangipettai (Porto Novo), Bird Sanctuary and Wildlife and forest conservation Zone near Point Calimere, Oyster beds near Point Calimere, Coral reef near Mandapam, shell fishing area within Tuticorin harbour, Sanctuary for coastal fauna at Kurusadai island, Sponge beds at Manoli and Putti Islands, Windowpane shell fisheries at point Calimere. **The Gulf of Mannar Biosphere Reserve is a very important Biodiversity region of the East Coast. The wetland Biodiversity includes approximately 40,000 tanks and 56 dams and reserviors. The important wetlands are Pichavaram mangroves, Muthupettai mangroves, Pulicat lake, Point Calimere sanctuary and other Bird Sanctuaries.**

Table 4.2 - Important Flora of Tamil Nadu

| S. No. | Species Name | Region of Occurrence * | Status** |
|--------|------------------------------------|------------------------|----------|
| 1. | <i>Acanthera grandiflora</i> | TL | EN |
| 2. | <i>Acrocephalus palniensis</i> | PL | I |
| 3. | <i>Actinodaphne bourneae</i> | M, PL, KL | EN |
| 4. | <i>Actinodaphne lanata</i> | N | EN |
| 5. | <i>Actinodaphne lawsonii</i> | N | R |
| 6. | <i>Aerva wightii</i> | CR, TL | I |
| 7. | <i>Albizia thompsonii</i> | CB | R |
| 8. | <i>Amomum microstephanum</i> | A | R |
| 9. | <i>Anisochilus argenteus</i> | KL, PL | VU |
| 10. | <i>Anisochilus wightii</i> | A | R |
| 11. | <i>Anoectochilus rotundifolius</i> | M | EN |
| 12. | <i>Antistrophe serratifolia</i> | A | R |
| 13. | <i>Aponogeton appendiculatus</i> | C | I |
| 14. | <i>Begonia aliciae</i> | N | EN |
| 15. | <i>Begonia anamalayana</i> | A, CB | EN |
| 16. | <i>Begonia cordifolia</i> | TL | R |
| 17. | <i>Begonia subpeltata</i> | TL | R |
| 18. | <i>Belosynapsis kewensis</i> | TL, KK | EN |
| 19. | <i>Bentinckia condapanna</i> | TL | R |
| 20. | <i>Bulbophyllum acurtiflorum</i> | N | R |
| 21. | <i>Bulbophyllum albidum</i> | N, TL | R |
| 22. | <i>Bulbophyllum elegantulum</i> | N | VU |

| S. No. | Species Name | Region of Occurrence * | Status** |
|--------|----------------------------------|------------------------|----------|
| 23. | <i>Bulbophyllum kaitiense</i> | N | VU |
| 24. | <i>Bunium nothum</i> | N | EX |
| 25. | <i>Campanula alphonsii</i> | N, PL | R |
| 26. | <i>Capparis diversifolia</i> | TL | VU |
| 27. | <i>Capparis fusifera</i> | TL, CR, A | R |
| 28. | <i>Capparis rheedii</i> | TL | R |
| 29. | <i>Capparis shevaroyensis</i> | TL, R | VU |
| 30. | <i>Carex christii</i> | N | I |
| 31. | <i>Carex pseudoaperta</i> | N | I |
| 32. | <i>Carex vicinalis</i> | N | I |
| 33. | <i>Cayratia pedata</i> | N | R |
| 34. | <i>Cayratia roxburghii</i> | TL | VU |
| 35. | <i>Ceropegia barnesii</i> | N | EN |
| 36. | <i>Ceropegia decaisneana</i> | A, N | R |
| 37. | <i>Ceropegia fimbriifera</i> | ES | VU |
| 38. | <i>Ceropegia maculata</i> | A | EN |
| 39. | <i>Ceropegia metziana</i> | N, PL | R |
| 40. | <i>Ceropegia omissa</i> | CR, TL | EN |
| 41. | <i>Ceropegia pusilla</i> | N | R |
| 42. | <i>Ceropegia spiralis</i> | ES | VU |
| 43. | <i>Ceropegia thwaitesii</i> | KL | VU |
| 44. | <i>Chrysoglossum halbergii</i> | M | I |
| 45. | <i>Clematis theobromina</i> | N | R |
| 46. | <i>Cleome burmanni</i> | R | I |
| 47. | <i>Coelogyne mossiae</i> | N, PL | VU |
| 48. | <i>Commelina hirsuta</i> | N, PL | R |
| 49. | <i>Commelina indehiscens</i> | ES | R. |
| 50. | <i>Commelina tricolor</i> | G, D | VU |
| 51. | <i>Commelina wightii</i> | N, PL | VU |
| 52. | <i>Corymborkis veratifolia</i> | N | R |
| 53. | <i>Cotoneaster buxifolius</i> | N, PL, KL | VU |
| 54. | <i>Crotolaria clavata</i> | CB, M, S | EN |
| 55. | <i>Crotolaria digitata</i> | S, PL | R |
| 56. | <i>Crotolaria fysonii</i> | PL, M | EN |
| 57. | <i>Crotolaria globosa</i> | N, D, CR | R |
| 58. | <i>Crotolaria kodaiensis</i> | KL | EN |
| 59. | <i>Crotolaria longipes</i> | N, S | EN |
| 60. | <i>Crotolaria peduncularis</i> | N, A, PL | R |
| 61. | <i>Crotolaria priestleyoides</i> | N, A | R |
| 62. | <i>Crotolaria rigida</i> | NP, CB, TL | R |
| 63. | <i>Crotolaria scabra</i> | CB, KK, S, TL | R |
| 64. | <i>Cyanotis cerifolia</i> | A | I |
| 65. | <i>Cyathea nilgirensis</i> | N | EN |
| 66. | <i>Cynometra travancoria</i> | TL | R |
| 67. | <i>Decaschistia rufa</i> | CH | EN |
| 68. | <i>Desmos viridiflorus</i> | CB, A | EN |
| 69. | <i>Dicranopteris linearis</i> | KL, N, M | VU |
| 70. | <i>Dictyospermum ovalifolium</i> | N | R |
| 71. | <i>Didymocarpus missionis</i> | KK | R |
| 72. | <i>Elaeocarpus recurvatus</i> | N, A | R |
| 73. | <i>Elaeocarpus blascoi</i> | M, KL, PL | R |

| S. No. | Species Name | Region of Occurrence * | Status** |
|--------|-------------------------------------|------------------------|----------|
| 74. | <i>Elaeocarpus gaussoni</i> | N ? | R. |
| 75. | <i>Elaeocarpus munronii</i> | N | R. |
| 76. | <i>Elaeocarpus venustus</i> | KK | VU |
| 77. | <i>Elaphoglossum beddomei</i> | N, A | R |
| 78. | <i>Elaphoglossum nilgircum</i> | N | EN |
| 79. | <i>Elaphoglossum stigmatolepis</i> | N, PL | VU |
| 80. | <i>Eria albiflora</i> | N | R |
| 81. | <i>Eriochrysis rangacharii</i> | N | EX |
| 82. | <i>Eriolanena lushingtonii</i> | R | VU |
| 83. | <i>Eugenia discifera</i> | V | EN |
| 84. | <i>Eugenia singampattiana</i> | TL | EN |
| 85. | <i>Euonymus angulatus</i> | N | EN |
| 86. | <i>Euonymus serratifolius</i> | N, A | EN |
| 87. | <i>Glycosmis macrocarpa</i> | TL | R |
| 88. | <i>Goniothalamus rhyncantherus</i> | TL, CR | R |
| 89. | <i>Habenaria barnesii</i> | N | R |
| 90. | <i>Hedyotis albonervia</i> | TL | EN |
| 91. | <i>Hedyotis barberi</i> | N | VU |
| 92. | <i>Hedyotis buxifolia</i> | N | R |
| 93. | <i>Hedyotis cyanantha</i> | ES | R |
| 94. | <i>Hedyotis eualata</i> | N, TL | R |
| 95. | <i>Hedyotis hirsutissima</i> | N | EX |
| 96. | <i>Hedyotis ramarowii</i> | ES | VU |
| 97. | <i>Hedyotis swersioides</i> | N | R |
| 98. | <i>Helichrysum perlanigerum</i> | A | R |
| 99. | <i>Hildegardia populifolia</i> | DP, KC | EN |
| 100. | <i>Humboldtia bourdilloni</i> | CR | EN |
| 101. | <i>Humboldtia decurrens</i> | TL | R |
| 102. | <i>Humboldtia unijuga</i> | TL | EN |
| 103. | <i>Hydnocarpus macrocarpa</i> | KK | EN |
| 104. | <i>Hydrocotyle coferta</i> | N, PL | R |
| 105. | <i>Ilex gardneriana</i> | N | EX |
| 106. | <i>Impatiens neo-barnesii</i> | N | EN |
| 107. | <i>Impatiens nilagirica</i> | N | EN |
| 108. | <i>Indigofera barberi</i> | S | R |
| 109. | <i>Indotristicha triunelveliana</i> | TL | R |
| 110. | <i>Isonandra villosa</i> | CH | I |
| 111. | <i>Kalanchoe olivacea</i> | A, CB | R |
| 112. | <i>Kendrickia walkeri</i> | A, CB | EN |
| 113. | <i>Kingiodendron pinnatum</i> | TL, KK | R |
| 114. | <i>Lepidagathis barberi</i> | CB, M, R, TL | R |
| 115. | <i>Lepidagathis diffusa</i> | CB | R |
| 116. | <i>Lindsaea malabarica</i> | ES | EN |
| 117. | <i>Liparis biloba</i> | N | VU |
| 118. | <i>Melicope indicus</i> | N | VU |
| 119. | <i>Memecylon flavescens</i> | N | EN |
| 120. | <i>Memecylon sisparensense</i> | N | I |
| 121. | <i>Meteormyrtus wynaadensis</i> | N | EN |
| 122. | <i>Miliusa nilagirica</i> | N, A | VU |
| 123. | <i>Murdannia juncoides</i> | CR | R |
| 124. | <i>Murdannia lanceolata</i> | TL | VU |

| S. No. | Species Name | Region of Occurrence * | Status** |
|--------|--------------------------------------|------------------------|----------|
| 125. | <i>Neuracanthus neesianus</i> | NA | RN |
| 126. | <i>Nothopegia aureo-fulva</i> | TL | EN |
| 127. | <i>Ochreinauclea missionis</i> | KK | VU |
| 128. | <i>Ophiorrhiza pykarensis</i> | N | EX |
| 129. | <i>Orophea uniflora</i> | TL | EN |
| 130. | <i>Palaquium bourdillonii</i> | TL | I |
| 131. | <i>Paphiopedilium druryi</i> | K | EN |
| 132. | <i>Pavetta hohenackeri</i> | N, TC | VU |
| 133. | <i>Pavetta wightii</i> | N | EX |
| 134. | <i>Peucedanum anamallayense</i> | A, CB, M | I |
| 135. | <i>Peucedanum anamallayense</i> | A | R |
| 136. | <i>Pimpinella pulneyensis</i> | PL, KL | EX |
| 137. | <i>Piper barberi</i> | KK | R |
| 138. | <i>Plectranthus bishopianus</i> | PL, KL | EX |
| 139. | <i>Plectranthus bourneae</i> | N, PL | I |
| 140. | <i>Poeciloneuron pauciflorum</i> | TL | I |
| 141. | <i>Pogostemon atropurpureus</i> | N | R. |
| 142. | <i>Pogostemon nilagiricus</i> | N | EN |
| 143. | <i>Pogostemon paludosus</i> | N | EN |
| 144. | <i>Polyalthia rufescens</i> | TL | R |
| 145. | <i>Polycarpaea diffusa</i> | TU, TL | VU |
| 146. | <i>Popowia beddomeana</i> | TL, KT, AG | R |
| 147. | <i>Pseudocyclosorus gambeli</i> | N, PL | EN |
| 148. | <i>Pseudocyclosorus griseus</i> | PL, M | EN |
| 149. | <i>Pseudoglochidion anamalayanum</i> | CB, A | I |
| 150. | <i>Psychotria globicephala</i> | CR | EN |
| 151. | <i>Pterospermum reticulatum</i> | CB, TC, KK | R |
| 152. | <i>Rhyncosia velutina</i> | TL, T, KK, N | VU |
| 153. | <i>Salacia beddomei</i> | A | R |
| 154. | <i>Santapaua madurensis</i> | M, P, T | EN |
| 155. | <i>Senecio kundaicus</i> | N | EN |
| 156. | <i>Sphaeropteris crinita</i> | N, A | EN |
| 157. | <i>Strobilanthes dupenii</i> | A | I |
| 158. | <i>Swilax wightii</i> | N | R |
| 159. | <i>Syzygium courtallense</i> | CR | EN |
| 160. | <i>Syzygium gambleanum</i> | KK | EN |
| 161. | <i>Tephrosia barberi</i> | TL, TU | R |
| 162. | <i>Tephrosia calophylla</i> | CB, N | R |
| 163. | <i>Teucrium plectranthoides</i> | TL | VU |
| 164. | <i>Thottea barberi</i> | TL | VU |
| 165. | <i>Toxocarpus beddomei</i> | KK | R |
| 167. | <i>Uleria salicifolia</i> | A, CB | EN |
| 168. | <i>Vanasushava pedata</i> | A, PL | R |
| 169. | <i>Vanda wightii</i> | N | EX |
| 170. | <i>Vanilla wightiana</i> | TL, KK | R |
| 171. | <i>Vernonia recurva</i> | A | EN |
| 172. | <i>Veronia pulneyensis</i> | PL, KL | EN |
| 173. | <i>Wendlandia angustifolia</i> | CR, TL, A | EX |
| 174. | <i>Willisia selaginoides</i> | A | R |
| 175. | <i>Youngia nilgiriensis</i> | N | EN |

Table 4.3 Important Fauna of Tamil Nadu

| | Name | Status |
|---------------------------------|--------------------------------|--------|
| A. Mammal | 1. Primates | |
| | i. Slender Loris | VU |
| | ii. Lion Tailed Tailed Macaque | EN |
| | iii. Nilgiri Langur | VU |
| | Carnivores | |
| | i. Oriental Small Clawed Otter | VU |
| | ii. Marine Otter | |
| | iii. Honey Badger or Ratel | IK |
| | iv. Malabar Civet | EN |
| | v. Honey Badger or Ratel | IK |
| | iv. Malabar Civet | EN |
| v. Leopard Cat | VU | |
| vi. Rusty Spotted Cat | IK | |
| vii. Fishing Cat | VU | |
| viii. Leopard | VU | |
| ix. Tiger | VU | |
| 3. Dugong | VU | |
| 4. Asian Elephant | VU | |
| 5. Mouse Deer | VU | |
| 6. Black Buck / Indian Antelope | VU | |
| 7. Four Horned Antelope | VU | |
| 8. Indian Bison / Gaur | VU | |
| 9. Nilgiri Tahr | VU | |
| 10. Indian Pangolin | VU | |
| 11. Grizzled Giant Squirrel | EN | |
| B. Aves | 1. White Spoon Bill | EN |
| | 2. Brown Baza/Lizard Hawk | VU |
| | 3. White Bellied Sea Eagle | VU |
| | Osprey | VU |
| | Laggar Falcon | EN |
| | Saheen Falcon | EN |
| | Indian Peafowl | VU |
| | Great Pied Hornbill | EN |
| | Forest Spotted Owlet | CR |
| C. Reptilians | 1. Salt Water Crocodile | EN |
| | Marsh Crocodile | EN |
| | Loggerhead sea Turtle | EN |
| | Green Sea Turtle | EN |
| | Hawksbill Turtle | EN |
| | Olive Ridley Turtle | EN |
| | Leather Back Sea Turtle | EN |
| | Indian Flap-Shelled Turtle | VU |
| | Common Indian Monitor | EN |
| Indian Rock Python | EN | |

* A-Anamalais, AG-Agasthyamalai, C-Chennai, CB-Coimbatore, CH-Chingelpet, CR-Courtallam, D-Dindigul, DP-Dharmapuri, ES-Entire State, CD-Gudalur, K-Kalakkad, KC-kallakurichi, KK-Kanyakumari, KL-Kodaikannal, KT-Kannikatti, M-Madurai, N-Nilgiris, NP-Nagapattinam, P-Pudukottai, PL-Palani Hills, R-Ramanathapuram, S-Salem, T-Thanjavur, TC-Trichy, TL-Tirunelveli, TM-Tiruvanamalai, TU-Tuticorin

**EN-Endangered, EX-Possibly Extinct, R-Rare, VU-Vulnerable.

II. CONSERVATION OF BIODIVERSITY

The state's rich biodiversity and the natural resources is facing a serious threat from the growing human and livestock population and also from various developmental activities.

Biodiversity Conservation has been structured covering the Ecosystem Diversity, Species Diversity and Genetic Diversity. Species Diversity has been structured separately for plants and animals. Wild plant diversity has been structured on the lines of Red-listed plants, Endemic plants, Medicinal plants, Wild relatives of cultivated plants, allied species of cultivated species and others. Wild Animal diversity has been structured on the lines of Red listed animals, Endemic animals, Flag ship species, Key stone species, Pollinators and others. Domesticated species diversity has been structured on the lines of Cultivated Plants and Domesticated animals.

Various departments control Biodiversity in the State. Forest Departments Manages Forests, Grasslands, Freshwater Wetland Bird Sanctuaries, Estuarine Wetlands like Mangroves, Coastal Biosphere Reserve like Gulf of Mannar Biosphere Reserve and entire spectrum of wild species Diversity. Forests also include the rivers that pass through the notified forest areas, dams located inside the notified forest areas and tanks and ponds inside the forest areas.

Agriculture Department and the farmers manage the Agro Biodiversity. Animal Husbandry Department and the farmers manage the domesticated Animals Diversity. Public works department controls the fresh water wetlands, tanks, dams/reservoirs and rivers. Panchayats control minor irrigation tanks, Fisheries department controls the coastal fisheries. Revenue department controls the biodiversity of the poromboke and other village common lands.

III. PROPOSED STRATEGY AND ACTION PLAN

Joint Forest Management, Eco Development, Watershed Management will be the major forest ecosystem based strategies. Eco development and joint forest management are more or less similar concepts except that there is no benefit sharing in Eco-development is practiced in protected areas whereas Joint Forest Management is practiced in other forest areas.

Joint Forest Management and Eco Development will address the issues of empowerment particularly women, equity focusing on tribals and other deprived sections and poverty eradication. Both these strategies aim at creation of sustainable alternative livelihood system for forest dependents and livelihood security of the tribals and other forest fringe dwellers. These strategies will also address the issues of reduction of head-loads, reduction of grazing, production of fuelwood and footer etc.,

1. JFM is practised in 1000 hamlets in the State. JFM practices will be strengthened further in all these 1000 hamlets by laying special emphasis on sustainable alternative livelihood system for the forest dependent people by adopting the KMTR model
2. JFM will be extended to another 2072 hamlets in the state by adopting the present model.
3. Eco-Development initiatives will be further strengthened in KMTR.
4. KMTR model of Eco-development will be extended to all the other sanctuaries, National parks and Biosphere Reserves.
5. The present policy of total biodiversity conservation in the state will be continued.
6. Biodiversity conservation will be integrated in forest planning by incorporating a chapter on Biodiversity conservation in all the working plans in all the wildlife management plans.
7. Agro Forestry will be promoted in wastelands and in dry- lands as a alternative production

strategy for meeting the fodder, fuelwood, small timber and timber requirements, so that pressure on forest resources can be minimized there by saving the forest biodiversity.

8. Social Forestry outside the forestland will be continued in the existing social forestry areas and tank beds. Production of fuelwood from these areas has reduced the pressure on forests. Plantations will be raised in the tank beds as and when the existing growth is harvested.
9. Watershed Management will be promoted by integrating the management of the Aquatic, agro ecosystem and forest ecosystem Biodiversity focusing on water management and appropriate land management.
10. Forest management issues like delay in settlement of forest lands needs to be tackled by appointing conservators of forest settlement officers as the present system causes enormous delay there by destroying the forest biodiversity. Issues like diversion of forestlands for non-forestry purposes has to be regulated by Central Government. Mining is a serious threat to forest ecosystem and should not be allowed. The existing encroachment will be evicted and it will not be regularized. Constant monitoring will prevent future encroachments.
11. Poaching and Smuggling requires interstate coordination. Extremism and Terrorism inside forest areas also need interstate coordination. Existing strategies for controlling poaching and smuggling is adequate.
12. Disasters like flood and drought take a heavy toll of biodiversity there is a need for disaster management plan in each forest division
13. Man animal conflict seriously threatens the existence of wildlife and it also affects the agriculture of the forest fringe villages. Adequate compensations for the victims of wild animal attack has to be ensured. Crop insurance has to be promoted in all the forest fringe villages.
14. Habitat Destruction and habitat fragmentation seriously threatened the wildlife and *in-situ* conservation of plants. The root causes of forest bio-mass dependency has to be analysed Green leaf manure collection will not be permitted from forests as it destroys the habitat
15. Wildlife corridor particularly Elephant Corridor problems are series in many elephant habitats. The stakeholders of elephant corridor regions have to be sensitized and appropriate awareness programs should be launched during migratory season.
16. Further planting of exotics will not be carried out in the existing exotic plantations will be converted to indigenous species plantations in future.
17. Ongoing strategies of medicinal plants conservation by adopting medicinal plants conservation area and medicinal plants development area approach will be strengthened
18. Recovery strategies for all the Red-listed plant species and Red-listed animal species will be evolved taking in to account the present extent of occurrence, area of occupancy, and population dynamics of each species.
19. *In-situ* conservation of all the endemic plant species and endemic animal species will be taken up by adopting area oriented approach. The endemic plant species of the state and the endemic animal species of the State will be grouped location wise and their extent of occurrence and area of occupancy and population dynamics will be studied for promoting conservation.
20. Special emphasis will be laid on conservation of wild relatives of crop plants and wild relatives of domesticated animals.
21. Permanent biodiversity registers for each forest division indicating the plant diversity and animal diversity will be maintained and it will be updated every month as and when more

species recorded. Benchmark information will be generated for each division taking the available publications conservation.

22. In some of the forest areas enclaves are existing. The management approach to these enclaves could be three fold. (i) Acquisition of these enclaves by the forest department,(ii) relocation and rehabilitation of residents of these enclaves/settlements and,(iii) maintain the status quo with proper monitoring and further restrictions imposed.
23. The management and conservation strategies indicated in the National Forestry action Plan, National Wildlife Action Plan, National Policy on Biodiversity etc., will be followed.
24. Monitoring protocols will be evolved for important species and key habitats.
25. *Ex-situ* conservation strategies will be adopted for Red-listed plants and over exploited medicinal plants. The existing zoos will be used for exsitu conservation for Red-listed animals.
26. Domesticated biodiversity the ongoing National initiatives of NBPGR, NBFGR, NBAGR etc will be strengthened.
27. Aquatic biodiversity management system will be evolved for the Riverine and wetland biodiversity.

Regarding Coastal biodiversity the recommendations of the east coast ecoregion will be followed. It includes setting up of expert centres for taxonomic identification of marine biodiversity. A permanent monitoring team for monitoring coastal biodiversity conservation of mangrove by creating alternative livelihoods and by development of small-scale development projects in and around mangroves. Coral reefs and sea grass beds under CRZ-1, formation of Eco clubs in fisherman villages, Identification of degraded sites for inclusion under protected areas creating centres for eco tourism, awareness creation etc.

5. Water Resources

A. FRESH WATER RESOURCES

The population and area of Tamil Nadu account for 7 % and 4% respectively to that of India but the available water resources of the state account for only 3%. The total precipitation in Tamil Nadu is around 32909 MCM. The surface water availability is about 17,563 MCM ground water availability is around 15,346 MCM. The demand for water is continuously on the rise with the growth of population, industry and agriculture while the availability of water remains almost constant. The surface water resources have been fully harnessed by impounding the available water in 61 major reservoirs and also in 39,202 small and big tanks. Hence groundwater resources alone could be utilised for formulation of any new schemes. However, the excessive pumping of ground water is aggravating the growing demand for water.

i. National water policy

The National water Policy lays down general guidelines in preparing basin-wise master plan, priorities for water use, inter-basin transfer, etc. The National water policy enunciated by the GOI in 1987 has recognized that water is prime natural resource, a basic human need and a precious national asset. It has recommended that resource, a basic human need and a precious national asset. It has recommended that resource planning in the case of water has to be done for a hydrological unit such as a drainage basin as a whole, or for a sub-basin. It has further emphasised that special multi-disciplinary units should be set-up in each State to prepare comprehensive plans taking into account the needs of not only irrigation, but also the various other water uses so that the available water can be put to optimum use. The National Water Policy has recommended to establish a standardized National information system with a network of data banks and data bases, integrating and strengthening the existing Central and State level agencies, and improving the quality of data and the processing capabilities for better planning.

ii. Tamil Nadu water policy

Government of Tamil Nadu (GTN) has also formulated a water policy called 'Tamil Nadu Water Policy'. The Institute for Water Studies has drafted the above policy and submitted to the Government, which has been approved. The Institute for Water Studies will function as an implementing agency of this policy. Under Tamil Nadu water policy, water allocation priorities in the planning and operation of systems should be broadly as Drinking water, Irrigation, Hydropower, Industrial and other uses. Within the frameworks provided by the national water policy, the broad objectives of the water policy for Tamil Nadu shall be:

- Establish a Management Information System (MIS) for water resources.
- Ensure preservation and stabilization of existing water resources.
- Plan for augmentation of utilisable water resources.
- Promote research and training facilities for water resources management.
- Establish allocation priorities for water use by different sectors with provision of drinking water being of highest priority.
- Maximize multi-purpose benefit from surface and ground water, land and other resources.
- Provide adequate water for domestic users.
- Maximize hydro - power generation within the constraints imposed by other water users.
- Provide adequate water for industry.
- Preserve and enhance the economic fisheries.

- Maintain water quality to established standards.
- Promote and equity and social justice among users of water from irrigation and domestic water suppliers.
- Plan for economic and financial sustainability based upon the principle that those who benefit from projects and programmes should also pay for them.
- Provide flood protection and drainage.
- Promote users participation in all aspects of water planning and management.
- Provide mechanisms for the resolution of conflicts between users within and between intra-state river basins.

iii. Demand and supply position of water in the State

The total water demand of Entire State of Tamil Nadu and total water deficit for the state is furnished in the following table 5.1

Table 5.1 Total Water Demand and Deficit (in MCM) - State of Tamil Nadu

| Sector | 1994 | 1999 | 2004 | 2014 | 2044 |
|-----------------------|----------|----------|----------|----------|----------|
| Agriculture | 29037.06 | 29079.47 | 29079.47 | 27807.85 | 269.5.46 |
| Domestic | 905.15 | 1001.51 | 1088.21 | 1345.98 | 1793.67 |
| Industries | 461.46 | 635.99 | 808.54 | 1307.20 | 2196.63 |
| Live Stock | 387.04 | 387.04 | 387.04 | 387.04 | 387.04 |
| Hydro Power | 34.37 | 60.29 | 66.47 | 63.27 | 78.27 |
| Environmental needs | 28.00 | 28.00 | 28.00 | 28.00 | 28.00 |
| Total | 30853.08 | 31192.30 | 31457.73 | 30944.34 | 31389.07 |
| Total Water Potential | 28463 | 28463 | 28643 | 28463 | 28463 |
| Total Demand | 30853 | 31192 | 31458 | 30944 | 31389 |
| Deficit | 2390 | 2729 | 2995 | 2481 | 2926 |

Source : Water Resources Plan of Tamil Nadu - Draft Final Report, IWS

The total surface water, groundwater and water resource potential of all the river basins, excluding Cauvery, is estimated to be 13117 MCM, 15346 MCM and 28463 MCM. Total water demand as on 1999 for domestic, irrigation, industrial, livestock. Power etc. except Cauvery basin are estimated as 311164 MCM. It is to be seen that the river basins demand, as on 1999, is in excess of the water resources potential available in all the river basins excepting Palar, Varahanadi, Vellar, Vaippar, Kallar, Kodaiyar and Paravanar basins. Even though most of the river basin are in deficit, both in long term and short term estimates, the surface water potential of Chennai basin will be increased from 906 MCM to 1311 MCM around 2001 AD due to addition of Krishna water flow. Efficiency of the irrigation sector, which is the largest users of all water resources, is to be stepped up.

iv. Declining Resource Availability

There are 16 river basins in Tamil Nadu. Of these 10 basins is “deficit” basin while 6 basins have surplus water. In all the basins there are some areas or pockets or blocks, which are

identified as potentially deficit areas due to low rainfall, formation factors, topographical factors, Water quality problems.

v. *Domestic water requirement*

The water requirement for the urban and rural area have been assumed at the rate of 90 lpcd for urban and 40 lpcd for the rural population. In many places, when most of the growth takes place, both the quality and quantity of water are already under pressure and the increase in population may push the resources to scarcity. The rural water supply schemes and urban water supply schemes implemented by TWAD Board, meet with the domestic water supply schemes. The projected total demand for the year 1994, 1999, 2004, 2019 and 2044 AD are furnished in Table 5.2.

Table 5.2 Domestic water requirement - Urban & Rural (in MCM)

| River Basin | 1994 | 1999 | 2004 | 2019 | 2044 |
|---------------------------|---------------|----------------|----------------|----------------|----------------|
| 1. Chennai | 208.45 | 230.88 | 253.32 | 320.62 | 432.79 |
| 2. Palar | 105.95 | 116.88 | 127.82 | 160.64 | 215.33 |
| 3. Varahanadhi | 39.07 | 43.10 | 47.13 | 59.22 | 79.38 |
| 4. Ponniyar | 68.81 | 74.69 | 80.56 | 99.99 | 132.35 |
| 5. Paravanar | 6.24 | 6.71 | 7.20 | 8.63 | 11.03 |
| 6. Vellar | 64.31 | 68.92 | 73.55 | 87.41 | 110.52 |
| 7. Agniyar | 27.61 | 29.55 | 31.48 | 37.29 | 46.98 |
| 8. Pambar & Kottakaraiyar | 33.12 | 35.21 | 37.31 | 43.60 | 54.07 |
| 9. Vaigar | 132.13 | 142.09 | 151.99 | 181.61 | 231.03 |
| 10. Gundar | 46.49 | 50.04 | 53.58 | 64.21 | 81.94 |
| 11. Vaippar | 34.00 | 14.06 | 66.02 | 98.00 | 152.01 |
| 12. Kallar | 13.46 | 48.72 | 14.68 | 16.51 | 19.57 |
| 13. Tambaraparani | 46.00 | 11.74 | 51.44 | 59.63 | 73.25 |
| 14. Nambiyar | 10.64 | 29.31 | 12.91 | 16.31 | 21.98 |
| 15. Kodaiyar | 27.55 | 44.60 | 31.33 | 34.57 | 57.28 |
| 16. P.A.P | 41.32 | 1001.51 | 47.89 | 57.74 | 74.16 |
| Total | 905.15 | 1001.51 | 1088.21 | 1345.98 | 1793.67 |

Source: State framework water resources plan of T.N - Draft Final Report, IWS

According to this estimate it is seen that around 2044 AD two-fold increase in water requirement for domestic water supply is a certainty in all the river basins. To meet out the challenge posed by the exponential growth of population, certain prior planning is necessary; otherwise it would be a burden to the existing water supply systems. First and the foremost remedy is to allow the treated water from the effluent treatment into recycling for domestic purposes. Another course of action is to treat the saline water along the coastal belt into potable quality and finally identifying fresh sources of ground water Aquifers and/or rejuvenating the existing Aquifers by artificial means. Similarly adopting rain-harvesting methods such as maintaining the local ponds, construction of percolation ponds, harvesting the rainfall falling in the multi-storeyed buildings, particularly in the urban areas and to recharge the domestic wells can also be considered to lessen the critical conditions.

vi. Agriculture

In Tamil Nadu, irrigation is practiced both through system and non-system tanks in the command areas using surface water as the main source supplemented with ground water.

Table 5.3 Agricultural Demand for Water (in MCM)

| River Basin | 1994 | 1999 | 2004 | 2019 | 2044 |
|---------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1. Chennai | 2864.70 | 2864.70 | 2864.70 | 2582.00 | 2393.00 |
| 2. Palar | 2532.00 | 2532.00 | 2532.00 | 2532.00 | 2532.00 |
| 3. Varahanadhi | 1604.00 | 1604.00 | 1604.00 | 1364.00 | 1204.00 |
| 4. Ponnigar | 2668.80 | 2668.80 | 2668.80 | 2321.39 | 2089.78 |
| 5. Paravanar | 0.357 | 0.384 | 0.384 | 0.493 | 0.630 |
| 6. Vellar | 2229.26 | 2229.26 | 2229.26 | 1946.25 | 1759.47 |
| 7. Agniyar | 2344.00 | 2344.00 | 2344.00 | 2344.00 | 2344.00 |
| 8. Pambar & Kottakaraiyar | 1960.73 | 1960.73 | 1960.73 | 1960.73 | 1960.73 |
| 9. Vaigar | 3840.00 | 3840.00 | 3840.00 | 3840.00 | 3840.00 |
| 10. Gundar | 1758.00 | 1758.00 | 1758.00 | 1556.00 | 1421.00 |
| 11. Vaippar | 1302.65 | 1302.65 | 1302.65 | 1386.15 | 1386.15 |
| 12. Kallar | 167.00 | 167.00 | 167.00 | 167.00 | 167.00 |
| 13. Tambaraparani | 2645.00 | 2645.00 | 2645.00 | 2645.00 | 2645.00 |
| 14. Nambiyar | 523.59 | 566.00 | 566.00 | 566.00 | 566.00 |
| 15. Kodaiyar | 728.33 | 728.33 | 728.33 | 728.33 | 728.33 |
| 16. P.A.P. | 1558.00 | 1558.00 | 1558.00 | 1558.00 | 1558.00 |
| Total | 28726.42 | 28768.85 | 28768.85 | 27497.34 | 26595.09 |

Source: State framework water resources plan of T.N - Draft Final Report, IWS

The demand for agriculture is almost steady for both short and long term periods. It is presumed that efficiency of the irrigation system will be enhanced to 50% around the year 2004 and then to 60% during the year 2044 to meet and to maintain the growing demand of the irrigation sector.

vii. Industries

As per the 1994 statistics, large, medium and small-scale industries have been taken into consideration. Even though there is no specific norm for assessing the industrial sectoral demand, the requirement of water is estimated based on the product, quantity manufactured its water consumption etc. (as per source of information furnished by the industries). **A simple arithmetical increase of 8% per annum over the existing estimate is projected for arriving future demand for this sector and tabulated below:**

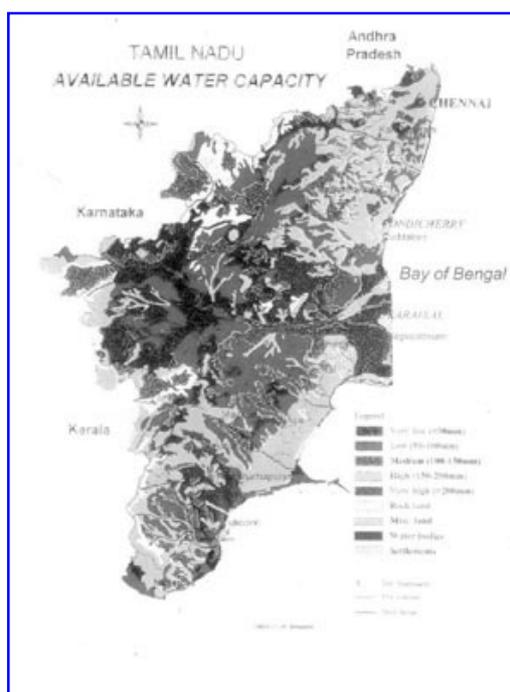
Table 5.4 - Water demand-industrial sector (in MCM)

| River Basin | 1994 | 1999 | 2004 | 2019 | 2044 |
|---------------------------|---------------|---------------|---------------|----------------|----------------|
| 1. Chennai | 86.23 | 120.72 | 155.25 | 258.60 | 431.15 |
| 2. Palar | 43.10 | 54.98 | 66.86 | 102.50 | 161.90 |
| 3. Varahanadhi | 20.10 | 27.26 | 34.42 | 50.17 | 91.70 |
| 4. Ponniyar | 69.59 | 95.56 | 121.53 | 199.43 | 329.27 |
| 5. Paravanar | 2.28 | 3.43 | 4.56 | 7.68 | 13.68 |
| 6. Vellar | 33.05 | 45.55 | 58.04 | 96.21 | 157.97 |
| 7. Agniyar | 17.09 | 23.93 | 30.77 | 51.27 | 85.45 |
| 8. Pambar & Kottakaraiyar | 34.59 | 47.53 | 60.46 | 99.25 | 163.91 |
| 9. Vaigar | 31.21 | 44.75 | 58.30 | 98.93 | 166.66 |
| 10. Gundar | 39.98 | 54.98 | 69.98 | 114.98 | 189.98 |
| 11. Vaippar | 20.62 | 28.87 | 37.11 | 45.36 | 103.10 |
| 12. Kallar | 14.88 | 20.35 | 25.84 | 42.28 | 69.68 |
| 13. Tambaraparani | 23.24 | 32.98 | 40.72 | 66.94 | 110.64 |
| 14. Nambiyar | 1.83 | 2.56 | 3.29 | 5.49 | 9.15 |
| 15. Kodaiyar | 1.53 | 1.92 | 2.31 | 3.48 | 5.45 |
| 16. P.A.P. | 22.14 | 30.60 | 39.10 | 64.54 | 106.94 |
| Total | 461.46 | 635.97 | 808.54 | 1307.11 | 2196.63 |

Source: State framework Water Resources Plan of T.N - Draft Final Report, IWS

It is evident that the demand for water for industries has been steadily increasing and three to four fold increase is anticipated in the year 2044. For development and economic growth it is vital to allot certain amount of water without affecting the agriculture and domestic sector.

Map 5.1 Available water Capacity in Tamil Nadu



VIII. BASIN-WISE INFORMATION

a) Total surface water potential

The total surface water potential of river basins of Tamil Nadu except Cauvery basin is 13117 MCM (448 TMC). There are about 56 reservoirs, with a total capacity of 2301 MCM (81.26 TMC) in 11 river basins. There are 17514 tanks (excluding ex-zamin and minor irrigation tanks) in 15 river basins of Tamil Nadu. Their approximate total capacity is 4930 MCM (174.10 TMC).

Table 5.5 Surface water potential of river basins

| River-Basin | Methodology | Surface Water Potential 75% dependability MCM |
|--------------------------|------------------------------------|--|
| 1. Chennai | 0-15 Run off co-efficient | 906 |
| 2. Palar | Run off co-efficient | 1758 |
| 3. Varahanadhi | 0-15 Run off co-efficient | 416 |
| 4. Ponniyar | 0-15 Run off co-efficient | 1310 |
| 5. Vellar | 0-15 Run off co-efficient | 1071 |
| 6. Paravanar | 0-15 Run off co-efficient | 144 |
| 7. Agniyar | 0-15 Run off co-efficient | 1084 |
| 8. Pambar &Kottakaraiyar | 0-15 Run off co-efficient | 653 |
| 9. Vaigar | 0-15 Run off co-efficient | 1579 |
| 10. Gundar | 0-15 Run off co-efficient | 568 |
| 11. Vaippar | Run off co-efficient | 616 |
| 12. Kallar | 0-15 Run off co-efficient | 142 |
| 13. Tambaraparani | Run off co-efficient | 1325 |
| 14. Nambiyar | Run off co-efficient | 204 |
| 15. Kodaiyar | Actual flow & Run off co-efficient | 925 |
| 16. Parambikulam-Aliyar | Actual flow measurement | 416 |
| | Total | 13117 |

Source: State framework water resources plan of Tamil Nadu - Draft Final Report, IWS

B) TOTAL GROUND WATER POTENTIAL

The total groundwater potentials of the river basins are furnished besides the well census and the present stage of utilisation indicating the Dark and Grey blocks are given in the following Table 5.6

Table 5.6 Ground water potential

| River Basins | Area in sq.km. | No. of Observation Wells | Ground water potential in MCM | | | Remarks |
|---------------------------|----------------|--------------------------|-------------------------------|--|-----------------------------------|---------|
| | | | GW Fluctuation Method | Ground Water Estimation Committee Norms 1992 | Ground Water Potential Considered | |
| 1.Chennai | 7292 | 150 | - | 1120.00 | 1120.00 | * |
| 2. Palar | 18.3 | 148 | 3416.00 | 2610.00 | 2610.00 | ** |
| 3. Varahanadhi | 4357 | 55 | - | 1482.00 | 1482.00 | *** |
| 4. :Ponniyar | 11257 | 172 | 1499.00 | 1622.00 | 1560.00 | |
| 5. Vellar | 7659 | 103 | 1022.00 | 1665.58 | 1344.00 | |
| 6. Paravanar | 760 | 13 | 226.00 | 225.00 | 226.00 | |
| 7. Agniyar | 4566 | 64 | - | 919.91 | 920.00 | |
| 8. Pambar & Kottakaraiyar | 5847 | 84 | 1272.00 | 680.00 | 976.00 | |
| 9. Vaigai | 7031 | 87 | 1956.00 | 993.07 | 993.00 | *** |
| 10. Gundar | 5647 | 87 | 867.00 | 665.07 | 766.00 | |
| 11. Vaipar | 5423 | 86 | 1261.00 | 1073.20 | 1167.00 | |
| 12. Kallar | 1878.8 | 18 | - | 70.00 | 70.00 | |
| 13. Thambaraparani | 5969 | 77 | 762.00 | 725.43 | 744.00 | |
| 14. Nambiyar | 2084 | 31 | 310.27 | 275.00 | 275.00 | |
| 15. Kodaiyar | 1533 | 22 | 459.55 | 224.66 | 342.00 | |
| 16. Prambikumar Aliyar | 3462 | 59 | 899.00 | 603.17 | 751.00 | |

Source: State framework resources plan of Tamil Nadu-Draft Final Report, IWS

Studies show that more than 60% of the groundwater is already exploited. Hence the tapping of groundwater should be monitored. Statistical information shows that there is a considerable increase in number of wells in the river basins of Tamil Nadu. To avoid over mining, recharge of ground water should be facilitated during flood periods by means of construction of percolation ponds check dams etc., small weirs across the streams. To improve the ground water potency of the state following measures are suggested:

- * The exploitation of groundwater may be restricted in dark blocks as such it has reached 85% to 100%. An act like 'The Chennai Metropolitan Area of ground water (Regulation) Act 1987' may be enacted for the State. Registration of existing wells, regulation of sinking wells, issue of licenses to extract for no-domestic use and for transportation through vehicles may be brought under the purview of the new Act.
- * Energizing the wells in dark blocks should be restricted.

- * Educating the Farmers to go in for modern irrigation systems such as drip irrigation for orchards and garden crops.
- * Rainwater harvesting as the method of recharging the aquifer in their own premises should be encouraged by giving incentives.
- * Conjunctive use of groundwater and surface water is to be made in suitable places to improve irrigation efficiency.

IX. MAJOR DAMS AND RESERVOIRS

There are about 56 reservoirs, with a total capacity of 2301 MCM (81.26 TMC) in 11 river basins and 17514 tanks (excluding ex-zamin and minor irrigation tanks) in 15 river basins of Tamil Nadu. Their approximate total capacity is 4930 MCM (174.10TMC). The abstract of reservoirs and tanks with their total capacity in the river basins are given in the following Table 5.7.



Table 5.7 Reservoirs in river basins of Tamil Nadu (except Cauvery river basin)

| Name of Reservoir | Year of Construction | Capacity MCM | Catchment area sq.km. | Water spread area sq.km. | Designed max.flood Cumecs | Ayncut hectare |
|--------------------------|----------------------|--------------|-----------------------|--------------------------|---------------------------|----------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Chennai Basin | | | | | | |
| 1. Poondi | | 97.98 | | | | Only for drinking water purposes |
| 2. Red Hills | | 93.46 | | | | |
| 3. Cholavaram | | 25.30 | | | | |
| Palar Basin | Nil | | | | | |
| Varahanadhi Basin | | | | | | |
| 1. Vidur Dam | 1958.59 | 17.13 | 1298 | 7.98 | 1786.43 | 1295.02 |
| Ponniyar Basin | | | | | | |
| 1. Krishnagiri | 1955-58 | 66.10 | 5428.43 | 12.48 | 4234.00 | 3642 |
| 2. Sathanur | 1955-58 | 207.00 | 10825.78 | 20.10 | 5664.00 | 18222 |
| 3. Pambar | 1977-8 | 37.00 | 1736.0 | 2.43 | 1513.39 | 1620 |
| 4. Shoolgiri Chinnar | 1981-85 | 2.30 | 143.62 | 0.45 | 547.10 | 352 |
| 5. Vaniar | 1979-85 | 1.80 | 101.76 | 0.11 | 654.90 | 4221 |
| 6. Thumbalahalli | 1979-83 | 3.70 | 232.50 | 1.93 | 577.47 | 884 |
| 7. Kelavarapalli | 1977-79 | 13.10 | 2442.0 | 349.50 | 2490.00 | 3240 |
| Vellar Basin | | | | | | |
| 1. Anaimaduvu | 1982-92 | 7.56 | 145.02 | 1.07 | 911.13 | 2118 |
| 2. Karriyakoil | 1982-92 | 5.38 | 70.50 | 0.69 | 770.21 | 1457 |
| 3. Gomuki | 1963-65 | 15.86 | 292.67 | 3.60 | 736.24 | 2023 |
| 4. Manimuktha | 1966-70 | 20.87 | 484.31 | 7.46 | 926.06 | 1720 |
| 5. Willingdon | 1913-23 | 65.18 | 129.50 | 15.54 | 66.84 | 11068 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------------------------------|-----------|--------------|---------|-------|---------|---------|
| Cauvery | Na | Na | Na | Na | Na | Na |
| Agniyar | Nil | | | | | |
| Pambar & Kottakaraiyar | Nil | | | | | |
| Vaigai Basin | | | | | | |
| 1. Periyar Dam | 1887-97 | 443.23 | 601.00 | 29.00 | 3600.00 | 57871 |
| 2. Vaigai Dam | 1954-59 | 185.00 | 2253.30 | 24.19 | 1780.20 | 9645.89 |
| 3. Manjalar Dam | 1963-67 | 13.80 | 119.14 | 1.97 | 331.34 | 809.39 |
| 4. Marudhanadhi Dam | 1973-79 | 5.31 | 53.35 | 0.72 | 419.99 | 1526.91 |
| 5. Sathiar Dam | | 1.59 | - | - | - | - |
| Gundar Basin | Nil | | | | | |
| Vaippar Basin | | | | | | |
| 1. Periyar Dam | 1971-76 | 5.45 | 45.30 | 0.76 | 283.3 | 3652 |
| 2. Kovilar Dam | 1971-76 | 3.77 | 24.77 | 0.74 | 220.8 | 143.65 |
| 3. Vembakkottai | 1980-85 | 11.29 | 26.91 | 4.68 | 1851.9 | 3280 |
| 4. Kullur Sandai | 1980-84 | 3.59 | 80.38 | 3.16 | 752.0 | 1170 |
| 5. Anaikuttam | 1982-89 | 3.56 | 4.83 | 1.99 | 1708.0 | 1214 |
| 6. Golwarpatty | 1982-92 | 5.20 | 13.80 | 3.47 | 2849.0 | 1821 |
| 7. Irukankudi | | 14.14 | - | - | - | 3787 |
| 8. Ullar Reservoir | | 7.73 | - | - | - | 4694 |
| Kallar Basin | | | | | | |
| 1. Eppothumvendran Tank | | 3.57 | | | | |
| Tambarabarani Basin | | | | | | |
| 1. Papanasam (under E.B) | 1951-58 | 156.0 | 150.0 | - | - | - |
| 2. Manimuthar | 1967-74 | 156.0 | 162.0 | 9.40 | 1699.20 | 8093.89 |
| 3. Gadana | 1966-74 | 10.0 | 46.5 | 0.80 | 758.98 | 404.69 |
| 4. Ramanadhi | 1971-77 | 4.3 | 16.6 | 0.39 | 295.94 | 202.35 |
| 5. Karuppanadhi | 1979-83 | 5.2 | 29.3 | 0.50 | 356.83 | 1163.49 |
| 6. Gunder | 1986 | 0.7 | 9.9 | 0.21 | 264.51 | 36.69 |
| 7. Servalar | 1887-1897 | 35.0 | 106.00 | - | - | - |
| 8. Periyar Dam | | 443.35 | 610 | 29 | 3463 | 51871 |
| Nambiyar Basin | | | | | | |
| 1. Nambiyar | 2.33 | Under | | | | |
| 2. Kodumudiyar | 3.58 | Construction | | | | |
| Kodaiyar Basin | | | | | | |
| 1. Pechiparai Dam | 1895-1906 | 152.36 | 207.19 | 15.15 | 1104.48 | 25900.4 |
| 2. Perunchani Dam | 1948-52 | 81.84 | 159.46 | 9.62 | 894.91 | 6070.42 |
| 3. Chittar Dam I | 1963-70 | 17.28 | 22.01 | 2.93 | 595 | 6879.81 |
| 4. Chittar Dam II | 1963-70 | 28.55 | 26.16 | 26.16 | 595 | 36836 |
| Under EB | | | | | | |
| 5. Kodaiyar Upper I | | 118.50 | | | | |
| 6. Kodaiyar Lower II | | 0.883 | | | | |
| 7. Kuttiyar Dam | | 0.227 | | | | |
| 8. Chinnakuttiyar Dam | | 2.776 | | | | |
| 9. Poigaiyar (U.C) | | 2.700 | | | | |
| PAP Basin | | | | | | |
| 1. Upper Nirar Weir | | 0.047 | 75.11 | | | |
| 2. Lower Nirar Dam | | 0.27 | 86.35 | | | |
| 3. Sholayar Dam | | 5.39 | 121.73 | | | |
| 4. Prambikulam | | 17.82 | 230.51 | | | |
| 5. Tunacadavu Dam | | 0.66 | 43.36 | | | |
| 6. Peruveripallam | | 0.62 | 15.80 | | | |
| 7. Aliyar Dam | | 3.86 | 196.84 | | | |
| 8. Thirumoorthy Dam | | 1.94 | 80.29 | | | |
| 9. Upper Aliyar Dam | | 0.94 | 16.52 | | | |

Source: State framework water resources plan of Tamil Nadu - Draft Final Report, IWS

X. STATUS OF WATER QUALITY IN TAMIL NADU

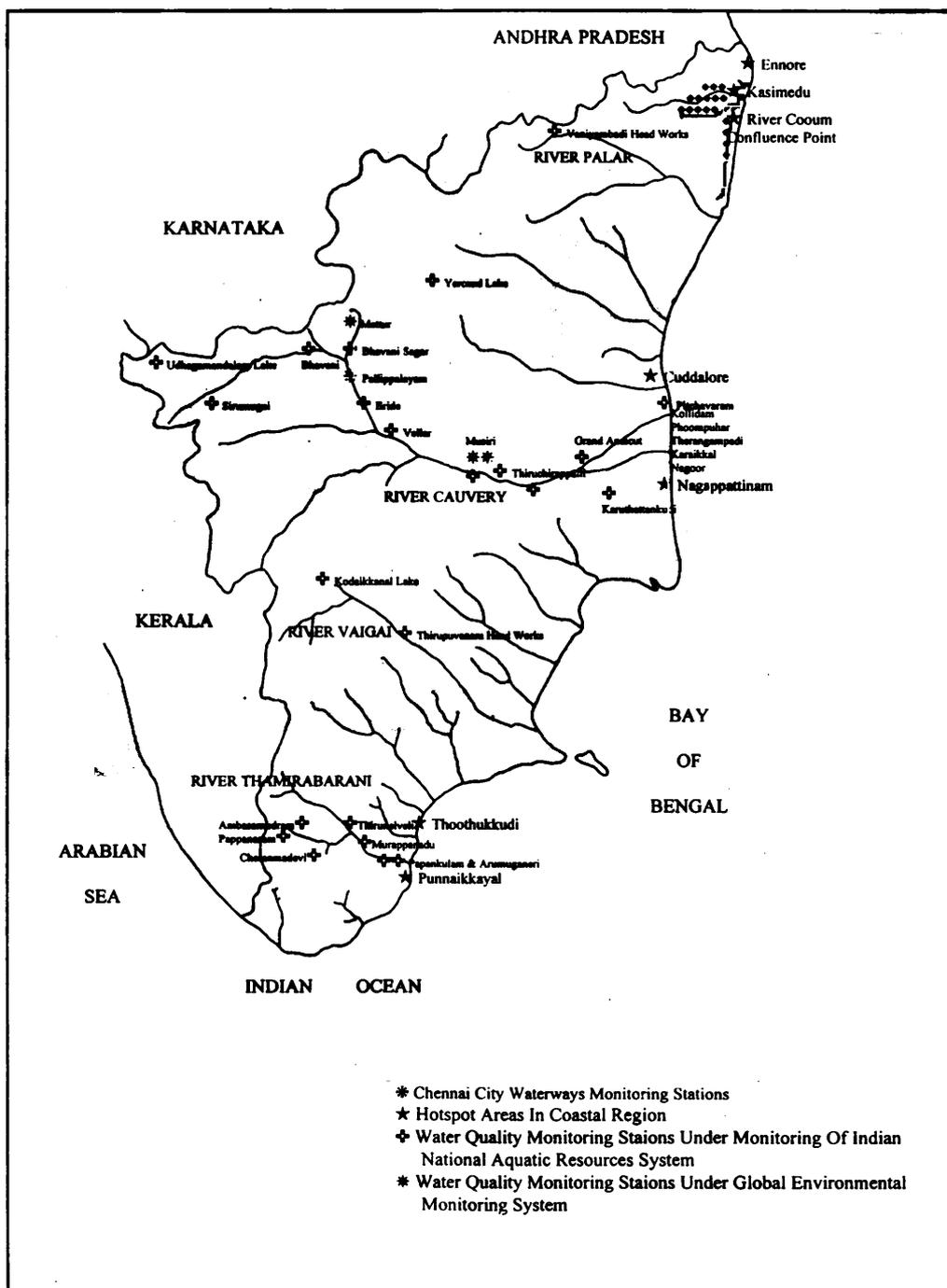
As there are no perennial rivers in Tamil Nadu, the agricultural, industrial and domestic activities depend largely on the ground water. Over extraction of ground water and discharge of wastes back into surface/ ground water make the water polluted. In order to protect the water sources, TNPCB is continuously monitoring the quality of discharge of waste water into the surface water/ basins of the important rivers and the ground water. TNPCB monitors the inland water quality, two major programmes namely Monitoring of Indian National Aquatic Resources System (MINARS) and Global Environmental Monitoring System (GEMS). The Rivers Cauvery, Thamiraparani, Palar and Vaigai and the lakes of Udhagamandalam, Kodaikkanal and Yercaud are monitored under the MINARS programme. Under the GEMS programme, 4 stations have been identified in the River Cauvery Basin and are regularly monitored every month are as follows:

Table 5.8 Water quality of river Cauvery

| Sl.No. | Station | PH Range | DO mg/l | BOD mg/l | CI mg/l | SO ₄ mg/l | TDS mg/l | NO ³ mg/l | TH mg/l | FCMPN /100ml | TCMPN /100ml |
|--------|----------------------|----------------|---------|----------|---------|----------------------|----------|----------------------|---------|--------------|--------------|
| 01 | Pathrakaliamman Koil | 7.32 - 7.73 | 7.3 | 1.0 | 38 | 11 | 206 | 0.21 | 64 | 31130 | 67981 |
| 02 | Trichy U/S | 7.54 - 8.70 | 4.1 | 3.3 | 55 | 15 | 372 | 0.31 | 172 | 3125 | 13343 |
| 03 | Grand Anaicut | 7.55 - 8.61 | 6.2 | 1.3 | 90 | 15 | 370 | 0.28 | 180 | 255 | 1940 |
| 04 | Sirumugai | 7.15 - 8.01 | 6.5 | 1.1 | 45 | 14 | 201 | 0.28 | 68 | 85100 | 204000 |
| 05 | Bhavani | 7.49 - 8.51 | 6.3 | 1.4 | 35 | 15 | 356 | 0.24 | 162 | 3180 | 40100 |
| 06 | Karathattankudi | 8.17 - 8.76 | 8.4 | 1.6 | 50 | 26 | 365 | 0.24 | 158 | 220 | 1300 |
| 07 | Madathukulam | 7.72 - 8.91 | 8.9 | 1.2 | 45 | 33 | 251 | 0.24 | 98 | 440 | 270 |
| 08 | Erode | 6.69 - 8.34 | 6.1 | 1.4 | 37 | 30 | 380 | 0.34 | 154 | 3100 | 26843 |
| 09 | Bhavani Sagar | 7.34 - 8.26 | 7.0 | 1.1 | 28 | 35 | 336 | 0.35 | 114 | 1000 | 1500 |
| 10 | R.N.Pudur | 7.50 - 8.52 | 6.4 | 1.4 | 35 | 41 | 360 | 0.90 | 140 | 180 | 13600 |
| 11 | P.Vellur | 7.80 - 8.60 | 6.9 | 1.0 | 25 | 19 | 336 | 0.20 | 150 | 1320 | 3340 |
| 12 | Mahavur | 7.87 - 8.58 | 7.9 | 1.1 | 28 | 14 | 328 | 0.28 | 136 | 1600 | 5600 |
| 13 | Trichy | 7.66 - 8.62 | 6.8 | 1.4 | 48 | 12 | 364 | 0.41 | 192 | 450 | 1100 |
| 14 | Coleroon | 7.84 - 8.57 | 6.8 | 1.4 | 130 | 48 | 438 | 0.21 | 175 | 800 | 1800 |
| 15 | Pitchavaram | 7.73 - 8.44 | 6.0 | 1.6 | 53 | 135 | 405 | 0.38 | 305 | 2700 | 9730 |
| 16 | Thirumukkudal | 7.82 - 8.56 | 7.8 | 1.0 | 48 | 40 | 370 | 0.20 | 174 | 312 | 800 |
| | I.S.I. Standards | 6.50 - 8.50 | 4.0 | 3.0 | 600 | 400 | 1500 | 50 | - | - | 5000 |

River Cauvery is a major river in Tamil Nadu, which drains more than one third of the State. The quality of water is monitored in 16 places along the river. The monitoring conducted under MINARS Programme during 1998-99 shows that the pH value varies from 7.32 to 8.91 and BOD varies from 1 to 33 mg/lit. The overall analysis of the data reveals that the faecal contamination all along the course of the river basin due to unhygienic anthropogenic activities and disposal of either untreated or partially treated municipal waste water into the River System directly or indirectly. It is observed that the water quality of River Cauvery meet the standards prescribed for surface water criteria under class 'C' for all parameters except the parameters of total coliform is from 130 to 11,288 MPN/ 100 ml and 160 to 4,084 MPN/ 100 ml respectively.

MAP-2
LOCATION OF WATER QUALITY MONITORING STATIONS
ESTABLISHED BY TNPCB



5.9 Water quality of river Thamiraparani

| Sl.No. | Station | PH Range | DO mg/l | BOD mg/l | Cl mg/l | SO ₄ mg/l | TDS mg/l | NO ³ mg/l | TH mg/l | FCMPN /100ml | TCMPN /100ml |
|--------|-------------------|-----------|---------|----------|---------|----------------------|----------|----------------------|---------|--------------|--------------|
| 1 | Cheranmadevi | 6.9 - 7.5 | 7.1 | 1.9 | 14 | 13 | 63 | 0.04 | 31 | 50 | 110 |
| 2 | Kokirakulam | 7.0 - 7.9 | 7.3 | 2.0 | 16 | 16 | 75 | 0.02 | 37 | 85 | 102 |
| 3 | Papanasam | 7.1 - 7.7 | 7.0 | 2.3 | 17 | 17 | 62 | 0.40 | 17 | 45 | 100 |
| 4 | Murappanadu | 7.1 - 7.9 | 7.2 | 2.3 | 20 | 15 | 96 | 0.15 | 52 | 35 | 65 |
| 5 | Ambasamudram | 6.8 - 7.4 | 6.9 | 2.6 | 13 | 7 | 47 | 0.02 | 14 | 60 | 85 |
| 6 | Thiruvadaimarudur | 7.0 - 7.7 | 7.2 | 2.0 | 15 | 12 | 57 | 0.01 | 24 | 65 | 100 |
| 7 | Arumuganeri | 8.0 - 8.2 | 7.1 | 2.1 | 172 | 36 | 516 | 0.80 | 202 | 75 | 130 |
| | I.S.I.Standards | 6.5 - 8.5 | 4.0 | 3.0 | 600 | 400 | 1500 | 50.00 | - | - | 5000 |

5.10 Water quality of river Palar

| Parameter | Value | Tolerance limit for Surface Water (Class 'C') |
|---------------------------|---------|---|
| PH | 7.0-8.3 | 6.5-8.5 |
| DO-mg/l | 6.2 | 4 |
| BOD-mg/l | 2.7 | 3.0 |
| Chlorides-mg/l | 91 | 600 |
| Sulphate-mg/l | 42 | 400 |
| Total Coliform-MPN/100ml | 195 | 5000 |
| Faecal Coliform-MPN/100ml | 120 | - |
| Nitrate Nitrogen-mg/l | BDL | 50 |
| Total Hardness-mg/l | 170 | - |

Note: Sampling point at Vaniyambadi Municipal Head works

5.11 Water quality of river Vaigai basin

| Parameter | Value | Tolerance limit for Surface Water (Class 'C') |
|---------------------------|---------|---|
| PH | 7.0-8.2 | 6.5-8.5 |
| DO-mg/l | 6.7 | 4 |
| Nitrate Nitrogen-mg/l | 0.06 | 50 |
| Total hardness-mg/l | 226 | - |
| BOD-mg/l | 2.4 | 3 |
| Chlorides-mg/l | 127 | 600 |
| Sulphate-mg/l | 20 | 400 |
| Total Coliform-MPN/100ml | 95 | 5000 |
| Faecal Coliform-MPN/100ml | 54 | - |

Note: water quality study was carried out in Thirubuvanam Head Works

5.12 Quality of water in Chennai city water ways

| Water ways | Average value of Parameters (except pH) in mg/lit. | | | | | | | | | |
|------------------|--|------|--------|--------|--------|--------|--------|--------|----------|----------|
| | PH | | TSS | | BOD | | COD | | TDS | |
| | U/s | D/s | U/s | D/s | U/s | D/s | U/s | D/s | U/s | D/s |
| River Cooum | 7.60 | 7.44 | 62.00 | 86.50 | 24.58 | 48.08 | 96.00 | 222.66 | 1085.66 | 7593.16 |
| River Adyar | 7.82 | 7.55 | 37.00 | 85.83 | 11.25 | 18.25 | 59.33 | 145.33 | 744.00 | 14787.33 |
| Otteri Nullah | 7.44 | 7.46 | 261.66 | 187.83 | 122.83 | 101.25 | 359.33 | 270.66 | 1432.50 | 1000.00 |
| Buckingham Canal | 7.53 | 7.78 | 166.16 | 88.83 | 56.50 | 41.25 | 293.33 | 188.50 | 17605.66 | 1474.00 |

NOTE: River Cooum at Napier Bridge , River Adyar at Thiru Vi ka Bridge, Otteri Nullah at Vysarpadi Bridge, Buckin-gham Canal at Elliots Road Bridge

TNPCB is monitoring the water quality of Chennai City waterways namely River Cooum, River Adyar, Buckingham Canal and Otteri Nullah from the year of 1989, regular water samples are collected from the four city waterways at monthly intervals and also PCB is monitoring the outfalls from industries and the sewage Treatment Plants. Chennai city waterways are contaminated by various organic and inorganic pollutants received predominantly from domestic, industrial and other man-made activities. The level of contamination is relatively high in Buckingham Canal followed by Otteri Nullah and River Cooum.

XI. ENVIRONMENTAL PLANNING FOR WATER RESOURCES

The environmental planning with reference to water resources has to be done considering the effect of various factors, which affect the environment and ecology.

A. Agriculture

In Tamil Nadu, the soil is generally suitable for agriculture in Palar, Varahanadhi, Ponnaiyar, Agniar, Pambar, Kottakkaraiyar, Gundar, Kallar and Vaigai basins. Soil salinity problems are encountered in some pockets in Vellar, Vaippar, Nambiyar, Koadaiyar and Parambikulam Aliyar basins. Drainage problems are found in tail end areas in Tambaraparani basin and some parts of PAP basin. Soil salinity is caused due to backwater effect of sea. In Chennai basin seawater intrusion occurs affecting the ground water quality due to indiscriminate pumping of groundwater. Conversion of lands for urbanisation results in loss of cultivable lands. Soil reclamation plan has to be prepared wherever soil salinity or alkalinity is noticed.

B. Industries

The industrial wastes/effluents allowed into the river courses cause water pollution in several areas. The following are the localities where industries cause severe pollution to surface water and ground water.

Table 5.13 River pollution due to Industries

| District / Type of Industry | Basin Affected |
|---|---------------------|
| North Chennai – Petro Chemical Industries | Chennai river basin |
| Vellore, Ranipet-Tannery Industries | Palar river basin |
| Erode, Tiruppur – Textile Industries | Noyyal River basin |
| Thoothukudi – Sterlite, Coral reeves | Kallar Basin |
| Salem – Sago Factories | Vellar Basin |
| Dindugal – Tanneries | Vagai Basin |
| Thirnelvali – Sun Paper Mills | Tambaraparani Basin |
| Manavalakuruchi | Kidaiyar Basin |
| Sivakasi, Kovilpatti and Sattur | Vaippar Basin |

The pollution control agencies must be empowered and stringent action has to be taken against defaulters of pollution laws and norms. Common effluent treatment plants should be installed and made to function effectively without interruption. All the industries must be made to recycle their wastewater for their use under statutory obligations.

C. Sewage disposal

Civic sewage, treated partly or untreated when allowed into water course or water bodies causes pollution and health hazards. The standards prescribed are to be scrupulously followed. Most of the civic bodies, irrespective of their population and status do not have facility for treating and recycling their sewage and resort to letting it to flow in the rivers. This causes ground water pollution and also becomes breeding places for mosquitoes and other parasites affecting public health and causes outbreak of epidemics. Much water borne diseases is the result of polluted watercourses. Malaria, hepatitis and diarrhoea are most common in all the basins. Epidemics of cholera also occur. These diseases could only be eradicated by preventing all forms of pollution

D. Fisheries

Tamil Nadu has a coastal length of 1076 KM., which constitutes about 15% of India's coastal line. There are 591 fishing villages in 13 coastal districts in Tamil Nadu starting from Tiruvallur to Kanniyakumari District. Around 3.48 lakh fishermen and 3.31 lakh fisher women totalling 6.79 lakh are living in these coastal fishing villages. The literacy rate is 66%, about 2.70 lakh marine fishermen are actively engaged in fishing. The above marine fishermen are eking out their livelihood by fishing in the continental shelf of 41,412 Sq.KM. engaging 8500 mechanised fishing crafts and 41,000 traditional crafts. About 3.70 lakh M.T. of fish are caught in Coramandal coast, Palk Bay and Gulf of Mannar coast throughout the year. **The State earned Rs.2015.48 crores as foreign exchange by exporting marine products of 55,160 M.T. during the year 2001.**

E. Objectives of the Fisheries department

- ❖ To optimise fish yield from small, medium and large reservoirs in the State through an integrated approach.
- ❖ To popularise integrated fish farming in tanks and ponds
- ❖ To optimally utilise coastal areas for productive utilisation and livelihood support for rural poor
- ❖ To enhance marine fish stocks through sea ranching and setting up of artificial reefs along the coast
- ❖ To reduce post-harvest losses and to improve the landing and berthing infrastructure for marine fishermen.
- ❖ To ensure the safety of artisanal and small scale fisherman at sea
- ❖ To generate employment opportunities for fisher folk and rural unemployed youth through aquaculture and culture based fisheries.
- ❖ To enable fishermen and fish farmers to get remunerative prices for their harvest through improved marketing infrastructure
- ❖ To provide nutrition and food security to the population through increased availability of fin and shell fishes
- ❖ To ensure the quality of fish and fish products and create awareness among consumers.

Table 5.14 Coastal Information

| S.No | Coastal information | Tamil Nadu | | |
|------|---|------------|------------|--------|
| | | West coast | East Coast | Total |
| 1 | Coastal length (in km) | 60 | 1016 | 1076 |
| 2 | Continental shelf (in sq.km) | | | 41412 |
| | a. Upto 50m depth | 844 | 22411 | 23255 |
| | b. 51m to 200 m depth | 6952 | 11205 | 18157 |
| 3 | Exclusive Economic Zone (in million sq.km) extends to 200 nautical miles from shore | | | 0.19 |
| 4 | Territorial water (in sq.km) (approx.) | | | 19,000 |

Source: Tamil Nadu Fisheries statistics 2002 Department of Fisheries

Table 5.15 District -Wise Coastal length

| S.No | Name of the District | Tamil Nadu | | | | | Fisher folk Population (Total) |
|------|--------------------------|------------------|----------|----------------|------------|----------------|--------------------------------|
| | | Coramendal Coast | Palk bay | Gulf of Mannar | West Coast | Total | |
| 1 | Chennai | 19 | | | | 19 | 72997 |
| 2 | Tiruvarur | 27.9 | | | | 27.9 | 69458 |
| 3 | Kancheepuram | 87.2 | | | | 87.2 | |
| 4 | Villupuram/ Cuddalore | 40.7/ 57.5 | | | | 40.7/ 57.5 | 15330/ 41690 |
| 5 | Nagai/ Tiruvarur | 124.9 | | | | 187.9/ 47.2 | 81946/ 10648 |
| 6 | Thanjavur | | 63/47.2 | | | 45.1 | 26071 |
| 7 | Pudukkottai | | 45.1 | | | 42.8 | 25710 |
| 8 | Ramanatha-puram | | 42.8 | 141 | | 236.8 | 120493 |
| 9 | Thoothukudi | | 95.8 | 163.5 | | 163.5 | 71457 |
| 10 | Tirunelveli | | | 48.9 | | 48.9 | 20762 |
| 11 | Kanyakumari | | | 11.5 | 60 | 71.5 | 141706 |
| | Total | 357.2 | 293.9 | 364.9 | 60 | 1076 | 698268 |

Source: Tamil Nadu Fisheries statistics 2000 Department of Fisheries

II. MARINE FISHERY

Fisheries Development Mission

Tamil Nadu is having a long coastal line has a rich fish potential to produce 3.7 lakh M.T. in the inshore waters and 1.2 lakh M.T. in the offshore waters. To promote sustainable eco friendly coastal aquaculture and to bring more water areas for increased marine and inland fish production and export, the Government has proposed to form Fisheries Development Mission. In order to increase the per capita income of small marine fishermen, due attention and care is taken for the development of inshore fishery wealth. This mission will explore the possibility of increasing inland fish production by formulating suitable schemes and techniques such as fish culture in the water bodies in the utilised mines, quarries, etc.,

establishment of integrated fish farm in paddy fields and establishment of model fishing villages. This mission will have an apex committee comprising members from technical institutions and experts. It will evolve strategies and suggest suitable measures to Government for achieving the goal of fisheries development by increasing marine and inland fish production.



III. MARINE FISH PRODUCTION (1999-2000)

The contribution of marine fish production of Tamil Nadu to the all India marine fish production was in the range of 13.4 percent in 1999-2000, contribution of inland fisheries to the total fish production from inland resources of India was about 4 percent. As against the total fishery potential of 0.965 million tonnes from both inland and marine resources of Tamil Nadu, the present level of fish production is 0.475 million tonnes, which is about 49.5 percent of the total potential. **The export of marine products from the state during 2001-2002 amounted to 58 483 metric tonnes valued at Rs.20 164 million and the Marine fish production is 3,72,402 tonnes.**

IV. INLAND FISH PRODUCTION

The inland fisheries sector has about 370 000 ha of water spread area, comprising about 52 000 ha of reservoirs, 97 700 ha of major irrigation and long seasonal tanks, 158 100 ha short seasonal tanks and ponds and 63 000 ha under estuaries, backwaters and swamps, which are suitable for **both capture fisheries**. Presently, about 4 00 ha of water spread is being utilised for fresh water aquaculture under the programmes of the Fish Farmers Development Agencies. In shrimp farming, about 2900 ha area is in use against 4 455 ha developed for aquaculture. It is proposed to increase the fish production annually by ten percent from the present production of 1.14 lakh M.T. by bringing more waterspread areas for fish culture. In Tamil Nadu, very few species of fish are produced inland waterways. The main species cultured in the inland areas are catla, rogu, mirgal and common carp, grass carp and silver carp.

V. BRACKISH WATER AND AQUACULTURE FARMS

Tamil Nadu has a total of 56,000 ha. of potential shrimp farming area. A total of 4455 ha. has been developed in the State for shrimp farming, only 2879 ha. is in use. The coast of Tamil Nadu has become attractive for investment in shrimp culture. In the districts of Chennai, Kancheepuram, Tiruvallur, Cuddalore, Nagapattinam, Kanyakumari etc., the activity is being increased. The aquaculture activity has attracted severe criticism from the environmentalists due to the dispersion of salt into land area inland around the farms, making them saline and unfit for any other agricultural purpose. Considering the environmental damages of aquaculture practices, the Supreme Court of India banned aquaculture within CRZ and entrusted the job of issuing clearance to the farms for the existing/proposed farms only outside the CRZ to the Aquaculture Authority constituted as per the directions of the Supreme Court of India with headquarters at Chennai.

C. COASTAL ZONE AND WET LANDS

The coastal stretch contains part of Chennai Metropolitan area, four municipal towns of Cuddalore, Nagapattinam, Thoothukudi, Colachel and 21 Town Panchayats/Townships. There are 30 Village

Panchayats and 13 Villages along the coast notified by the MoEF, Government of India as Coastal Regulations Zone. For regulating the development activities, the coastal stretches within 500m of High tide line of the land ward side are classified into four categories of Coastal Regulation Zone. The Table shows the lists of urban settlements, which lie within the coastal area of Tamil Nadu with its population as on 1981 and 1991.

Table 5.16 List of urban settlement with extent and population

| District | Name of the Town | Extent | Classification | 1981 | 1991 |
|----------------|------------------|--------|----------------|---------|---------|
| Chennai | Chennai | 174 | C | 3276622 | 3841396 |
| Kancheepuram | Thiruvottriyur | 21.42 | M | 134014 | 168642 |
| | Triuvidanthai | Na | | 1166 | 1294 |
| | Mamallapuram | Na | TP | 5523 | 9896 |
| Villupuram | Markanam | Na | TP | 14211 | 2183 |
| Cuddalore | Cuddalore | 27.71 | M | 127625 | 73245 |
| | Prangipettai | Na | TP | | 23550 |
| Nagapattinam | Tirumullaivasal | Na | TP | 10326 | 11551 |
| | Tarangabadi | Na | TP | 18610 | 18881 |
| | Nagapattinam | 14.80 | M | 82828 | 43081 |
| | Velankanni | Na | TP | | 6155 |
| | Vedaraniyam | 33.99 | TP | 26573 | 29822 |
| Thanjavur | Athirampattinam | Na | TP | 21179 | 26645 |
| Ramanathapuram | Tondi | 3.92 | TP | 11148 | 12332 |
| | Mandapam | 21.16 | TP | 4350 | 19935 |
| | Rameswaram | 52.36 | TP | | 32721 |
| | Kilakkarai | 27.20 | TP | 2643 | 2992 |
| | Sayalkudi | Na | TP | 6800 | 10182 |
| Thoothugudi | Thoothugudi | 13.47 | M | 192949 | 100883 |
| | Eral | 3.88 | TP | 8862 | 9376 |
| | Arumuganeri | Na | TP | 21107 | 23453 |
| | Kayalpattinam | Na | TP | 23544 | 24428 |
| | Thiruchendur | 10.50 | TP | 24233 | 27420 |
| Kanniyakumari | Kaniyakumari | 4.91 | TP | 5763 | 17225 |
| | Agatiswaram | Na | TP | 12857 | 8301 |
| | Rajakkamangalam | Na | TP | | 14796 |
| | Kollancode | Na | TP | 33368 | 30075 |
| | | | | 4066301 | 4617406 |

Sourace: Census of india 1981 & 1991 Note: C-Corporation TS – Township TP.Town Panchayat

The population of the urban centers from 1981 to 1991 increased substantially by 13.55%. This shows the increasing trend of the population from the plains to the coastal stretches.

I. COASTAL ZONE MANAGEMENT AUTHORITY

The Government of India, MoEF have constituted an authority namely, the Tamil Nadu coastal zone management authority the Chennai metropolitan coastal zone authority and district coastal zone management committee. The State coastal zone management authority shall meet regularly to discuss the measures to be taken in the coastal area, for protecting and improving the quality of the coastal environmental and preventing and abating and controlling environmental pollution in the coastal area of Tamil Nadu. The

chairman of the authority shall be the secretary to Government, MoEF and the Member Secretary shall be the Director, Department of Environment.

II. POLLUTION LOAD IN HOTSPOTS IN COASTAL AREAS

Tamil Nadu has a 1076 Km long coast line. There are petrochemical, fertilizer and chemical industries which discharge their treated effluent into sea. These discharges and the confluence points of rivers are monitored by TNPCB to assess the pollution load and to take corrective action. Based on the earlier studies conducted with 32 sampling stations in 5 sectors, TNPCB has identified the on-shore discharges and 7 Hot-Spot Areas in the coast line. The Hot-Spot Areas are monitored regularly. The Hot Spot areas identified are Ennore, Kasimedu, River Cooum confluence point, Cuddalore, Nagapattinam, Tuticorin and Punnaiakayal (the confluence point of river Thamiraparani).

The Central Electrochemical Research Institute – Madras Unit has conducted the study on Marine Pollution along the Tamil Nadu coast during 1998-99 under the programme of Coastal Ocean Monitoring and Prediction System (COMAPS), and revealed the following results:

1. Suspended solids were higher at Chennai – Ennore Coast (39.68 mg/lit), where fly ash is dumped in slurry form in the surface of the sea by the Ennore Thermal Power Station at the rate of 96,000 tonne/month. The Ennore Thermal Power Station is presently constructing ash dyke arrangements to avoid sea disposal.

2. pH of near shore surface waters of Chennai-Ennore and Cooum river mouth are in the lower side and in the range of 7.58 to 7.79.

3. DO values of surface waters at all the transects were fairly high indicating good oxygenated conditions suitable for marine life. The yearly average is ranging from 5.19 mg/lit to 6.86 mg/lit.

4. Higher BOD values (>3 mg/lit) in surface waters of different transects studied do not show corresponding lower DO values indicating that oxygen diffusion in the surface water from air is faster and oxidized at the organic load accumulated on these transects.

5. Higher total phosphorous content in bottom waters of Cooum river mouth, Cuddalore, Nagapattinam and Madapam indicates regeneration of inorganic phosphate from the organic detritous materials present in their sediment phase. The higher values of inorganic reactive phosphate is recorded as 2.01 microgram. atom/l for pulicat bottom water. However, these values are within the normal range of coastal waters.

6. Higher values of nitrogenous nutrients (<5 microgram. Atom/l) observed at various transects like Ennore, Mahabalipuram, Cuddalore and Mandapam (Ammonia-N) and Pulicat and Cooum river mouth (Nitrate-N) indicates that these transects have the effect of land based activities (viz., municipal sewage). This is again supported by the lower salinities at the seashore stations of these transects.

7. Higher values of Cadmium are seen in the coastal sediments at Ennore, Cooum River mouth and Mahabalipuram transects. The annual average range is from 1.42 microgram/g to microgram/g.

8. Higher values of Pb concentrations (>20 ppm) were found in coastal sediments of Ennore, Cooum river mouth, Mahabalipuram, Cuddalore, Nagapattinam and Mandampam during post-monsoon season. Pb concentrations were found to be higher in offshore stations compared to nearshore stations at Mahabalipuram and Ennore, particularly during summer indicating atmospheric input as the main source.

III. WETLANDS

Wetlands are transitional zones that occupy an intermediate position between dry land and open water. Wet land ecosystems is dominated by the influence of water, possess characteristics of both terrestrial and aquatic ecosystems and properties that are uniquely their own. This single term encompasses a diverse and heterogeneous assemblage of habitats ranging from rivers, floodplains, and rainfed lakes to mangrove

swamps, estuaries and salt marches. Wetlands are considered most productive among the ecosystems. Wetlands perform some useful functions in the maintenance of the overall balance of nature. These include flood control, natural sewage treatment, stabilization of shorelines against wave erosion and the recharging of aquifers. They provide habitat for wildlife and help in conservation of aquatic flora and fauna. In addition, many food chains are dependent on wetland productivity.

IV. IMPORTANT WETLANDS IN TAMILNADU

a. Kazhuveli Tank: This tank is located in Tindivanam taluk of Villupuram district. This tank lies adjacent to Bay of Bengal along East Coast Road. It lies in between 79° 45'E longitude and 79°55'E longitude and between 12°0' latitude and 12°10'N latitude. This tank spreads about 15 villages with catchment area of 4722 hectare. Kazhuveli is an old mangrove forest, which has been degraded over period of time. the entire ecosystem of this wetland is completely destroyed and denuded due to the Human inference due to establishment of salt pans and over fishing.

b. Pulicat lake: Pulicat lake is located in Thiruvallur district. It lies between 80°2'E longitude and 80°16'E longitude and between 13°24'N latitude and 13°47'N latitude. The lake spread about 12 villages with catchment area of 350 sq.km. Pulicate lake is threatened due to industrial Pollution from North Chennai Thermal Power Station, and other industries and also the domestic sewerage entering through Buckingham canal.

V. VANISHING WETLANDS

Due to their fertility, more and more wetlands are being converted into agricultural lands. Drainage of swamps and marshes and conversion of natural wetlands to paddy fields have, been practised the world over. In recent years, with the introduction of powerful dredging, draining and earthmoving machinery the conversion of wetland to farmland has become particularly profitable. The draining of wetlands not only eliminates wildlife, but also increases storm water surges and lowers water tables.

VI. ENDANGERED MANGROVE ECOSYSTEMS

Due to the prime seafront locations that mangroves occupy and also because of the value of their wood, mangroves have been indiscriminately exploited. and ruthlessly felled. A part of the Pichavaram mangroves of Tamil Nadu have been drained and certain mangrove species such as *Sonneratia* and *Xylocarpus* have been extensively felled, restricting some areas to pure coppices of *Avicennia*, severely depleting the species diversity. In addition, overexploitation of the rich mangrove fisheries and the poaching of marine turtles, estuarine crocodiles, and other fauna has had deleterious impact on biota. The increase in sewage and industrial effluent in mangrove estuaries has also led to the disappearance of many species of flora and fauna.

VII. WETLAND SPECIES ON THE DECLINE

The conservation value of several of the country's wetlands has decreased substantially on account of habitat degradation and loss of bio diversity. While pollution and wetland destruction have been major causes of faunal decline, a more direct threat is the hunting and poaching of waterfowl and other animals prevalent in many parts of the country. Yet another threat to wetland species comes from apathetic or ignorant tourists. The use of very fine fish nets in which juveniles get trapped is a major blow to sustainable fishing construction of dams and barrages has also caused a drop in fish catches by disrupting fish migration routes and thereby interfering with spawning.

6. Tourism and Eco Tourism

Tourism plays an important role in the socio-economic development of our country. It is also one of the major sources to earn foreign exchange. Tourism promotion also generates employment in urban as well as rural areas, which may arrest the large scale migration of rural mass to urban centres and in turn help avoid formation of more slums. Tamil Nadu, with its picturesque hills, beaches, waterfalls, wildlife sanctuaries, temples, ancient monuments, places of worship for all faiths and centres of art and culture has lot to offer to the domestic and international tourists. The Government of Tamil Nadu has taken steps to strengthen the existing infrastructure at the tourist destinations and to identify the areas of tourist importance and to develop them with adequate infrastructure for the benefit of tourists.

I. STRATEGY FOR TOURISM PROMOTION

The Strategy for promotion of Tourism in Tamil Nadu is as follows:

- 1) Augmenting infrastructural facilities at the existing tourist centres.
- 2) Promotion and development of places of local importance and identifying new tourism potential for development.
- 3) Evolving publicity strategy and to publicise the potential through films, newspaper, magazines, websites, Internet and online Services within and outside the Country.
- 4) Providing facilities for recreation and adventure sports at select tourist places for attracting tourists from other States and abroad.
- 5) Encouraging the Private Sector in the hotel and travel trade to provide adequate accommodation and travel facilities and also to set up amusement and theme parks.
- 6) Organising Fairs and Festivals in and outside Tamil Nadu.
- 7) To appoint marketing agents inside and outside the Country for effective promotion of Tourism.
- 8) To evolve more number of circuits covering neighbouring States.
- 9) To promote Beach Tourism by developing and maintaining beaches along the coastline.
- 10) To produce quality guides in coordination with the Anna Institute of Management, Chennai.

II. TOURISM IN TAMIL NADU

Table 6.1 The number of tourists visited Tamil Nadu during the past three years are furnished below

Table 6.1 Number of Tourist Visited Tamil Nadu

| Year | Domestic (Arrivals in lakhs) | Foreign (Arrivals in lakhs) | Total | % change |
|------|---------------------------------|--------------------------------|--------|----------|
| 1997 | 189.28 | 6.37 | 195.65 | 4.0 |
| 1998 | 204.13 | 6.36 | 210.49 | 7.6 |
| 1999 | 211.37 | 7.22 | 218.59 | 3.8 |
| 2000 | 229.82 | 7.86 | 237.68 | 8.7 |
| 2001 | 238.12 | 7.73 | 245.85 | 3.4 |

Source: Tourism Statistical Handbook, Tamil Nadu, 2001.

III. TOURIST VISITORS TO SELECT PLACES IN TAMILNADU - 2002

Table 6.2 Monument Centres

| Name of Monument Centre | No. of Tourists | % to total |
|---|-----------------|--------------|
| 1. Sri Brahadeeswarar Temple, Thanjavur | 6553500 | 90.0 |
| 2. Monument at Mamallapuram | 656536 | 9.1 |
| Total | 7210036 | 100.0 |

Source: Tourism Statistical Handbook, Tamil Nadu - 2000



Table 6.3 Fort and Other Places

| Fort and Other Places | No. of Tourists | % to total |
|---|-----------------|--------------|
| 1. Circular Fort, Vattakkottai & King Marthanda Varma Place | 884683 | 25.4 |
| 2. Padmanabapuram Palace | 571359 | 16.4 |
| 3. Thirumalai Naicker Palace, Madurai | 252661 | 7.3 |
| 4. Kattabomman Fort, Panchalankurichi | 121907 | 3.5 |
| 5. Rajagiri and Grishnagiri Fort, Gingee | 191774 | 5.5 |
| 6. Danishburg Fort, Tharangampadi (Tranquebar) | 16548 | 0.5 |
| 7. Ramalingavilasam Palace, Ramanthapuram | 6516 | 0.2 |
| 8. Rockfort, Trichy | 1436912 | 41.2 |
| Total | 3482360 | 100.0 |

Source: Tourism Statistical Handbook, Tamilnadu - 2000

Table 6.4 Museum and Art Gallery

| Museum and Art Gallery | No. of Tourists | % to total |
|---|-----------------|--------------|
| 1. Govt. Museum, Chennai | 342407 | 30.3 |
| 2. Govt. Art Gallery, Thanjavur | 140481 | 12.4 |
| 3. Govt. Museum, Vellore | 57181 | 5.1 |
| 4. Govt. Museum, Trichy | 62740 | 5.5 |
| 5. Govt. Museum, Pudukkottai | 78995 | 7.0 |
| 6. Govt. Museum, Udhamandalam | 3051 | 0.3 |
| 7. Govt. Museum, Salem | 10893 | 1.0 |
| 8. Govt. Museum, Erode | 10789 | 1.0 |
| 9. Archaeological Museum, Dharmapuri | 52970 | 4.6 |
| 10. Silappathikara Kalaikoodam, Poompuhar | 370606 | 32.7 |
| Archaeological Museum, Rameswaram | 1624 | 0.1 |
| Total | 1131737 | 100.0 |

Source: Tourism Statistical Handbook, Tamilnadu - 2000



Table 6.5 Memorials

| Memorials | No. of Tourists | % to total |
|---|-----------------|---------------|
| 1. Gandhi Memorial, Madurai | 0 | 0 |
| 2. Vivekananda Rock Memorial, Kanyakumari | 1787211 | 97.9 |
| 3. VOC Memorial Home, Ottapidaram | 19366 | 1.1 |
| 4. Bharathiyar Memorial, Ettayapuram | 18175 | 1.0 |
| Total | 1824752 | 100.00 |

Source: Tourism Statistical Handbook, Tamilnadu - 2000



IV. ECO TOURISM IN TAMIL NADU

Ecotourism may be defined as nature-based tourism that is educative and ensures the suitable use of environmental resources, while producing viable economic opportunities for the host communities. Tamil nadu's geographical diversity provides wealth of ecotourisms that potentially support ecotourism activities. These include biosphere reserves, mangroves, coral reefs, deserts, mountain and forests, flora and fauna, seas, lakes, rivers and caves. Some of the ecotourism spots (wild life sanctuaries, botanical garden and boat house) visited by the tourist for the year 1999-2000 are as follows:

Table 6.6 Wildlife Sanctuary

| Wildlife Sanctuary | No. of Tourists | % to total |
|---|-----------------|---------------|
| 1. Zoological Park, Point Calimere | 8807 | 0.5 |
| 2. Vandalur Zoo, Chennai | 1295343 | 67.2 |
| 3. Zoological Park, Karumpapatty (Salem District) | 47697 | 2.4 |
| 4. Crocodile Bank, Mamallapuram | 300815 | 15.6 |
| 5. Wild Life Sanctuary, Mudumalai | 75213 | 3.9 |
| 6. Tiger Sanctuary, Mundanthurai | 200583 | 10.4 |
| Total | 1928458 | 100.00 |

Source: Tourism Statistical Handbook, Tamilnadu - 2000



Table 6.7 Botanical Garden

| Botanical Garden | No. of Tourists | % to total |
|-------------------------------------|-----------------|---------------|
| 1. Botanical Garden, Udhagamandalam | 1631151 | 67.2 |
| 2. Sim's Park Coonoor | 342396 | 14.1 |
| 3. Bryant Park, Kodaikanal | 452581 | 18.7 |
| Total | 2426128 | 100.00 |

Source: Tourism Statistical Handbook, Tamilnadu – 2000



Table 6.8 Boat House

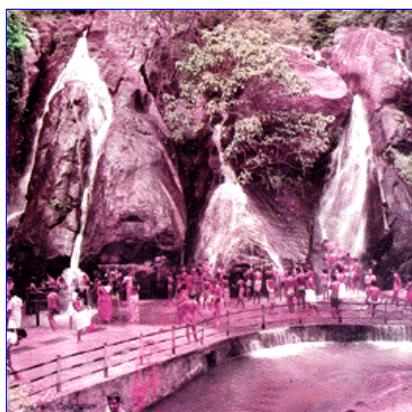
| Boat House | No. of Tourists | % to total |
|-------------------|-----------------|---------------|
| 1. Muttukadu | 240594 | 13.0 |
| 2. Pichavaram | 62257 | 3.4 |
| 3. Udhagamandalam | 1043354 | 56.6 |
| 4. Yercaud | 498061 | 27.0 |
| Total | 1844266 | 100.00 |

Source: Tourism Statistical Handbook, Tamilnadu – 2000



Table 6.9 District wise list of Tourist Spots

| District | District/Name of the Tourist Place | Historical/cultural/ Natural Heritage area | Special significance of the area |
|----------------|---|---|---|
| Chennai | Marina Beach | Natural | Beach |
| Mamallapuram | Mamallapuram Kovalam | Historical and heritage Natural | Temple and Beach Beach |
| Cuddalore | Parangipettai Pitchavaram | Historical Natural | Boat club Mangroves, estuaries |
| Nagapattinam | Poombukar Tharangampadi Nagore Veilankanni Point Calimere | Historical Historical Pilgrim centre Pilgrim centre Natural heritage area | Monuments Monuments Mosque Christian shrine Sanctuary |
| Thiruvarur | Muthupet Udayamarthanda-puram | Natural heritage area Natural heritage area | Lagoon, mangrove Bird sanctuary |
| Thoothukudi | Thiruchendur Manapadu | Historical Historical | Murugan Temple R.C.Temple |
| Kanniyakumari | Kanniyakumari | Historical, heritage and Natural | Vivekananda rock, Ghadhi memorial, Valluvar statue, beach Temple of virgin goddess |
| Ramanathapuram | Rameswaram | Heritage | Ramanathaswamy temple |



7. Industrialisation and Urbanisation

A. INDUSTRIES

The level of urbanisation in Tamil Nadu stands at 33% per the census of 1991. The State of TamilNadu ranks as the second highest urbanized state in the country. Over the decade of 1981-91, a population of 31,25,717 persons added to 1981 population in the urban sector.

Table 7. 1 Growth of urban population

| Year | Urban population (Million) | | Percentage decadal variation | | Urban-rural growth differential | |
|--------|----------------------------|-----------|------------------------------|-----------|---------------------------------|-----------|
| | India | Tamilnadu | India | Tamilnadu | India | Tamilnadu |
| 1901 | 25.85 | 2.72 | - | - | - | - |
| 1911 | 25.94 | 3.15 | 0.35 | 15.57 | 6.05 | 8.15 |
| 1921 | 28.09 | 3.42 | 8.27 | 8.86 | 9.56 | 6.34 |
| 1931 | 33.46 | 4.23 | 9.12 | 23.40 | 9.14 | 17.68 |
| 1941 | 44.15 | 5.17 | 31.97 | 22.30 | 20.16 | 12.67 |
| 1951 | 62.44 | 7.33 | 41.42 | 41.75 | 32.63 | 33.73 |
| 1961 | 78.94 | 8.99 | 26.41 | 22.59 | 5.77 | 14.20 |
| 1971 | 109.11 | 12.46 | 38.23 | 38.64 | 16.37 | 22.29 |
| 1981* | 159.73 | 15.95 | 46.39 | 27.98 | 26.71 | 15.03 |
| 1991** | 217.61 | 19.07 | 36.47 | 19.28 | 16.46 | 6.48 |

Source: 1. Census of India, 1981, Tamilnadu, General population

In Tamil Nadu there is one metropolitan city of 4.3 million population in addition to 20 Class I Cities of over one million population and 41 Class II Cities less than a million population. In general the distribution of urban population in the state is not uniform spatially. The urban population is distributed among 1 Metropolitan City, 6 Municipal Corporations, 102 Municipalities, 9 Municipal Townships and 653 town panchayats.

I. URBANISATION AND GROWTH OF SLUM

As urbanisation process marches ahead the trade industrial sectors make strides. The cities attract more people to move from the remote rural places to the developed towns or cities, which are pulsating with activities. As the general phenomenon of all metropolitan cities, the slum in Chennai were forced to spring up on all available chunks of vacant land and subsequently on the objectionable land i.e. river margins, road margins, railway margins etc. The total number of families living along the three major water ways and who have to be necessarily resettled will be 33313 as detailed below:

Table 7.2 Total slum families along major water ways

| S.No | Name of the River | No. of slum Families |
|------|-------------------|----------------------|
| 1 | Cooum River | 8266 |
| 2 | Buckingham Canal | 18423 |
| 3 | Adyar River | 6624 |
| | | 33313 |

The P.W.D in co-ordination with TNSCB has identified that 8164 families are squatting on the margin of water ways posing hinderance to the desilting operations by the P.W.D. Schemes have been formulated for rehabilitating the 8164 families who are posing hindrance to the desilting operation by P.W.D. Construction of 3000 shelter units have already been completed and proposal for construction of another 5164 shelter units is pending with the government and it will be taken up execution shortly.

II. SEWAGE POLLUTION

TNPCB has identified 25 class I and class II towns located on the bank of four major rivers causing sewage pollution. Only four of these towns, viz., Kumbakonam, Madurai, Thirunelveli and Kancheepuram have partial underground sewerage facilities. The Cauvery River receives sewage from 11 towns, Palar from six towns Vaigai from five towns and Tamirabarani from three towns. Due to the significant pollution load added from sewage discharges. Tamilnadu Water Supply and Drainage Board (TWAD) is entrusted with the task of preparing a sewerage scheme whereas local bodies will be entrusted with operation and maintenance of sewerage and treatment. This will cover a population of 16.385 lakh (1991 census). The average cost of sewerage and treatment is estimated at Rs.60 lakh per million litres per day (MLD) of sewage.

III. SOLID WASTE DISPOSAL

As per the order of Hon'ble Supreme Court of India during 1996, the TNPC Board issued directions to all the Municipal Corporations and Municipalities in the State to apply for the consent of TNPCB with time-bound proposals of action plan for collection, transportation, treatment and disposal of sewage and Municipal solid wastes. Among the local bodies, only one Municipal Corporation and one Municipality have applied for consent of TNPCB and that too without much details of action plan. All the local bodies represent about their financial incapability to implement schemes for sewage and solid wastes. Similar to the sewage problem, the solid wastes arising from the major cities and towns are also not properly disposed. After recovery of materials by the road pickers, the wastes are mostly collected through municipal lorries and are dumped in the low-lying areas. The status of solid wastes generated in major cities in Tamilnadu is tabled below.

Table 7.3 solid waste generated in major cities in Tamilnadu

| Cities | T/Day |
|------------------|-------|
| 1 Chennai | 3500 |
| 2 Madurai | 711 |
| 3 Coimbatore | 710 |
| 4 Tiruchirapalli | 408 |
| 5 Salem | 330 |
| 6 Thirunelveli | 210 |

Source :Report on Status of Environment in Tamilnadu, TNPCB

B. ENERGY SCENARIO

CONVENTIONAL AND NON-CONVENTIONAL ENERGY SOURCES

The energy sector plays a pivotal role in the overall development of the economy. Soon after independence, the country shifted to "uncontrolled monopoly" with the passing of electricity supply act, with the creation of state electricity boards and the industrial policy resolution, (1956) reserving generation, transmission and distribution of electricity for the state sector. This led to a state monopoly of power transmission, generation and distribution. With the opening of power generation to private sector by amending electricity act, in 1991, India entered a regime of controlled monopoly. Now the electricity industry has entered an era of regulated competition with the enactment of the electricity regulatory commission act 1988 and gives a meaningful role to the private sector and the market to play its part in the nation's infrastructure building.

In Tamil Nadu the electricity is used for all purposes viz, domestic consumption, lighting, cooking and eating and non domestic-commerce, industry, street lighting, transport and communication, utilities and services etc. The table 7.4 shows the performance of the Power Sector in Tamil Nadu during the year 1998-1999.

Table 7.4 Performance of the Power Sector during the year 1998-1999

| | | | |
|--|----------|----------|-------------|
| 1. Installed Capacity at the Disposal of the Board as on 30.03.99 (MW) | | | |
| TNEB | | | |
| a) Thermal | 2970.00 | | |
| b) Gas | 130.00 | | |
| c) Hydro | 1963.25 | | |
| d) Wind | 19.355 | | |
| Sub-total | | 5082.605 | |
| e) Share from Central Stations | 1841.000 | 1841.000 | |
| f) Independent Power Project | 196.000 | 196.000 | |
| Total | | 7119.605 | |
| 2. Energy Generated (Hydro+Thermal+Windmill+Gas) (MU) | | 22131 | |
| 3. Energy Purchased & Imported from other States (MU) | 13031 | | |
| 4. Gross Energy Consumed (2+3) (MU) | | 35172 | |
| 5. Energy Exported to other States & Kadamparai Pumping (MU) | | | 60.000 |
| 6. Net Energy Consumed (4-5) (MU) | | 35112 | |
| 7. Per Capita Consumption (KWH) | | | 113.907 |
| 8. Length of Lines (KM)* | | 452.000 | |
| a) EHT and HT Lines | | | |
| b) L.T Lines | | 130533 | |
| Total Lines | | 409100 | |
| 9. Electrification of Towns, Villages, Hamlets, etc. (Nos). | | Existing | Electrified |
| a) Towns | | 439 | 439 |
| b) Villages | | **15831 | 15822 |
| c) Hamlets | | \$47485 | 47830 |
| Total (a+b+c) | | 64115 | 64091 |
| d) Adidravidar Colonies | | | 26764 |
| e) Agricultural Pumpsets | | | @ 1643149 |
| f) Huts | | | 1479715 |
| 10. Consumers Served (Lakh Nos). | | | 124.03 |
| 11. Total outlay on Power (Rs.in Crores) | | | 1092.14 |
| 12. Revenue including Subsidy (Rs. in Crores) | | | 5578.10 |
| 13. Block Capital (Rs. in Crores) | | | 12318.59 |

Source: Statistics at a Glance, 1998-199, TNEB

The table above shows that more than half of the power energy are purchased and imported from other States to the consumers of Tamil Nadu.

I. THERMAL POWER GENERATION

The State Electricity Board, generally produces power from different source viz, Hydro, Thermal, Windmill and Gas. **The total energy generated is in the order of 22141 MW from all the sources.** The generation of Thermal Power is 17076 MU during the year 1998-1999. There are four major thermal power stations installed in Tamil Nadu, which are Ennore, Tuticorin, Mettur and North Chennai.

II. HYDRO POWER GENERATION

Next to the thermal power generation, the State's alternate major power generators are hydro power stations. There are two category of hydro power stations viz, hydro-non irrigation and hydro-irrigation. Kadamparai powerhouse, the Mettur tunnel and Kundah powerhouse are some of the major hydro power stations. The total generation is only one fourth of the thermal power generation of the state. The other sources of power generations through gas turbine and windmills are negligible.

III. NATURAL GAS

The Gas turbines at Narimanam and Basin Bridge have added 124 MU of power during the year 1998-1999 making natural gas also an important source of electrical energy.

IV. POWER CONSUMPTION

During the year 1998-1999, the net energy consumed is reported as 35112 MU. The category of consumption of electricity is tabled below.

Table 7.5 - Pattern of Electricity Consumption 1990-1999

| Category | Power Consumption Share (percentage to total) | | | | | | | | |
|-----------------|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 | 1995-96 | 1996-97 | 1997-98 | 1998-99 |
| 1. Domestic | 16.21 | 16.21 | 15.93 | 15.62 | 14.19 | 16.86 | 16.20 | 15.47 | 18.95 |
| 2. Commercial | 6.73 | 6.24 | 5.38 | 5.21 | 4.69 | 6.62 | 6.88 | 9.15 | 5.64 |
| 3. Agricultural | 24.48 | 25.91 | 26.97 | 27.78 | 32.78 | 26.93 | 26.78 | 27.00 | 27.12 |
| 4. Industry | 42.09 | 40.72 | 40.34 | 40.20 | 38.13 | 39.95 | 41.14 | 40.81 | 37.68 |
| 5. Others | 10.50 | 10.92 | 11.38 | 11.19 | 10.21 | 9.64 | 9.00 | 7.57 | 10.61 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source : Statistics at a Glance, 1998-1999, TNEB

The pattern of consumption shows that there is substantial increase in consumption by the domestic and industrial sectors. The increase in domestic sector is due to the electrification of all town, villages and hamlets of the State. The percapita consumption of electricity was 452 kWh during the year 1998-1999.

V. NON CONVENTIONAL SOURCE OF ENERGY

Non-conventional source of energy has good scope for supplementing significantly to the conventional energy supplies and solving on a decentralised and renewable basis the energy problem in general and those of rural areas in particular. Our achievements in the wind power generation, co-generation, solar water and air heating systems and bio-gas plants, improved challahs etc., have been remarkable. **The renewable energy sources have contributed more than 770 MW of power to the installed capacity of the State.**

VI. GASENERGY

Bio-gas is an important part of the strategy for tackling the cooking energy shortage. It is said that biogas can virtually supply all the energy needs of agriculture, from motive power for tractors, electricity to pumpsets and fertilisers in the form of sludge. Somehow its role as supplier of organic fertiliser and as

energy for engines has been overlooked. The biogas development is being undertaken as a state level programme for community and institutional setups.

VII. WIND POWER ENERGY

Tamil Nadu is the second largest state next to Gujarat in harvesting the wind potential since 1985-1986. Nearly 75 percent of the installed capacity of the country is in Tamil Nadu. **Out of 2000 MW wind potential available in the State, a quantum of 19.355 MW alone was harnessed as on March 1997, through 120 units functioning under the Government hold.** These farms on an average add nearly 23 MU of power to the State grid. Major windmill power projects are located at Mullakkadu, Kayathar, Muppanthat etc. This apart, there are as many as 2407 wind mill units with 656.8 MW installed capacity functioning in the State under private sector since 1997.

In wind power sector, India, ranks fourth in the world, has earned international recognition as 'Wind Super Power' with a total wind power capacity of 992 MW installed by the end of 1998. **Tamil Nadu stood next to Gujarat in harvesting the wind potential since 1985-1986. In the State a) Aralvoimozhi pass, b) Shenkotta pass, c) Palaghat pass and d) Rameswaram Coastal area are the places identified for wind farm establishments.**



VIII. SOLAR POWER TECHNOLOGY

Tamil Nadu has enormous potential for exploitation of solar energy. There has been a steady increase in the demand in installing solar water heating systems. During the Eighth plan 570 solar water heating systems were installed. Due to stoppage of subsidy by GOI to solar water heating systems, the scheme is continued only with the state funds for installation of systems in Government hospitals and hostels. By March 1997, Tamil Nadu had 2152 SWH domestic systems, 295 SWH bigger system, 398 solar cookers, one solar timber kiln, 2759 solar lanterns, 1006 solar street lights, 100 SPV pumps and 52 SPV televisions.



IX. OUTLOOK OF TAMIL NADU ELECTRICITY

The Government of India in a consultation with TNEB, has forecast the growth of demand in Tamil Nadu upto the year 2001-2002. A statement on the forecast and demand of power and the energy consumption of power (MW) is detailed in the table below.

Table 7.6 Forecast and demand (MW)

| No. | Particulars | 1998-1999 | 1999-2000 | 2000-2001 | 2001-2002 |
|-----|------------------------------|-----------|-----------|-----------|-----------|
| 1. | Requirement | 6056 | 6661 | 7327 | 8020 |
| 2. | Availability | 4997 | 5934 | 6850 | 8228 |
| 3. | Shortfall (-)/ Excess (+) | -1059 | -727 | -977 | +208 |

Table 7.7 Forecast on energy consumption (MW)

| No. | Particulars | 1998-1999 | 1999-2000 | 2000-2001 | 2001-2002 |
|-----|------------------------------|-----------|-----------|-----------|-----------|
| 1. | Requirement | 41282 | 45247 | 49593 | 54423 |
| 2. | Availability | 33295 | 40253 | 44902 | 56829 |
| 3. | Shortfall (-)/ Excess (+) | -7987 | -4794 | -4961 | +2406 |

Source : Five year plan of Tamilnadu Government

X. ENERGY POLICY AND PLANNING

During the Eighth Plan, following nine pronged strategies for power development in the State :

- (1) Completing the major ongoing schemes in hydel/thermal/gas based power project expeditiously
- (2) Execution of schemes, which will give benefits during the ninth plan period.
- (3) Improving the plant load factor of existing thermal/hydro stations by carrying out betterment
- (4) Reducing the line losses from 18.5% to 18.1%
- (5) To set up gas based shore station power plant by using gas available in the Cauvery basin
- (6) To utilise lignite potential of the state to its own advantage
- (7) Conservation of energy
- (8) To encourage private sector in power generation
- (9) To install 100 MW capacity wind mills in private and state sector. Eighth Plan drew the programmes to credit sector schemes to reach 7637.25 MW of installed capacity.
- (10) The forecast of energy consumption by 1996-1997 was 23900 MU and with 18.1% of line loss, the energy requirement was estimated at 29182 MU. Third Plan outlay was fixed at Rs.3,000 crores.
- (11) In physical terms Eighth Plan performance could reach 756.32 MW of additional general capacity and get 132.50 MW additional share from central sector. The gas turbine project at PP nathe and windmill farms were earmarked from private sector. The actual slippage, in fact, is only 15.5 MW generating capacity. Windmill capacity of 626.215 MW had been added through private sector. The physical targets and achievements during VIII plan period for installing additional capacity are given in the following Tables:

Table 7.8 Eighth plan target and achievement (Figure. in MW)

| No. | Schemes | Target | Achievement |
|-----|---|---------|----------------------------|
| 1. | North Madras Thermal Power Stage I | 630 | 630 (10/94,3/95 & 2/96) |
| 2. | Basin Bridge Gas Turbine | | 120 (2/96 & 3/96) |
| 3. | Micro Hydel Projects (Punachi 2 MW & Maravakandi 0.75 MW) | 2.75 | 2.75 (10/92 to 12/92) |
| 4. | Sathanur HES | 7.50 | Slipped to LX Plan |
| 5. | Lower Bhavani R.B. Canal HES | 8.00 | Slipped to LX Plan |
| 6. | Gas Turbine Project in Pillai Perumal Nallur | 300.00 | - |
| 7. | Wind mill farms | 100.00 | 3.57 |
| | Total | 1168.25 | 756.32 |

Source : Eight five year plan of Tamilnadu Government.

Table 7.9 - Physical Targets and Achievement

| No. | Schemes | Target for VIII Plan | Achievement in VIII Plan |
|-----|-----------------------|----------------------|--------------------------|
| 1. | Generation (MW) | 1168.25 | 757.75 |
| 2. | Pumpsets (Nos). | 200000 | 204754 |
| 3. | Huts (Nos). | 200000 | 381201 |
| 4. | HT Substations (Nos). | 108 | 190 |
| 5. | EHT lines (CKT Kms) | 2169 | 205.3 |

Source : Eight five year plan of Tamilnadu Government.

It may be concluded that the following objectives envisaged in the VIII Plan have been achieved; (a) Maximisation of utilisation of thermal capacity, (b) Completion of almost all on-going schemes, (c) Establishment of coal based thermal stations and (d) reduction of line loss to 17.0%.

XI. NON CONVENTIONAL ENERGY SOURCES

Non-conventional sources of energy has good scope for supplementing significantly to conventional energy supplies and solving on a decentralised and renewable basis the energy problem in general and those of rural areas in particular. The exploitation of non-conventional energy sources has assumed greater significance in recent years in the context of dwindling resources of conventional fuels and our ever increasing energy needs. In order to meet the objectives set in the last plan period an outlay of 20.00 crores was provided but the performance is 44.18% of the outlay. The eighth five-years plan outlay and the financial achievements are shown in table below.

Table 7.10 Eighth plan financial performance

| No. | Year | VIII plan outlay 1992-1997 | Total VII Plan Performance | Performance to total outlay (%) |
|-----|--|-------------------------------|-------------------------------|------------------------------------|
| 1. | Solar Thermal Wind Energy | 700.00 455.00 | 516.22 | 44.69 |
| 2. | Biomass | 55.00 | 25.71 | 45.83 |
| 3. | Energy conservation and Alternative source of Energy | 290.00 | 150.00 | 51.72 |
| 4. | IREP | 500.00 | 192.20 | 38.44 |
| | Total | 2000.00 | 884.13 | 180.68 |

Source : Eight five year plan of Tamilnadu Government.

C. HAZARDOUS WASTE MANAGEMENT

The economy of any country mainly depends on Industry and Agriculture. The industrial map of Tamil Nadu is dotted with many large-scale industries and industrial estates in addition to down-stream industries. **Being one of the most industrialized States in the Country, the growth of factories and the number of persons employed in the industrial sector is marked and Tamil Nadu is ranked as second by the All India annual survey of industries conducted in 1993-1994.**

I. INDUSTRIAL GROWTH

Industrial production in the State had exhibited an up trend during 1996-97. The overall industrial production measured by index numbers and has recorded a growth of 5.5% in 1996-97. The growth performance of industrial sector in the State during 1996-97 is given in the following table.

Table 7.11 Index numbers of industrial production – Tamil Nadu

| Group | Weight | 1995-96 | | 1996-97 | |
|---------------|--------|---------|--------|---------|--------|
| | | Index | Growth | Index | Growth |
| Mining | 1.67 | 242.6 | 11.6 | 250.9 | 3.4 |
| Manufacturing | 90.43 | 197.2 | 2.5 | 208.4 | 5.7 |
| Electricity | 7.90 | 232.5 | 5.4 | 241.4 | 3.8 |
| Total | 100.00 | 200.8 | 3.0 | 211.8 | 5.5 |

Source: Directorate of Economics and Statistics, Chennai-6.

II. PERFORMANCE OF SELECTED INDUSTRIAL PRODUCTS

An analysis of the performance of the specific industry groups according to use based classification has revealed that the production in respect of 14 products out of 20 products has recorded a positive growth rate in 1996-97 over the previous year. The table below gives the performance of select industrial products in 1996-97.

Table 7.12 Performance of select industrial products- 1996-97

| Items Recording positive growth | Weight in the index | Unit | Actual Production | |
|-------------------------------------|---------------------|---------------|-------------------|---------|
| | | | 1995-96 | 1996-97 |
| 1 Lignite 1.256 | '000 tones | 17316 | 18080 | |
| 2 Tea (all grades) | 2.204 | '000 tones | 144 | 158 |
| 3 Cotton yarn | 8.986 | '000 tones | 236 | 241 |
| 4 Giant tyres | 3.055 | '000 Nos. | 518 | 641 |
| 5 Superior kerosene | 1.816 | '000 tones | 306 | 418 |
| 6 High Speed diesel oil | 3.224 | '000 tones | 1859 | 2389 |
| 7 Furnace oil | 2.900 | '000 tones | 1009 | 1223 |
| 8 Aviation turbine fuel | 1.024 | '000 tones | 280 | 293 |
| 9 Asphalt/ Bitumen | 1.125 | '000 tones | 239 | 266 |
| 10 Naphtha | 1.150 | '000 tones | 669 | 759 |
| 11 Bars and rods | 1.533 | '000 tones | 130 | 147 |
| 12 Boilers and fittings | 4.886 | '000 tones | 90 | 121 |
| 13 Motor vehicle chassis | 7.839 | Nos. | 31867 | 38742 |
| 14 Electricity generated | 7.902 | Million Units | 35389 | 36887 |
| II Recording negative growth | | | | |
| 15 Sugar (refined) | 3.028 | '000 tones | 1468 | 1227 |
| 16 Cotton woven piece goods | 3.684 | Million Units | 95 | 88 |
| 17 Banians 1.046 | Lakh Nos. | 176 | 159 | |
| 18 Soft leather (tanned) | 2.439 | '000 pieces | 47 | 1 |
| 19 Mixed fertilizer | 2.445 | '000 tones | 1157 | 859 |
| 20 Cement 1.877 | '000 tones | 5722 | 5502 | |

Source: Directorate of Economic and Statistics

III. MANUFACTURING & ENGINEERING INDUSTRY

The Manufacturing industry is one of the vibrant sectors of the State economy and contributes significantly to the industrial output. The manufacturing industry broadly covers manufacture of machinery and equipment, transport parts, basic metal and alloy industries, metal products and repair of capital goods. Status of this sector during 1996 can be seen from the following table.

Table 7.13 Status of manufacturing & engineering industry

| No | Sectors | No. of Factories (No.) | Fixed investment | Industrial output (Rs. in crores) | Employment (Workers) (No.) |
|----|--|------------------------|------------------|-----------------------------------|----------------------------|
| 1 | Metal Products & parts | 708 | 177 | 783 | 17655 |
| 2 | Basic Metals & Alloys | | | | |
| | Manufacture of machinery and equipments. | 581 | 711 | 1891 | 216281 |
| | (other than transport) | 1649 | 949 | 4247 | 68521 |
| 3 | Transport Equipment and parts | 548 | 982 | 3448 | 65625 |
| 4 | Repairs of Capital Goods | 757 | 69 | 300 | 10146 |
| | | 4243 | 2888 | 10669 | 378228 |

Engineering sector contributes significantly to exports from the State. During 1995-96, out of Rs.12595 crore of exports in the country, Tamil Nadu has contributed Rs.829 crores (6.58%).

IV. AUTOMOBILE INDUSTRY

The share of Tamil Nadu in all India production of automobiles and heavy vehicles is 27% mopeds 26%, motorcycles 13% and auto components 33%. Automobile industry plays a crucial role in the State economy and has been one of the key driving factors, contributing 8% to State GDP and giving direct employment to 220,000 people.

V. LEATHER INDUSTRY

The growth of the leather industrial sector in the State of Tamil Nadu is due to the large tannery base established here over the last two centuries. **It is estimated that over 85% of leather produced in the country is produced in Tamil Nadu. Today, the annual turn over of the industrial sector including tanneries, shoe factories, garment and leather goods making units is Rs.4,500 crores, of which Rs.2,750 crores is the income from export outside the country. During 2000-2001 export of leather and leather products has reached a figure of Rs.9000 crore against foreign Rs.6952 crores during 1999-2000.**

VI. PAPER INDUSTRY

Tamil Nadu accounts for about 12% of India's production. There are 74 Paper mills in operation in Tamil Nadu. TNPL is the largest paper mill in India with an installed capacity of 600 tonnes per day. **Tamil Nadu contributes 40% to South India's production of paper.**

VII. INFORMATION TECHNOLOGY INDUSTRY

India has recently stepped into the Information Technology age. Software Industry grew by 55% in 1995-96. The growth has slightly reduced to 50% in 1996-97. **Tamil Nadu's contribution to the I.T Industry has been significant and the key elements which have made Tamil Nadu an important place in this area are: (a) Availability of skilled and educated manpower (b) High class Educational facilities and (c) Reasonably good infrastructure and lower costs of operation.** Despite these advantages, Tamil Nadu accounts for only 7% of the total revenues from Information Technology in the country. Tamil Nadu's strengths have been mainly in the area of software. The industry has ambitious plans to improve the contribution of Tamil Nadu from 7% to 20% by the end of the IX Plan period.

VIII. PETROLEUM & PETROCHEMICAL INDUSTRY

Oil and Gas exploration have been done in Tamil Nadu for several decades. Only small oil fields have been found. Pure gas fields are rare in Tamil Nadu unlike in Gujarat where small isolated gas fields have been identified by ONGC. Some of the gas fields which are unviable for exploration by ONGC, were handed over to Gujarat Mineral development Corporation for development. In Tamil Nadu, gas fields contain around 50% oil.

IX. CHEMICAL & PLASTIC INDUSTRY

The Chemical industry in India accounts for a turnover in excess of Rs.480 billion and is one of the fastest growing sectors of the economy. The sector contributes 13% of the value in addition of manufacturing industries and 8% of the total exports of the country.

X. COTTON TEXTILE INDUSTRY

Textile industry, one of the major industries in Tamil Nadu, is characterised by its capacity to provide large-scale employment and a source of foreign exchange earner. The total number of textile mills in the State rose by 11.7% from 717 in 1995-96 to 801 in 1996-97. The spinning capacity increased by 7.6% to 116.8 lakh spindles in the previous year. Yarn production at 965.8 million kgs in 1996-97 recorded a growth of 24.3% over the previous year's level of 777.0 million kgs and the production of cloth rose by

3.75% from 1.36 million square meters in 1995-96 to 141.1 million square meters in 1996-97. It is very significant to note that the textile industries in Tamil Nadu continue to be spinning oriented and that 50% of the spinning mills in the country with 36% of the installed capacity are located in the State.

XI. HANDLOOMS & POWERLOOMS

Handloom industry is the traditional industry of Tamil Nadu providing employment to about 10 lakh weavers. According to the latest handlooms census conducted in 1987-88, there were 4.72 lakh handlooms out of which 2.58 lakhs looms were in the co-operative sector. There were 1439 primary weavers co-operative societies functioning in the State as of 1996-97 with 3.45 lakh looms. The State had also established workshed type of 195 industrial weavers co-operative societies to accommodate the loomless weavers and out of which 165 are functioning at present with 12600 looms. Of these 165 societies, 10 societies are exclusively for women.

XII. SUGAR INDUSTRY

In terms of the number of sugar mills and the installed capacity there was no addition in the State during 1996-97. **The total number of mills at 34 consists of 18 mills in the public sector and 16 mills in the private sector.** The total sugar production decreased by 34.8% in 1997 from 16.13 lakh tonnes and capacity utilisation also fell steeply by 10% from the previous year level. At the national level, the State's sugar production fell down from 9.9% during 1995-96 to 8.1% during 1996-97.

XIII. FERTILISER INDUSTRY

The performance of fertilizer industry in Tamil Nadu also was hit in 1996-97. **The number of plants is remains at the same level of 14 as in the previous year.** There was a decrease in the installed capacity in 1996-97 by 6.9% over 1995-96 to 8.1% during 1996-97. The performance of fertilizer industry in the State and All India is presented below.

Table 7.14 - Performance of fertilizer industry: Tamil Nadu and All India

| Parameters | Tamil Nadu | | All India | |
|-------------------------------------|---------------|---------------|-----------|---------|
| | 1995-96 | 1996-97 | 1995-96 | 1996-97 |
| 1. Number of Plants | 14 (9.2) | 14 (8.8) | 153 | 160 |
| a. Nitrogenous | 5 | 5 | 58 | 59 |
| b. Phosphatic | 9 | 9 | 95 | 101 |
| 2. Installed Capacity (lakh tonnes) | 9.77 (8.1) | 9.10 (7.3) | 121.16 | 125.06 |
| a. Nitrogenous | 5.90 | 5.88 | 91.34 | 94.68 |
| b. Phosphatic | 3.87 | 3.22 | 29.82 | 30.38 |
| 3. Production (Lakh tonnes) | 9.80 (8.6) | 8.98 (8.1) | 113.62 | 111.51 |
| a. Nitrogenous | 6.28 | 5.67 | 87.69 | 85.92 |
| b. Phosphatic | 3.52 | 3.31 | 25.93 | 25.59 |
| 4. Capacity Utilisation (%) | 100.3 | 98.8 | 93.3 | 89.2 |
| a. Nitrogenous | 106.0 | 94.5 | 94.0 | 90.7 |
| b. Phosphatic | 91.0 | 103.0 | 90.0 | 84.2 |

Note: Figures in brackets indicate percentage share of T. N in All India.

Source: The Fertiliser Association of India

XIV. CEMENT INDUSTRY

Due to modernization and expansion of the existing cement industries in the State, two lakh tonnes of additional capacity was created in 1996-97 raising the total capacity from 5.00 million tonnes in 1995-96 to 5.20 million tonnes in 1996-97. In spite of this addition to installed capacity, the actual production declined by 4.3% to 5.50 million tonnes from 5.75 million tonnes in 1995-96. At the national level, the installed capacity rose from 95.8 million tonnes in 1995-96 to 105.3 million tonnes in 1996-97 and the cement production increased by 6.6 million tonnes. The performance of cement industry is given in the following table.

Table 7.15 - Performance of cement in Tamil Nadu and All India

| Year | Tamil Nadu | | | All India | | |
|---------|--------------------|------------|----------------------|--------------------|------------|----------------------|
| | Installed Capacity | Production | Capacity Utilisation | Installed Capacity | Production | Capacity Utilisation |
| 1992-93 | 4.97 | 4.88 | 98.19 | 61.8 | 50.7 | 82.1 |
| 1993-94 | 5.00 | 5.05 | 101.00 | 76.9 | 58.0 | 75.4 |
| 1994-95 | 5.00 | 5.50 | 110.00 | 83.8 | 62.4 | 74.5 |
| 1995-96 | 5.00 | 5.75 | 115.00 | 95.8 | 69.6 | 72.7 |
| 1996-97 | 5.20 | 5.50 | 105.77 | 105.3 | 76.2 | 72.4 |

Source: TamilNadu Cement Corporation Ltd. and Cement Manufacture's Association

XV. SMALL- SCALE INDUSTRIES (SSIS)

The promotion of small- scale industrial sector becomes inevitable due to its inherent merits such as low capital intensity, short gestation period, high employment potential, capability to induce dispersal of industrial activities and widening of the entrepreneurial base. For the promotion of small scale industries in Tamil Nadu, the state in its Industrial Policy of 1992 had initiated several policy measures such as technology development fund and introduction of the system to monitor the prompt payment of dues to SSI units by State public sector enterprises and boards and measures including capital investment subsidy, power tariff concessions, sales tax waiver deferrals, the creation of venture capital fund etc. As on 1996-97, there were totally 2,63,845 number of registered SSI units functioning in the State including 29,445 units newly registered. These units employed 25.22 lakh persons in different production functions and produced Rs.16,257 crores worth of goods and services.

XVI. TAMIL NADU INDUSTRIAL DEVELOPMENT CORPORATION (TIDCO)

As the foremost industrial promotional agency of the State, TIDCO promotes joint, associate and escort industrial projects by participating with an investment of more than Rs.5 Crores. It has also dis-invested its share in the public sector projects and provides fruitful attempts to bring more private investments in mega and medium projects like chemicals, agro-based industries, petro-chemicals, pharmaceuticals, industrial parks, etc., and also in industrial infrastructural areas ports and roads. As at the end of September 1996, 74 projects were promoted by TIDCO with the total investment of Rs.18,709.92 crores and employment potential of 26,860 persons. In all these 74 projects, TIDCO's equity share was Rs.506 crores.

XVII. ELECTRONICS CORPORATION OF TAMIL NADU (ELCOT)

ELCOT as a forerunner in the field of electronic industries in Tamil Nadu has promoted 31 projects as on 31st March 1997 with the total project cost of Rs.175.66 crores under public, joint, associate and escort sectors. Producing wide range of electronic items such as power, medical, consumer, communication equipments, etc., ELCOT is providing marketing assistance to the selected products. The Phase-I of Electronic city at Sholinganallur with 5 Electronic projects has entered into Phase II. Proposed to set up

a software technology park at Coimbatore and Chennai in the joint venture and also Hi-Tech-Diagnostic Centers at the Government Hospitals in the State for diagnostic purposes, ELCOT has successfully implemented the Voter's Photo Identity Card.

XVIII. TAMIL NADU CORPORATION FOR INDUSTRIAL INFRASTRUCTURAL DEVELOPMENT (TACID)

TACID was established with the prime objective of creating world-class industrial infrastructural facilities in the new and existing industrial growth centers and complexes in the State. Functions of TACID in a nutshell are:

- a) to identify promising areas with potential for growth and set-up industrial parks/complexes in such places with needful integrated infrastructure facilities.
- b) Taking study of inadequacy in existing industrial areas and launch into perfecting the facilities to guarantee a progressive industrial productivity.
- c) To meet the demand of industries in project and to promote business and trade that includes exports and imports.

Apart from the above establishment of industrial parks at various centers, the TACID is also taking up developmental activities to promote business as trade with the State.

XIX. TAMIL NADU NEWSPRINT PAPER LIMITED (TNPL)

TNPL was set up in 1985 to produce newsprint and writing paper using bagasse is running a paper mill at Pugalur with a capacity of producing 50,000 tonnes of newsprint and 40,000 tonnes of writing paper per year. In 1995, the plant was expanded from 90,000 tonnes per annum to 1,80,000 tonnes per annum at a cost of Rs. 585 crores. Recognising the importance of using natural renewable resources for industry, the World Bank sanctioned US\$75 million as part finance for the expansion project under the Renewable Resources Development scheme. TNPL is also involved in wind farming and has set up a windmill for generation of 15MW of power. The company has also implemented a lift irrigation scheme to exploit trade effluents of the plant to irrigate 1400 acres of dry land within the vicinity of the paper mill.

XX. TAMIL NADU CEMENTS CORPORATION (TANCEM)

The Alangulam Cement plant was set up in 1970 by TIDCO and taken over by the new company TANCEM subsequently. One more cement plant at Ariyalur in Tiruchirapalli district was set up in the year 1979. In 1981, TANCEM started an Asbestos Cement Pressure Pipe plant at Mayanur. In 1981, TANCEM, took over the stoneware pipe unit at Virudhachalam. The company has several new proposals for implementation during the IX plan period.

XXI. TAMIL NADU MINERALS LIMITED (TAMIN)

TAMIN is one among the major exporters of granite. Due to severe competition, there are plans to diversify in other profitable activities of mining. There is a good opportunity for TAMIN to diversify in to petroleum exploration both in land and offshore of Tamil Nadu.

XXII. VILLAGE AND SMALL INDUSTRIES

The main thrust of the Government is on the widespread development of village and small-scale industries. The small, tiny and cottage industries have contributed in a significant way to the development of rural and backward areas as these industries are easily dispersed throughout the State and bridge the gap between the developed and the under developed regions. This sector uses available raw materials and labour force to the maximum extent. Since it generally raises the level of income of the workers in the rural areas, it proves to be a powerful tool for improving the living standard.

XXIII. INFRASTRUCTURAL SUPPORT FOR ELECTRONIC AND ALLIED INDUSTRIES

Industrial estates have been set up in Thiruvanniyur – Perungudi in Chennai, Kakkalur, Hosur, Kappalur, Coimbatore, Salem and Thuvakudi where entrepreneurs were provided with ready built sheds and plots.

The Thiruvanniyur and Perungudi estates have emerged as growth centres for electronic industries with growth of about 190 units producing goods worth of Rs. 170 crores by which 7000 persons are provided with employment.

XXIV. POLLUTION LOAD DUE TO INDUSTRIAL ACTIVITIES

In Tamil Nadu, out of the 8,978 industries required to provide Effluent Treatment Plants (ETP), 5,391 industries have provided ETP's and the remaining units mostly in the small scale sector are in the stage of providing ETP either individually or collectively. Schemes for Common Effluent Treatment Plants (CETPs) have been evolved for the industrial sectors of tanneries (26 CETPs), textile bleaching and dyeing units (26 CETPs), hotels (1 CETP) and hospitals (1 Common Incinerator), covering 2,355 number of industries. In which 12 CETP's covering 620 tanneries, 13 CETP's covering 537 textile bleaching and dyeing units, 1 common Incinerator for 58 hospitals have been commissioned. The remaining CETP's are under various stages of implementation. TNPCB is taking legal actions against the consistently non-complying industries. So far, show cause notices have been issued to 13,056 industries and closure orders have been issued to 2,796 industries. TNPCB has filed court cases against 321 industries under the Water (Prevention and Control of Pollution) Act, 1974 as amended and out of the 213 cases disposed, 73 cases were in favour of the Board.

The pollution from industries can be managed without much impact on the environment, if they are properly located in the suitable sites. In Tamil Nadu, the Government imposed a total ban on the setting up of the specified 14 categories of highly polluting industries within 1 Km from the embankments of the specified water sources like rivers and their tributaries, tanks and reservoirs and canals have been specified. The Government imposed a total ban on setting up of the specified 14 categories of highly polluting industries within 5 Km from the important water sources of Rivers Cauvery and its tributaries, Pennaiyar, Palar, Vaigai and Thamiraparani.

There are 1961 highly polluting industries in Tamil Nadu, located within 1 Km distance of the specified water sources. As per the order of the Hon'ble Green Bench the Board issued directions for closure and stoppage of power supply to 926 industries, which have not applied for consent of the Board. Out of the 1,020 units, applied for consent, the Board has issued directions for closure and stoppage of power supply to 308 units, which have not provided Effluent Treatment Plants. Among these, tanneries and textile bleaching & dyeing units are predominant.

In Tamil Nadu, there are 939 tanneries which neither provided ETP nor joined CETPs were issued with closure orders and with further court cases, totally 187 tanneries were closed. Out of the 939 tanneries, 132 tanneries have provided individual ETPs and 35 tanneries are to provide individual ETPs. For the units in clusters, 26 CETP Schemes have been evolved for 772 tanneries for the total trade effluent quantity of 43,091 KLD, in which 12 CETP's covering 620 tanneries are in operation and the remaining CETP's at Tiruchirapalli and Vellore are in various stages of implementation. Earlier, these tanneries were discharging their trade effluent without treatment or partial treatment, which was the main reason for contamination of land in the belt of River Palar on the Vellore District.

Similarly there are 4,173 textile bleaching and dyeing industries. As per the order of the Hon'ble High Court of Madras, dated; 23.9.98, closure orders have been issued to 821 units, which have not applied for consent of the Board and which have not provided Effluent Treatment Plant. The indiscriminate discharge of trade effluent from textile bleaching and dyeing units in and around Tirupur, Erode and Karur areas have caused pollution in the river systems of Noyyal and Amaravathy. 26 CETP Schemes have been evolved for 1,442 units for the total quantity of 68,565 KLD of trade effluent, in which 13 CETPs covering 537 units are now in operation. The remaining CETPs are in various stages of implementation.

trade effluent directly into the important water sources. Out of the 404 industries identified, 280 industries have provided ETP, 80 industries have not provided ETP and have been issued with closure orders and 44 industries vacated their premises. The pollution load from these industries into the water sources are summarised in the table below.

Table 7.16 Pollution Load, Discharged Into Important Rivers From Industries

| Name of the River | Type of Industry | Number of Units | Quantity of Effluent Discharged in KLD | Pollution Load in Kg/day | | | |
|-------------------|--------------------|-----------------|--|--------------------------|------------------|-----------------|------------------|
| | | | | Before Treatment | | After Treatment | |
| | | | | BOD | TDS | BOD | TDS |
| Adyar | Pharmaceutical | 1 | 345 | 22 | 749 | 3.7 | 530 |
| Amaravathy | Textile Processing | 9 | 161 | 0 | 0 | 0 | 0 |
| Bhavani | Man Made Fibre | 1 | 32500 | 357.5 | 65 | 65 | 357.5 |
| | Textile processing | 1 | 1668 | 165 | 4337 | 43 | 1521 |
| Cauvery | Chemical | 2 | 390 | 10.5 | 0 | 0.35 | 0 |
| | Electroplating | 1 | 0 | 0 | 0 | 0 | 0 |
| | Pesticides | 1 | 0 | 0 | 0 | 0 | 0 |
| | Tannery | 12 | 682 | 377 | 1788.5 | 9.81 | 3327.2 |
| | Textile Processing | 156 | 9805.3 | 2132.11 | 28828.63 | 1105.05 | 30050.47 |
| | Thermal Power | 1 | 75000 | 0 | 0 | 75 | 43800 |
| | Sago | 1 | 40 | 0 | 0 | 0 | 0 |
| Noyyal | Textile Processing | 187 | 21463 | 2279.8 | 118149 | 616.74 | 72113.25 |
| Palar | Tannery | 2 | 171.7 | 206 | 2260 | 101 | 2160 |
| Tamiraparani | Textile Processing | 1 | 7623 | 533 | 27442 | 221 | 21801 |
| Thirumanimutharu | Sago | 10 | 362.5 | 4007.1 | 2675 | 40.14 | 2675 |
| Vaigai | Milk Chilling | 1 | 10 | 0 | 0 | 0 | 0 |
| | Textile Processing | 1 | 300 | 147 | 1050 | 51 | 900 |
| Vashista Nadhi | Sago | 12 | 1134.5 | 0 | 0 | 0 | 0 |
| Vellar | Sugar | 1 | 650 | 1053 | 748 | 82 | 621 |
| Others | Pulp and Paper | 1 | 4950 | 1930 | 11880 | 891 | 7920 |
| | Textile Processing | 2 | 570 | 178 | 4235 | 178 | 1188 |
| | Total | 404 | 157826 | 13398.01 | 236642.13 | 3482.79 | 188964.42 |

Further, TNPCB has identified 201 medium and large scale industries under the 17 categories of highly polluting industries as notified by the Government of India. TNPCB has setup a special monitoring cell in the Head Office for monitoring the highly polluting industries.

D. URBANIZATION

Air pollution has been aggravated by developments that typically occur due to industrialization, increasing traffic, rapid economic development and higher level of energy consumption. The high influx of population to urban areas, increase in consumption patterns and unplanned urban and industrial development has led to the problem of air pollution. The emissions and the ambient air quality have to be kept within the limits prescribed for so that there are no adverse effects on the environment. **The Tamil Nadu pollution control board (TNPCB) has been monitoring the quality of air under various programmes.**

I. NATIONAL AMBIENT AIR QUALITY MONITORING PROGRAMME

TNPCB has been monitoring the quality of ambient air in Chennai City since 1987 under the National Ambient Air Quality Monitoring (NAAQM) Programme. The programme has further been extended to other important cities in Tamil Nadu. Under the NAAQM Programme, Ambient Air Quality Monitoring Stations have been established in Chennai (3 Stations), Thoothukudi (3 Stations), Coimbatore (3 Stations), Madurai (3 Stations) and Salem (1 Station). Samples collected from these stations are analysed for Suspended Particulate Matter (SPM) and for the gaseous pollutants of Sulphur-di-Oxide (SO₂) and Oxides of Nitrogen (Nox). The Survey conducted during 1998-99, show the following results.

Table 7.17 Air Quality of Important Cities in Tamil Nadu

| S.No | Important Cities | SPM (mg/m ³) | | SO ₂ (mg/m ³) | | No _x (mg/m ³) | |
|------|-------------------|--------------------------|--------------|--------------------------------------|-------------|--------------------------------------|-------------|
| | Permissible Limit | Ind. 500 | Resi. 200 | Ind. 120 | Resi. 80 | Ind. 120 | Resi. 80 |
| | | Max | Min | Max | Min | Max | Min |
| 1 | Chennai | 238 | 18 | 317 | 0.05 | 94 | 01 |
| 2 | Coimbatore | 301 | 46 | 27 | 0.01 | 49 | 03 |
| 3 | Thoothukudi | 299 | 12 | 35 | 0.05 | 38 | 04 |
| 4 | Madurai | 678 | 22 | 25 | 0.28 | 118 | 03 |
| 5 | Salem | 433 | 20 | 103 | 0.26 | 28 | 0.6 |

II. CONTINUOUS AMBIENT AIR QUALITY MONITORING PROGRAMME

With a view to continuously monitor the air quality in major industrial areas. TNPCB has established Continuous Ambient Air Quality Monitoring Stations in Manali, Cuddalore, Ranipet and Thuthukudi and monitors the air quality in the industrial clusters with reference to the parameters of particulate matter, oxides of nitrogen, sulphur di oxide, ammonia, etc. These continuous monitoring enables the Board to take action for corrective measures immediately when the quality of air exceeds the provided for.

III. CHENNAI AMBIENT AIR QUALITY MONITORING PROGRAMME

TNPCB has implemented its own Ambient Air Quality Monitoring Programme during 1997 for Chennai City in 5 Stations covering 3 traffic intersections and a sensitive area at CLRI, Adyar. The result of survey shows that the atmospheric concentration of air pollutants shows a rising trend in some areas, mainly due to the increasing growth in vehicular population. The results of the monitoring programme is published in News Paper every week.

IV. VEHICLE AIR EMISSION MONITORING

With the increasing commercial and industrial activities, the transport system is also increasing especially in the cities. The major source of air pollution in cities is due to emissions from vehicles. From 1.5.92, TNPCB monitors the vehicular emissions for the Goods Transport Vehicles in Chennai. Towards this, 3 monitoring stations have been established at Guindy, Viyasarpadi and Thirumangalam in Chennai. Further during the period from 1996 to 1998, TNPCB has established vehicle Emission Monitoring stations in Udthagamandalam, Chengalpattu, Palani, Kancheepuram and Dindigul. The monitoring conducted during 1998-99 shows the following results.

MAP-3
LOCATION OF AIR QUALITY/ VEHICLE EMISSION
MONITORING STATIONS ESTABLISHED BY TNPCB

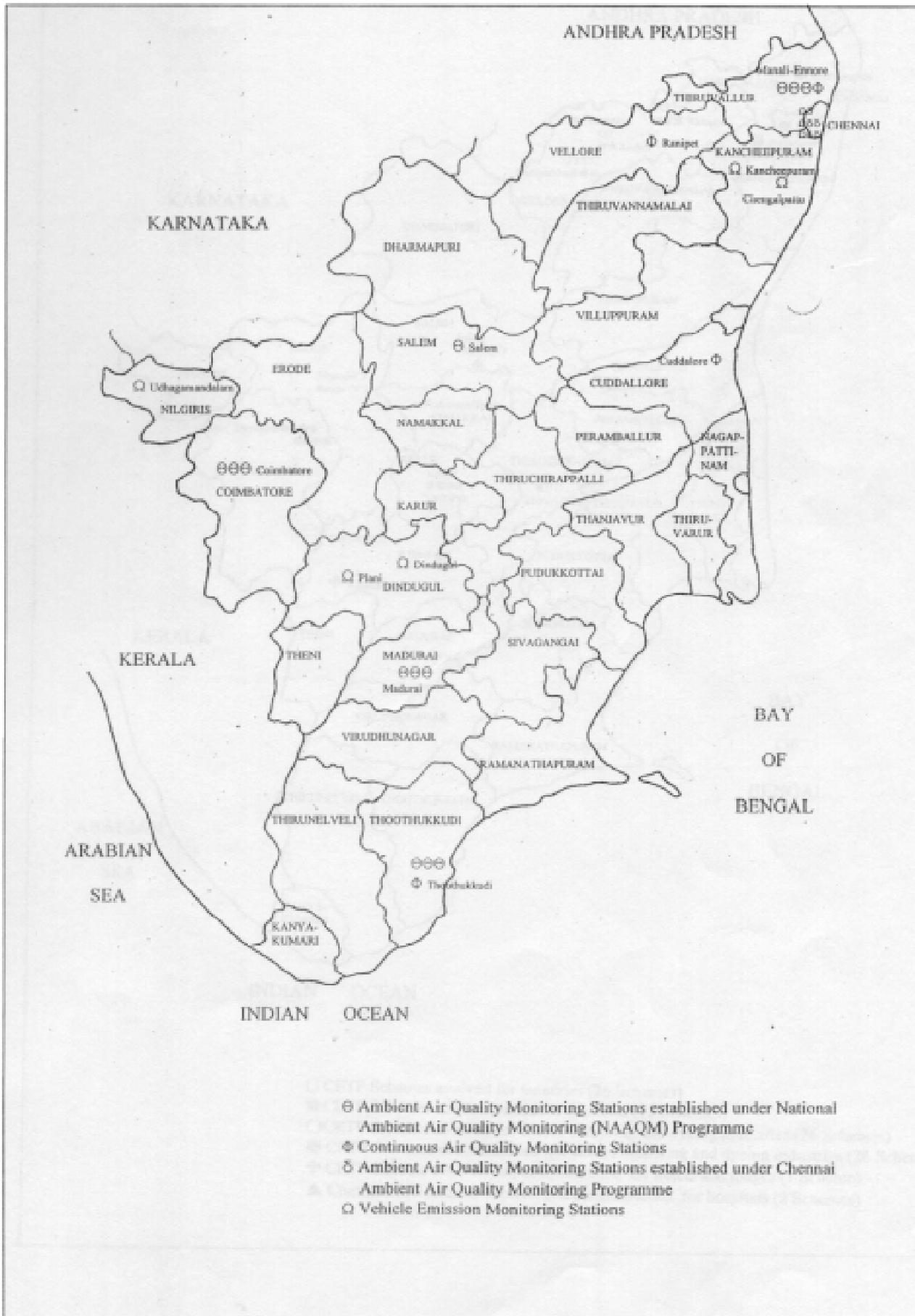


Table 7.18 Vehicle Emission Monitoring Stations

| S.No | Districts | Vehicle Tested | Diesel Driven Vehicle | Petrol driven Vehicle |
|------|----------------|----------------|-----------------------|-----------------------|
| 1 | Chennai | 22,256 | 665 | 06 |
| 2 | Udhagamandalam | 8,649 | 386 | 80 |
| 3 | Chengalpet | 4,477 | 29 | 62 |
| 4 | Palani | 2,281 | 33 | - |
| 5 | Dindigul | 4,621 | 194 | 18 |

TNPCB has the pollution load arising from the vehicular movement in Chennai and the details are as follows

Table 7.19 Pollution arising from the Vehicular movement in Chennai

| S.No | Type of Vehicle | Pollution Load in Tonnes/day |
|-------------------------------|---------------------|------------------------------|
| Petrol Driven Vehicles | | |
| 1 | Taxis and Motor Car | 16.79 |
| 2 | Two Wheelers | 778.11 |
| 3 | Auto Rickshaws | 122.87 |
| 4 | Motorised Tricycle | 4.04 |
| 5 | Cars | 463.03 |
| Sub Total | | 1384.84 |
| Diesel driven Vehicles | | |
| 1 | Jeeps and Maxi cab | 1.23 |
| 2 | Buses | 36.93 |
| 3 | Goods Vehicles | 30.91 |
| 4 | Others | 1.64 |
| Sub Total | | 70.71 |
| Total | | 1455.55(app 1456) |

Table 7.20 Type of pollutants from the vehicle in Chennai

| Type of Pollutants | Pollution load in tonnes/day |
|---------------------------------|------------------------------|
| 1. Suspended Particulate Matter | 11 |
| 2. Sulphur di oxide | 4 |
| 3. Oxides of Nitrogen | 72 |
| 4. Hydrocarbon | 383 |
| 5. Carbon Monoxide | 986 |
| Total | 1456 |

Source: Report on Status of Environmental in TamilNadu, TNPCB

V. AIR POLLUTION AND EMISSION IN MAJOR INDUSTRIES

Tamil Nadu Pollution Control Board (TNPCB) enforces the provision of the Air (Preservation and Control of Pollution) Act 1981 as amended in 1987. The main purpose of this Act is to prevent and control air pollution and preserve the air quality. All industries in TamilNadu, which let out process emissions are regularly monitored through inspection of the air pollution control measures provided by the units. Ambient air quality survey and stock emission surveys are conducted regularly to assess the quality of emission and the industries are advised necessary corrective measures

E. AIR POLLUTION

I. HAZARDOUS WASTES

The activities such as collection, transportation, storage, handling, treatment and disposal of hazardous wastes are important issues since improper handling and disposal could cause serious damages to the environment. To ensure the disposal of hazardous wastes in a scientific manner, TNPCB is effectively enforcing the Hazardous Waste (Management & Handling) Rules, 1989 framed under the Environment (Protection) Act, 1986. As per these rules, agencies handling hazardous wastes have to obtain authorisation from the Board. So far 1,100 such units/agencies have been identified, and they have applied for authorisation. Authorisations have been issued to 1,088 units/agencies. The category wise quantity of hazardous wastes generated in the State is furnished below.

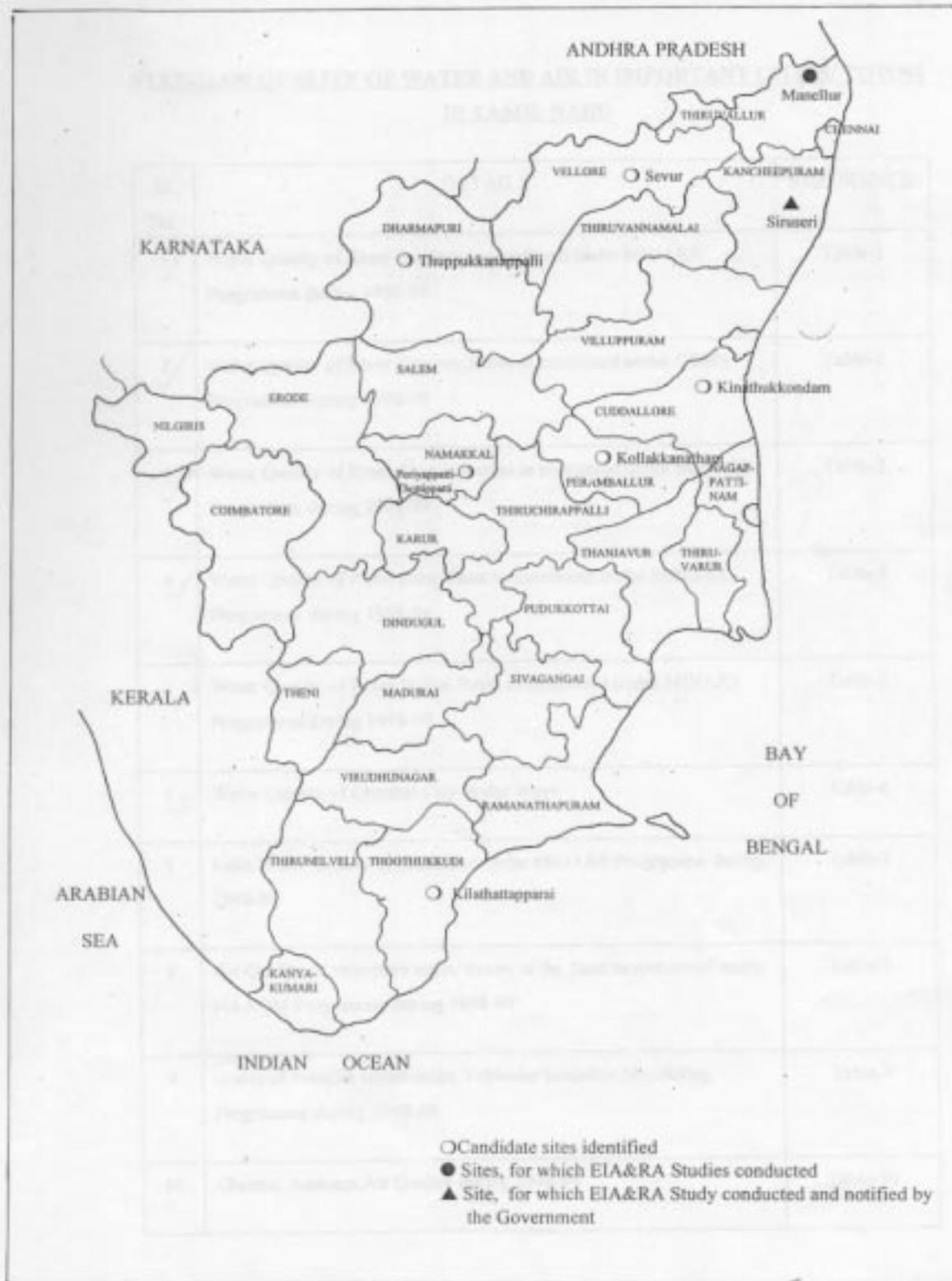
Table 7.21 category wise quantity of hazardous waste generated in Tamil Nadu

| WASTE CATEGORIES | TYPE OF WASTES | TOTAL (T/YEAR) |
|----------------------|---|----------------|
| Waste Category No.1 | Cyanide Wastes | 88.013 |
| Waste Category No.2 | Metal Finishing Wastes | 375.304 |
| Waste Category No.3 | Waste Containing water soluble chemical compounds, of lead, copper, zinc, chromium, nickel, selenium, barium and antimony | 10360.433 |
| Waste Category No.4 | Mercury, arsenic, Thallium, and Cadmium bearing wastes. | 8892.140 |
| Waste Category No.5 | Non-halogenated hydrocarbons including solvents | 205.116 |
| Waste Category No.6 | Halogenated hydro carbons including solvents | 3174.000 |
| Waste Category No.7 | Wastes from paints, pigments, glue, varnish and printing ink. | 29.224 |
| Waste Category No.8 | Wastes from Dyes and Dye intermediate containing inorganic chemical compounds | 18.000 |
| Waste Category No.9 | Wastes from Dyes and Dye intermediate containing organic chemical compounds | 0.310 |
| Waste Category No.10 | Waste Oil and Oil emulsions | 7108.366 |
| Waste Category No.11 | Tarry wastes from refining and tar residues from distillation or pyrolytic treatment | 2249.960 |

| WASTE CATEGORIES | TYPE OF WASTES | TOTAL (T/YEAR) |
|-------------------------|---|-----------------------|
| Waste Category No.12 | Sludges arising from treatment of waste waters containing heavy metals, toxic organics, oils, emulsions and spend chemicals and incineration ash. | 276965.972 |
| Waste Category No.13 | Phenols | 0.030 |
| Waste Category No.14 | Asbestos | 3339.497 |
| Waste Category No.15 | Waste from manufacturing of pesticides and herbicides and residues from pesticides and herbicides formulation units | 6.985 |
| Waste Category No.16 | Acid/alkaline/slurry wastes | 70217.560 |
| Waste Category No.17 | Off-specification and discarded products | 7516.040 |
| Waste Category No.18 | Discarded containers and container liners of hazardous and toxic wastes | 113.471 |
| | Total | 390660.421 |

Indiscriminate disposal of (solid) hazardous waste gives rise to contamination of ground, surface water and land. TNPCB enforces the provisions of Hazardous waste (Management and Handling) Rules 1989 as amended in 2000, which cover the collection, transport, treatment and disposal of hazardous waste. The amended Rules have identified 44 processes as hazardous waste generating processes and 126 waste streams as hazardous. The Rule also specifies concentration limits for substances, grouped under four categories. The Board has identified 1170 hazardous waste generating units. The Board has issued authorisation to 1158units.

MAP-5
 LOCATION OF SITES IDENTIFIED BY TNPCB TOWARDS ESTABLISHMENT OF
 COMMON TREATMENT AND DISPOSAL FACILITIES FOR HAZARDOUS WASTES



II. HOSPITAL WASTE MANAGEMENT

There are 1405 Private Hospitals and 243 Government Hospitals in Tamil Nadu. The Chairman, Tamil Nadu Pollution Control Board has been designated as prescribed authority for granting authorisation and implementation of the Bio-medical wastes (management and Handling) Rules, 1998. TNPCB is taking necessary steps for the safe environmental management of hospital wastes and is monitoring the prevailing practices and evaluating various treatment and disposal options for the safe destruction of Bio-medical wastes, considering the aspects of both environmental impact and cost. Common Incinerator Facilities have been provided in Salem for 58 hospitals and in Madurai for 78 hospitals with a capacity of 50Kg/hr each.

III. SOLID WASTE MANAGEMENT

In Tamil Nadu solid wastes generated from the major cities and towns are also not properly disposed. After recovery of materials by the road pickers the wastes are mostly collected through municipal lorries and are dumped in the low lying areas. The status of solid generated in major cities in Tamil Nadu is furnished as below.

Table 7.22 Quantity of solid waste generated in major cities in Tamil Nadu

| S.No | Cities | T/ day |
|------|----------------|--------|
| 1 | Chennai | 3500 |
| 2 | Madurai | 711 |
| 3 | Coimbatore | 710 |
| 4 | Tiruchirapalli | 408 |
| 5 | Salem | 330 |
| 6 | Thirunelveli | 210 |

The Board has directed the corporations, Municipalities and Town panchayats to comply with the provisions of the Municipal solid waste (Management and Handling) Rules 2000 and directed all the municipal corporations and municipalities in the State to apply for the consent of the Board with time bound proposals for action plan for collection, transportation, treatment and disposal of sewage and municipal solid waste. The local bodies represent that the financial constraint is the main problem in implementing sewage and solid waste management plans.

F. NATURAL DISASTER

I. CYCLONES AND DEPRESSIONS

In general, the coastal area of Tamil Nadu is prone to cyclones and depressions. Cyclone forms in low-pressure zones in the Bay of Bengal. The cyclone along the Tamil Nadu coasts is not as severe as in Andhra Pradesh. A severe cyclone causes furious wind and torrential rain in the coastal region.

There are few specific zones along the coast that are identified as cyclone affected areas. Cyclones normally occur on the east coast during the monsoons months of May to November during the southwest and northeast monsoons are active. The areas mostly affected along the Tamil Nadu coast are in between **1) Mamallapuram and Puduppattinam zone, 2) Marakkanam and Cuddalore zone, 3) Tharangambadi, Nagapattinam and Vedaranyam zone**

Considering the periodic cyclonic storms along the coast, Government of Tamil Nadu have constituted a committees for preparation of Anti-Disaster Plan for pre and post disaster action along the coast. A detailed survey has been conducted and a report prepared which spells out the areas that's are affected by the cyclonic storms, the causality of men and material during the period and also the preventive measures to be taken. The Government of Tamil Nadu has also constructed 108 cyclone shelters along the coast to

shelter the coastal village population during the cyclonic period as a preventives measures. The list of cyclonic storms that hit the coast of Tamil Nadu and details of cyclonic shelters that are constructed along the coast are given in the Table 14.5 and 14.6

Table 7.23 List of cyclonic storm that had hit the coastal stretch

| S.No | Date of Crossing | Place of Crossing | Details of damages |
|-------------|-------------------------|--------------------------|--|
| 1 | Nov' 1992 | Nagapattinam | Nearly 400 lives and thousands of cattle were lost |
| 2 | Nov' 1977 | Nagapattinam | 560 human lives were lost, several lakhs of acres of paddy fields, plantations, sugarcane, coconut topes were inundated |
| 3 | Dec' 1976 | Chennai coast | Unprecedented torrential rain lashed the city and Chengalpattu district |
| 4 | Nov' 1975 | Chennai Coast | Caused continuous heavy rains in Chennai city and neighbourhood for 3 to 4 affected City life.Many thousands of hut dwellers rendered homeless and huts damaged. |
| 5 | Dec' 1972 | Cuddalore | 23 human lives, 121 livestock were lost and about 25000 acres of cultivable land was inundated and road communications were affected |
| 6 | Dec' 1967 | Near Rameswaram | Rameswaram island was cut off due to gales and heavy rains due to the storm |
| 7 | Nov' 1966 | Chennai Coast | Two adults and a child killed. |
| 8 | May' 1966 | North of Cuddalore | Normal life was disrupted |
| 9 | Feb' 1964 | Tondi | Caused immense damage to Dhanushkodi and the death toll was 900 lives. A passenger train with all its passengers swept off. Mandapam railway bridge was washed a away and communication with the island was cut off. |
| 10 | Oct' 1963 | Cuddalore | Dislocated telecommunication, rail and traffic |

8. Institutional Mechanism for Environmental Management

I DEPARTMENT OF ENVIRONMENT (DOE)

The DoE was created in G.O.Ms.No.335, Environment and Forests Department dated 13.10.95 as the nodal Department for dealing with Environmental Management of the State. It has a mandate to promote environmental in the state. It is undertaken Policy formulation, Environmental Improvement and Monitoring schemes environmental ancilication and generation of environmental awareness through education and training. The Department is entrusted with the implementation of major projects like pollution abatement in Cauvery System, Pollution abatement in Chennai City waterways, National Lake Conservation Programme and all aspects of Environment other than those dealt with by Tamil Nadu Pollution Control Board. Besides implementing major pollution abatement programmed in Tamil Nadu, the Department is also undertaking Eco-restoration programme for the urban lakes viz., Ooty and Kodaikanal and co-ordinates with other Government departments coastal zone management of the state. The Directorate started functioning at Chennai from 22.3.1996.

II. OBJECTIVES OF DOE

- To ensure that economic growth of the State occurs with sustainable use of natural resources and enhances the quality of environment
- To co-ordinate with the implementing sectors for bringing about of environmental consideration in the programmes for economic development,
- To provide for improvement in environment services in the urban and rural areas to ensure better environmental standards for the human population,
- To develop streamlined programme for environmental awareness through education and training

III. ACTIVITIES OF DOE

In meeting the above objectives, the DoE is performing several key functions relating to environmental issues in the State, which include project implementation, programme co-ordination, appraisal and monitoring and policy formulation. For performing these tasks seven divisions have been create in Directorate of Environment they are 1. Land Use, 2. Solid Waste Management, 3. Water Resources Management, 4. Coastal zone Environmental Management, 5. Impact Assessment, 6. Environmental Audit 7.Environmental Education and Awareness.

To achieve these goals the various functions that department is performing apart from Co-ordination of NRCP and NLCP are as under:

1. Director of Environment is the Member Secretary **of State Coastal Zone Management Authority** and department is fully responsible for implementing Coastal Regulation Zone Notification 1991, Which is extremely important to project the fragile eco-system of Coastal areas especially in case of Tamil Nadu which has a long Coast line.

2. Preparation of **Environmental Status Report** taking all those aspects into consideration which have an impact on environment. This will help in formulating better environmental management plans for the state

3. Preparation of **District Environment Profile** to establish a bench mark environmental information system and serves as an integrated data bank and to serve as a resource base for identification of critical areas at district level that need priority attention

4. Spreading environmental awareness through the school students in whole society and with this objective 1200 Eco-Clubs have been formed in all the districts of states

5. Apart from that Directorate of Environment has also been identified as the Nodal Agency for National Green Corps a Government of India Programme and the project is under implementation at full swing.

Directorate of Environment is the Nodal Agency for taken up “Combating Desertification”

IV. RIVER CONSERVATION PROGRAMME

A. POLLUTION ABATEMENT IN RIVER CAUVERY

GoI has approved a programme for pollution abatement in river Cauvery in Tamil Nadu along the most polluted stretches of Erode, Bahvani, Komarapalayam, Pallipalayam and Trichy at a cost of Rs. 3820 lakhs under NRCP in 1996. This is a 10-year project and will be completed by 2005.

The programme has been divided into two major schemes viz (a) Core Schemes (b) Non core schemes. The core schemes works include interception, diversion of sewage and establishment of Sewage Treatment Plants. The non-core schemes works include low cost sanitation, River Front Development, Dhobi Ghats and Wood based crematoria etc., The DoE is the Nodal Agency for implementation of this project and facilitate co-ordination among various user agencies and Government.

The department is also co-ordinating the river cleaning programme and provision of under ground sewerage for abatement of pollution in Tiruchy, Madurai, Tirunelveli, Karur, Thanjavur, Kumbakonam and Mayiladuthurai at an estimated cost of Rs.575.00 crores. Besides pollution abatement in coastal towns of Tiruchendur and Rameswaram is being taken up at a cost of Rs.18.00 crores. These works are being executed through various agencies such as CMWSSB, TWAD Board, PWD and the local bodies.

B. CHENNAI CITY RIVER CONSERVATION PROJECT (CCRCP)

The department is also co-ordinating the massive CCRCP implementation at a total cost of Rs. 1700 crores, of which Rs. 491.52 crores would be Government of India grant. It envisages interception of 422 sewage outfalls in the six waterways in Chennai City. These works are executed through Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB).

V. WATER QUALITY MONITORING

As the success of the pollution abatement programmes is measurable only in terms of improvement of water quality in the post project period, a water quality monitoring programme for monitoring surface water, sediment and Drain has been approved at a cost of Rs. 34.83 lakhs and entrusted to the Environmental Sciences Department, Bishop Heber College, Tiruchy for Research at Post Graduate level

VI. PUBLIC INTERFACE

• Environmental Awards

Environmental Awards for the exemplary works done in Environmental Management, Environmental Education and Environmental protection are given to selected NGOs and Researchers on World Environment Day every year. This is to motivate such organizations/ individuals to excel in the area of environmental conservation.

* **One public Grievance Cell** has been formed at the Directorate of Environment, headed by Deputy Director (EIA) which will take care of public concerns and petitions regarding environmental issues.

* Department of Environment is launching a new **interactive website** on environmental issues, which will take the department closer to the people by putting environmental statistics, CRZ Notification, maps etc that can be accessed from any part of the state and will be of immense use to environmental researchers.

* **News Letter** and Environmental Publications: The DoE has been publishing quarterly News Letter with all the latest information and happenings in the field of environment. It has also published 37 environment related publications. Apart from that DoE has brought out a compendium, which gives district wise details of 262 NGO's that are working in the field of environment in Tamil Nadu.

VII. ENVIRONMENTAL AWARENESS

Environmental awareness is one of the primary objectives of the DoE. The awareness programmes are directed towards specific target groups like school students. In this direction, the formation of Eco-clubs started with 3 riverine districts of Erode, Trichy and Namakkal in 1998. Subsequently Eco-clubs were formed in all the district of state of Tamil Nadu by the end of 2001-2002. **At present, 1260 Eco-clubs are functioning all over the state carrying the message of environmental awareness along the length and breadth of the state.** Directorate of Environment has been identified as the Nodal Agency for National Green Corps, a Government of India sponsored programme to propagate environmental awareness by this year. About 2900 school eco-clubs have been formed at 100 per district. The project is under implementation and receiving overwhelming response from all corners of State.

VII. COMMITTEE ON IMPACT ASSESSMENT AND BIO MEDICAL WASTE

In tune with Government of India notification on Environmental Impact Assessment, an Expert Committee headed by former Secretary to Government of India Thiru N.R. Krishnan, I.A.S. (Retd.), and DoE as Member Secretary has been constituted with the main thrust on Environmental Impact Assessment, carrying capacity etc., Certain Major Power projects etc., are subject to scrutiny by this committee before recommending the same to the State Government for according Environmental Clearance. Objections if any raised by the public will be given due regard by conducting public hearing on New Projects. An Advisory Committee on Bio-medical Waste (Management & Handling) Rules 1998 is functioning with the Secretary to Government, Health and Family Welfare Department as the Chairman and Director of Environment as the Member Secretary to oversee the implementation of the provisions of the Rules.

VIII. ENVIS EMCPTA PROJECT

The Environmental information system is a world bank assisted project of the Ministry of Environment and Forests of Government of India (GOI) to facilitate generation and dissemination of information on various facets of Environment. The ENVIS-NODE located at the DoE is function form 29th June 2002. The node at Chennai will collect and disseminate environmental information of Tamil Nadu.

Objective of the ENVIS Node

1. Creation of web based database on the state of Environment of Tamil Nadu with local language interface
2. Acting as a clearing house to answer environmental queries
3. To establish linkages with environmentalists, researchers, NGO's students and public at large.

ENVIS Node of the Department of Environment will also work on preparing Environmental Status Report of T.N and creating a database on River Cleaning projects and Biodiversity of Tamil Nadu. In the Tenth Five Year Plan Rs.113.05 crores have been approved by the Planning Commission as State Government component apart from Rs.1053 crores proposal for Central Government component to carry out different environmental activities through the DoE

VIII ENVIRONMENTAL MANAGEMENT AGENCY OF TAMIL NADU (EMAT)

EMAT will assist the DoE for effective implementation and closer monitoring of River Cleaning Programme under National River Conservation project (NRCP) and National Lake Conservation projects. The functioning of EMAT is as follows:

i. Functions of EMAT

1. Implementation of River cleaning programmes under NRCP
2. Liaison with National River Conservation Directorate, MoEF and get funds from Government of India for the projects distribute the same among various user agencies.
3. Getting the progress reports from different user agencies for NRCP, consolidating and submitting the same to GoI.
4. Receiving the proposals from user agencies for NRCP scrutinising them both from user technical and financial point of view and submitting them to Government of India.
5. Co-ordination with Tamil Nadu Water Supply and Drainage Board, Chennai Metropolitan Water Supply and Sewerage Board, Tamil Nadu Slum Clearance Board, Public Works Department, Chennai Metropolitan Development Authority, Municipalities, Corporation of and NGO's in smooth implementing of ongoing schemes.
6. Implementation of new Lake Conservation Programme under National Lake Conservation Project.
7. Co-ordination among various user agencies, Government of India and State Government for smooth functioning and effective monitoring of NLCP in Tamil Nadu.
8. Coastal Zone Conservation
9. Implementation of Environmental Awareness Programmes with the help of NGO's for NRCP, CCRCP and NLCP projects.
10. Being an autonomous agency it will facilitate more effective net working with Government and NGO's and also attract more funds from Government of India for better implementation of project.

II TAMILNADU POLLUTION CONTROL BOARD

TamilNadu Pollution Control Board (TNPCB), established in 1982, enforces environmental legislated in the state it functions with Head Office at Chennai, and two District Offices headed by Assistant Environmental Engineers. To assist in the Analytical and Scientific side, the Board has established three Advanced Environmental Laboratories, six District Environmental Laboratories and three Mobile Environmental Laboratories.

TNPCB is implementing the Pollution Control Legislations and Rules and Notifications framed there in. In discharging the duties entrusted to it, the Board investigates collects and disseminates data relating to water, air and land pollution, lays down standards for sewage/trade effluent and emissions.

Tamil Nadu Pollution Board has classified the industries as per their pollution load for effective monitoring as follows:

Table 8.1 classification of industries as per pollution load

| Classification | Category | Periodicity of Monitoring |
|---------------------------|--------------------------|---|
| RED (Highly Polluting) | Large Medium Small | Once in a month Once in two months Once in 3-4 months |
| ORANGE (Medium Polluting) | Large Medium Small | Once in two months Once in three months Once in 4 -6 months |
| GREEN (Less Polluting) | Large Medium Small | Once in three months Once in six months Once in a year |

II. ACTIVITIES OF TNPCB

TNPCB issues consent to new industries in two stages, i.e., consent to establish depending upon suitability of the site before the industry takes up the construction and consent to operate, after installation of pollution control measures to satisfy the standards. TNPCB is taking effective steps for safe disposal of hazardous wastes and has completed the inventory of hazardous waste generating units and also identified sites for disposal of hazardous wastes. TNPCB is creating environmental awareness in the State.

Table 8.2 Various functions of the Board

| Sl.No. | VARIOUS BRANCHES OF THE BOARD | Activities of TNPCB |
|--------|-------------------------------|---|
| 1. | Head Office at Chennai | Overall Control of all Board Offices and Laboratories Technical/Consent Wing Complaint Cell Legal Wing Hazardous Waste Management Cell Emergency Response Centre CETP section Planning and Develop. Section Monitoring of highly Polluting Industries Environment Awareness Cell Environmental Training Institute Ozone Monitoring Cell NGO Cell |

Table 8.3 Activities of Tamil Nadu Pollution Control Board

| Sl.No. | ACTIVITIES |
|--------|---|
| 1. | Issue of Consent to establish a) Under Water Act b) Under Air Act Issue of Consent to operate a) Under Water Act b) Under Air Act |
| 2. | Legal Actions a) Show cause Notices b) Closure orders c) Cases filed under Water Act d) Cases filed under Air Act |
| 3. | Common Effluent Treatment Plants A. CETPS formed for a. Tanneries b. Textile Dyeing c. Hotels d. Hospitals |
| 5. | Vehicle Emission Monitoring a) No. of Stations b) No. of Tests done |
| 6. | Ambient Air Quality Monitoring a. Chennai b. Coimbatore c. Tuticorin d. Madurai e. Salem |
| 7. | River Monitoring a) Chennai city water ways b) Cauvery c) Tamiraparani d) Palar e) Vaigai |

III. Legislation of Government of India on Environmental Protection

Government of India enacted the following legislations towards protection of environment.

1. The Water (Prevention and Control of Pollution) Act 1974, as amended in 1978 and 1988.
2. The Water (Prevention and Control of Pollution) Cess Act 1977, as amended in 1991.
3. The Air (Prevention and Control of Pollution) Act 1981, as amended in 1987.
4. The Environment (Protection) Act 1986.
 - a. Hazardous Wastes (Management and Handling) Rules, 1989.
 - b. Manufacture, Storage and import of Hazardous Chemical Rules, 1989.
 - c. Coastal Regulation Zone Notification, 1991.
 - d. The Environmental Impact Assessment Notification 1994, as amended in 1997.
 - e. The Bio Medical Waste (Management and Handling) Rules, 1998.
 - f. The Recycled Plastics, Manufacture And Usage Rules, 1998.
 - g. Use of Fly ash from Thermal Power Plants, Notification, 1999.
 - h. The Noise Pollution (Regulation and control) Rules, 2000.
 - i. Municipal Solid Wastes (Management and Handling) Rules, 2000

9. SUMMARY OF ENVIRONMENTAL CHALLENGES AND SUGGESTIONS

1. STATE OF ENVIRONMENT

Environment is a matrix of various ecosystems existing in a web of delicate relationship. Nature always tries to maintain equilibrium among these ecosystems. However, man's activities have started affecting the quality of the environment. Pollution is a significant facet of environmental concern apart from deforestation, natural calamities, famine, etc. The waste spewed by the developmental activities into the environmental resources without consideration of the assimilating capacity of these resources has seriously affected their quality. Pollution is perceptible in the form of alteration of the physical, chemical and biological qualities of the natural resources – viz. water, air and land. The industrial sector has registered a tremendous growth during the last few decades. Pollution caused by the industrial sector is quite significant. Urbanization in Tamil Nadu is on increase decade after decade leading to consequent problem of disposal of liquid and solid wastes.

2. DEMOGRAPHY

Tamil Nadu's population has increased to 62.1 million and the urban population has risen up to 43.86%. Increasing urban population demands better environmental services such as drinking water, sewerage and effective solid and liquid waste management through segregation. On the one hand employment opportunities and livelihood security should be increased in the towns. While on the other, migration from rural areas should be minimized through effective rural development activities and augmentation of non-agricultural employment. It is significant to note that the poverty in Tamil Nadu has decreased from 35.03% (1993-1994) to 21.12% (1999-2000). Active steps should be taken to eradicate poverty through developmental programs in urban and rural areas.

3. LAND RESOURCES

A. LAND USE PATTERN

Land is one of the important components of the life support system. There are a number of competing demands on land like agriculture, forestry, grasslands, urban and industrial development. For meaningful planning of our land resources we need a time bound micro-level land use survey starting with the village level survey that should indicate our long-term requirements for competing land uses in consonance with land capability.

B. AGRICULTURE AND HORTICULTURE

Agriculture and allied sectors account for nearly 62% of the total employment of the state. In order to increase the production we have relied too much on improved crop varieties, fertilizers and pesticides. These chemical fertilizers have affected the soil structure and has polluted the surface and ground water; chemical fertilizers can be supplemented with bio-fertilizers and vermi compost can sustain crop yield without deteriorating soil health. Bio fertilizers increase crop yield by about 10-30 percent. They also suppress the incidence of pathogens and crop diseases. This will also enable the country to bring down the fertilizer import bill considerably.

An integrated nutrient management (INM) and an integrated pest management (IPM) programme needs to be implemented to have optimal yield. Pest resistant crops and permaculture could be introduced for ecological farming. TNAU and other research institutions should intensify research on integrated farming system and aspects leading to more Eco friendly integrated farming practices.

Tamil Nadu is endowed with varied agroclimatic conditions suitable for the cultivation of varied horticultural crops. The major crop of domestic importance is banana; other important crops are mango,

pineapple, citrus, grapes, papaya. Medicinal plants like *Aloe vera* and *Gloriosa superba* and several ornamental plants. In India the major market for tissue culture plants are in the states of Maharashtra and Karnataka followed by Tamil Nadu. Tamil Nadu has suitable climatic condition and technological capability to become the leader in this field by strengthening market mechanism improving non ODS type cold storage facilities for perishable fruits and vegetables.

C. FORESTS AND WILDLIFE

The Forest department in Tamil Nadu is custodian of 22,845 sq. kms of forest land, which constitute 17.56% of the geographical area as against 33% targeted under the National Forest Policy, 1988. It is proposed to increase the tree cover to 25% by the year 2007 and 33% by 2012. In order to achieve these targets, various schemes and programs of Government are aimed at restoring the degraded forests and expanding forests outside the Reserve Forests. To preserve the existing forest cover of 17.56% inside the reserve forest, Joint Forest Management approach should be extended to all degraded forest areas and better protection should be given to the existing forests. Further to increase tree cover outside the forest area, integrated wasteland development programme is being implemented throughout the state with community participation with adequate technology 3.7 million ha. of wasteland could be brought under the tree cover. Also substantial land has become unfit for any cultivation due to the salinity, alkalinity and shifting sands in coastal areas. Such area may be tackled under the combating desertification programme of UNCCD. Another area that needs more attention is the Agro forestry and urban tree planting. Mangrove plantation in suitable sites and shelter belts of casuarinas, odai, cashew, ipomea etc., can be raised along the seacoast to arrest the velocity of winds to stabilize the coastal sands.

Soil and moisture conservation measures will have to be stepped up in degraded forests to benefit the flora and fauna besides communities living adjacent to Forests. Efforts should be made to locate threatened species, multiply them and maintain them in gene pool gardens and accord strict protection to shola forests, the major reservoirs of water in the hilly regions. Eco development schemes are to be implemented with the participation of the forest dwellers and tribals. It is also suggested to prohibit mining activities around 10K.M areas of reserved areas to protect the rich wildlife of the state. Alternative employment and revenue could be generated through forest management and Eco tourism initiatives Strengthening the infrastructural facilities and providing modern equipment in to forest personals protect the existing forest wealth from poachers and smugglers needs adequate attention.

4. BIO DIVERSITY

Tamil Nadu State has a geographical area of 13 million ha which constitutes about 4% of the land area of the country. The rich bio diversity of the state is facing a serious threat from growing human and livestock population besides various developmental activities. To conserve the bio diversity of Tamil Nadu in the wake of depleting natural resources the Protected Area Network should be strengthened and Places like Kodaikannal, Kanaiyakumari and Megamalai which are rich in diversity can be included under this net work Efforts should further be made to locate threatened species, multiply them and maintain them in gene pool gardens.

The proposed strategy and action plan recommended are protection of forests and habitats rich in bio diversity, restoration of degraded and eroded land, preservation of prime farm land for agricultural use. A detailed plan based on Geographical information system map should be developed jointly involving professionals, local communities to foster an integrated approach to forest conservation. Also it is recommended to carry out extensive bio diversity assessment in different forest types to know the exact biological wealth of the state. Joint Forest Management, Eco Development, Watershed Management will be the major ecosystem based strategies for conservation of biodiversity.

Department of Environment under the Envis EMCBTA project is developing a data base on Floral,

Faunal and Microbial diversity of Tamil Nadu. The objective of the project is to host a bio diversity profile of the State that is not only up-to-date in all respects but also provide an overview of the various landscapes, ecosystems and their respective components of bio diversity. It will also identify relevant databases and provide hyperlinks.

5. WATER RESOURCES

A. WATER RESOURCE MANAGEMENT

Water is elixir of life. It is estimated that the total precipitation in Tamil Nadu is around 32909 MCM. The surface water availability is about 17,563 MCM, ground water availability is around 15,346 MCM. Domestic and industrial water needs have largely been concentrated around the cities so far; but the demand from rural areas is also expected to increase sharply as they get developed. Consequently, water which is already a scarce resource, will become dearer in near future. This underscores the need for the utmost efficiency in water utilization and public awareness towards its conservation.

Increased industrialisation and consequent discharge of trade effluents from textile, tanneries and chemical industries is another major reason for Pollution of water bodies. In order to treat the industrial effluents effectively the industries shall provide and ensure proper functioning of ETP's and CETP's before they reach the water bodies. In many places the surface river water is not suitable for domestic use. Efforts should be made to recharge ground water through rainwater harvesting by making it mandatory in all the corporation and municipalities and town panchayats. Conserving rainwater in temple and village tanks and construction of check dams, more efficient irrigation through drip or sprinkler irrigation in river basins can lead to water conservation. Taking up massive afforestation works in the catchment areas of major reservoirs to avoid sedimentation and riverbank plantations of Teak and bamboo may be encouraged. Farmers should also be educated about the danger of over exploitation of ground water.

In Tamil Nadu the major river basins and ground water are polluted due to increase in the population and consequent increased untreated sewage flow into the rivers and water bodies. To tackle them river conservation works through interception and diversion (I&D) will have been taken up works have been taken up. DoE is taking such steps in abatement of pollution in the most polluted stretches of River Cauvery, Vaigai and Tamiraparani by providing underground sewerage and STP besides providing sanitation and solid waste management facilities under National Conservation River Action Plan (NRCP). Chennai City waterways are being cleaned up under CCRC. Abatement of pollution in Ooty and Kodaikanal lakes has been undertaken for ecorestoration these two lakes. It is also suggested to undertake monitoring the water quality in all-major river basins and important water bodies. The non-point sources of pollution such as pesticide run off from agricultural fields will have to be tackled by promoting organic farming.

B. FISHERIES

The environmental concern in the marine fisheries in Tamil Nadu is that the fish catch is either stagnating or declining. Pollution of coastal water through dumping of raw sewage, garbage, industrial effluents, pesticides, thermal pollution, and residues, resulted in depletion of fishery resources. The local bodies should develop suitable mechanism for collection and treatment of raw sewage, solid waste, etc., entering sea to prevent sea water pollution.

The other environmental Concern is the aquaculture practices in the coastal region of Tamil Nadu and the over exploitation of marine resources. In Tamil Nadu it is suggested that fishermen should allow fishes to multiply by giving adequate rest during this period they should also look for some alternative employment like fish food processing and sea weed cultivation in coastal areas for their livelihood. The Supreme Court of India banned aquaculture within CRZ and entrusted the job of issuing clearance to the state aquaculture authority for developing aquaculture farms outside the CRZ.

C. COASTAL AREA MANAGEMENT AND WET LANDS

Tamil Nadu has a long coastline of over 1076 kms. Coastal area of the State is thus a major natural resource with immense value for commercial, recreational and aesthetic purposes. The rich coastal habitats are being threatened by pollution especially from land based sources, development projects such as ports, dams, tourism, deforestation, natural disasters, over fishing and destructive fishing practices. Expansion of human activities and settlements has also led to excessive withdrawal of groundwater in the fragile coastal belt and many parts of the coastline are being threatened by salinity intrusion.

A scientific study may be initiated on integrated coastal management to meet the diverse needs of various stakeholders. The coastal marine pollution should be assessed based on certain measurable bio chemical and physiological parameters in addition to strictly chemical classification of pollutants. Sectoral environmental standards to be strictly enforced as given in CRZ notification 1991.

In Tamil Nadu, mangrove ecosystem is also undergoing widespread degradation due to a combination of physical, biological, anthropogenic and soil factor. A variety of human induced stresses such as changes in water quality, soil salinity, and sedimentation, inadequate fresh water in the upstream, conversion of mangrove wetlands for aquaculture, salt pans etc. are largely responsible for reduction of mangrove vegetation. Sustained efforts are required to conserve the mangrove ecosystem in the best interest of the ecological security of the coastal areas and the livelihood security of the coastal communities.

CONSERVATION OF WETLAND ECO-SYSTEM

Conservation of wetlands especially around the cities and towns is critical for recharge of ground water and aesthetic amelioration. At present these wetlands and swamps, which are ecologically sensitive, are highly threatened. Quite often these wetlands are converted into dumping yard for garbage or polluted by sewage and other effluents. They are encroached and built up in several cases. Hence conscious efforts are needed to identify these threatened wetlands and conduct scientific study and action plan for their eco restoration. Most critically threatened wetlands could be declared under RAMSAR convention for their future protection. It is recommended to undertake a survey of wetlands, identification of threats and prepare action plan for their Eco-restoration.

6. TOURISM

Tourism plays an important role in the socio-economic development of our country. It is also one of the major sources to earn foreign exchange. Tamil Nadu, with its picturesque hills, beaches, waterfalls, wildlife sanctuaries, temples, ancient monuments, places of worship for all faiths and centres of art and culture has lot to offer to the domestic and international tourists. It is suggested that the Tamil Nadu government should give more importance to Eco Tourism to conserve and protect the natural resources.

Tourism development should be planned in such manner that part of the fund generated by it is used for the conservation of natural resources. Plantation of trees and landscaping with garden is to be encouraged, which will enhance the local ambience. Usage of plastics and non-degradable materials should be banned at the places of tourism to minimize pollution. Conservation of monuments and sites need to be taken as an integral part of preparation and implementation of master plan. Existing open space and landscape around the monuments such as Mahabalipuram, Meenashi temple, Rameshwaram etc. must be preserved protected against degradation..

7. INDUSTRIALISATION AND URBANIZATION

Tamil Nadu ranks third in terms of development of industries and fifth in terms of level of pollution. The major contributors to industrial pollution are leather tanning units, textile processing units, Chemical and petro chemical industries, cement industries and thermal power plants. About 80 percent of 2,500

leather processing units in the country are located in Tamil Nadu. The sector is the fifth largest foreign exchange earner with annual sale exceeding \$6 billion. The units discharge about 24 million cubic liters of wastewater about 40,000 tonnes of hazardous solid waste every year. It is suggested that these industries should treat the effluent in ETP, CETP and also reduce TDS through reverse osmosis. In case of textile industries it is recommended to go for cleaner technology using low salt dyes.

The level of urbanisation in Tamil Nadu stands at 33%, the State of Tamil Nadu ranks as the second most urbanized state in the country. Since concentration of industries at one place is largely responsible for shortage of housing and mushroom growth of slums, efforts should be made to locate industries in satellite towns and outside cities. Strict enforcement of Town Planning rules is needed. Strengthening of urban local bodies to enable them to perform their basic functions such as drinking water supply, sanitation and solid waste management in an effective manner.

Effective implementation of schemes for proper segregation, collection, transportation, treatment and processing of solid wastes is needed as per the provision of Municipal Solid Waste Management and Handling Rules 2000. Practical treatment and disposal options for the safe disposal of bio medical wastes as per Biomedical Wastes Rules 1998 shall be implemented. Bringing down the emission and noise levels of vehicles, adopting improved methods for disposal of wastes are some of the important measures to reduce the pollution levels.

Sustainable development is to achieve the needs of the present generation without compromising the ability of the future generation to derive benefits from our natural resources. The State of Environment Report of Tamil Nadu has attempted to broadly outline the environmental issues in various sectors and possible approaches to tackle them. Optimum utilisation of land resources, sustainable agricultural production, forest restoration and greening for better quality of life, conservation of rich bio diversity and scarce water resources, abatement of land, water and air pollution are some of the management issues which need immediate attention. Water conservation is the key not only to Natural Resources economic development cannot be considered in isolation urgent but to healthy urban development as well the four 'E' s Ecology, Energy, Economics and Equity are intertwined. If energy consumption is considered as a parameter for economic development environmental ethic with inter generational equity is the key to sustainable socio economic development. This State of Environment Report of Tamil Nadu is the first step towards such an endeavour.