

## 1. PREAMBLE

India is gifted with a wide diversity of ecosystems, plant and animal species, and genetic forms, including habitats ranging from the Himalayas to marine areas, about 48,000 species of plants and about 82,000 species of animals. It has a wide range of very rich agriculture biodiversity including variety of crops, livestock, poultry and pets. There was an intrinsic value to biodiversity, an ethical right to survival which Indian traditions had recognized. It is also provided with various benefits to humans, including climatic stability, hydrological security, daily livelihood needs of large section of society, medicinal plants genetic resource etc., However, there should be a sustainable use of the biodiversity, as it is rapidly losing its state due to the so called "development" projects, increasing population, indiscriminate land use, introduction of exotics, over exploitation etc.,

Governments and the others outside the government have taken many initiatives to protect biodiversity, such as the widespread effort of declaring of protected areas, communities, regeneration and conservation of natural resources. With an aim to encourage these trends, the urgent need for developing a National Biodiversity Strategy and Action Plan (NBSAP) is strongly felt. In developing the NBSAP, it is absolutely necessary to maintain India's ecological security and ensuring people's livelihood security.

There is a need to create greater awareness and understanding on the complex issues of biodiversity so that biodiversity concerns permeate to all levels of the society. In preparing this action plan, it has been decided to involve many people from different walks of life, such as Government officials from line departments, professionals of various nature, NGOs,

academics, fisher folk, farmers, agriculturists, students, industrialists, teachers and other related relevant persons.

It was the World Conservation Strategy which first stressed upon the need for conservation based development. Subsequently the United Nations Conference on Environment and Development at Rio de Janeiro in June 1992 highlighted the concept of biodiversity and resulted in the Convention of Biological Diversity (which entered into force in 1993). Under the Convention, it is mandatory for all contracting parties to prepare Biodiversity Strategy and Action Plan was initiated by the Government of India in 2000 which envisages preparation and merger of eco - regional, state level and sub state level plans and thematic documents.

This document defines the Pondicherry State Biodiversity Strategy and Action Plan. It establishes a general frame work for the State policy on conservation and sustainable use of biological resources, explains its current status and identify the processes which are leading to its deterioration. This proposal will form a strong link between the National Strategy and Action Plan and the role of the Union Territory of Pondicherry for applications of measures and actions at the grass root level.

This first and preliminary document identifies and inventories such areas and assess the diversity in the state agriculture fields and define guidelines and actions to promote its conversation. The utility of this document would depend upon the degree of influence it would have on the range of social context, state planning, development of education, research, culture and above all, attitudes which Government and society must adopt.

## **1.1 Public participation and coordination**

- In order to ensure that strategic and action plan is based on the principles of shared responsibility by all stakeholders, both the government and NGO's have to share responsibility of promoting active participation of the public in conservation activities. Ensuring the NGO's (including commune panchayats, madhar sangams and youth groups, etc.) are recognized and accepted as fundamental participants in execution of all conservation based programmes.
- Creating awareness & disseminating information on biodiversity and conservation issues to ensure public participation in conservation action.
- Coordination between the Government and the public.

## **1.2 Equity**

- Defining responsibility of various sections of society in conserving their biological resources.
- Ensuring their share of local communities in the benefits obtained from use of natural resources which they have helped to conserve over long periods of time and also promoting suitable practices for resource management.
- Defining a mechanism to obtain the informed consent of local communities for economic / commercial use of a bio- resources in an area.
- Ensuring sustenance of Common Property Resources through local institutions.

### **1.3 Planning**

- Channelising natural resource planning based on observation
- Promoting interdepartmental coordination during planning of development projects.
- Inclusion of environment impact assessment in all development projects.

### **1.4 Environment Education, Training & Research**

- Educating younger generation about the values of biodiversity, the way to protect it for the future generations by involving governmental agencies, NGO's, academic institutions, scientific bodies etc.
- Promoting biodiversity education at the school level.
- Generating biodiversity databases and biodiversity information distribution mechanism.
- Multi-disciplinary approach in biodiversity research.

### **1.5 Ethical & Cultural issues**

- Encouraging local populations and socio-economic agents to maintain environment friendly traditional uses of bio resources and promote traditional knowledge and techniques to conserve biodiversity.
- Recording existing religious and cultural practices and to look for their scientific linkages.

## 1.6 Scope

This document covers the following levels of biodiversity in the context of issues of conservation, sustainable and equitable use of natural resources and their scientific, economic and cultural dimensions :

1. Natural ecosystems: They include forests, wetlands, grasslands, semi-arid areas, sub-montane zones, etc.
2. Wild species and varieties : An attempt has been made to collect and collate all available data on species of plants and animals and to some extent micro-organisms .
3. Agriculture eco-systems: They include historic changes in land use pattern, farm lands, horticulture, etc.,
4. Domesticated species and varieties: An attempt has been made to study varieties / species of crops, livestock, fishes, including genetic variation, wherever possible.
5. Socio – economic and cultural ways of relating to nature.

## 1.7 Objectives

The objectives of the National Biodiversity Strategy & Action Plan for Pondicherry State are as follows.

1. To assess the existing status of biodiversity,
2. To identify the causes of its deterioration, if any
3. To promote conservation and sustainable use of the states' biological resources,
4. To promote awareness and dissemination of information amongst government departments and the public for realizing peoples' participation in conservation activities,

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5. To create mechanism required to plan natural resource management and long term conservation,
6. To promote cooperation between all stake holders including government, public institutions, social and economic groups and the masses,
7. To incorporate principles of restoration, conservation and sustainable use of biodiversity in planning and execution of sectoral and cross sectoral policies,
8. To stimulate education, training and research in the area of biodiversity,
9. To identify legal and financial instruments to achieve these objectives, and
10. To promote regional, inter-state, national and international co-operation through multilateral programmes and joint initiatives.

### **1.8 Major actors**

#### A. Government of Pondicherry.

1. Department of Science, Technology & Environment
2. Department of Agriculture
3. Department of Fisheries
4. Department of Forests and Wild Life
5. Department of Animal Husbandry
6. Department of Education

#### B. Pondicherry University

#### C. N.G.O' s.

#### **D. Private Initiatives**

## **2. A Profile of Pondicherry**

### **2.1 Geographical profile**

The Union Territory of Pondicherry constituted out of the four erstwhile French establishments of Pondicherry, Karaikal, Mahe and Yanam (excluding Chandranagore) is not merely a creation of seventh amendment of Indian Constitution, but an out come of a three hundred year long history.

Pondicherry consists of four territories viz., Pondicherry and Karaikal surrounded by the State of Tamil Nadu, Yanam, surrounded by the State of Andhra Pradesh, and Mahe surrounded by the State of Kerala. The primary economy of the Union Territory depends mainly on agriculture & fisheries. Industrial development has also taken place in recent years boosting its overall economy. Since its independence and merger with India, the Union Territory has made remarkable strides in the field of agriculture by increasing the land productivity, utilizing the irrigation potentials effectively and thereby achieving the required crop diversification. It has also created a well-knit input and marketing network, along with development of infrastructure and other facilities for building a sound economy. In spite of this progress, 37.4% of the current estimated population of 1.05 million (Year 2000) are below the poverty line, as per the current survey information. Analysis of the nutritional status indicates that 23.6% of the people in the rural areas and 12.7% in the urban areas consume less than 1800 K cal. per day which is far less than the minimum required for the productive activity. Studies on the natural

resource endowments, general development plans etc., indicate that there is ample scope to increase the peoples income, nutritional status and general standard of living.

The Pondicherry area is said to mark the northern limit of sediments laid down during the great Cenomanian marine transgression along the east coast of South India. According to geologists the high ground might have been formed due to faulting and upliftment along a plane extending in a general E.N.E–W.S.W. direction. The Muthirapalayam water wells with plentiful of water may be lying along the plane postulated fault. According to them, the lateritised scrap of the Cuddalore rocks west of Kalapet may also be representing a fault which, when extended, joins the Red Hills.

Black clays and simulating marine clays have been observed in well cuttings to the west and south west of Pondicherry with local intercalation of peaty materials and sands. The persistence of the horizon over a considerable area is said to be suggestive that the area at one time must have been a lagoon. There are evidences to show a gentle submergence along the east coast perhaps during the Pleistocene times. During the period several changes seem to have taken place including the changes of course of certain rivers. According to geomorphologists the straight shore line is also suggestive of some structural dislocation. Shallow bays were formed during the submergence, the limits of which may be traced from the presence of black sticky clays recorded in the area.

The unusual thickness of alluvium near Pondicherry (which is stated to exceed 167 meters) is said to indicate that it was part of an extensive lagoon which has since been silted up and uplifted. Near Pondicherry,

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beds of peat at various levels below the surface of the ground have been recorded. The coastal border has a length of 22 Km. and a breadth ranging from four to six hundred meters. Superficially the coast is flat and sandy.

From the above description, it is evident that Pondicherry region consists of four geographical zones. The coastal zone comprising newer and older dunes including saline areas of clayey texture. The second zone is made up of the two plateaux called Podicherry plateau and the Thiruvakkarai plateau composed of geological formation called the "Cuddalore sandstone". The upper layers are made up of red transported ferralitic soil. The Valudavur plain lies between these Plateaus. Marshy depressions are also frequently encountered in the plains of Valudavur. The flat alluvial zone occupies the rest of the Pondicherry region.

## **2.2 Location**

All the four regions of Union Territory of Pondicherry are at different geographical locations isolated from one another. Pondicherry region, which is the largest of all the four, lies on the east-coast, consisting of 12 scattered areas lying in between 11 42' 12 30' N, and between 76 36' and 79 53' E. Karaikal region is about 150 Km. south of Pondicherry and is surrounded by Nagaipattinam Dist. of Tamil Nadu. It is located between 10 49' and 11 01N, and 79 43 and 79 52'E. Yanam region is located between 16 42' and 16 46'N and 82 11' and 82 19' E. at about 840 Km. Km. North East of Pondicherry near Kakinada in Andhra Pradesh. Mahe region lies almost parallel to Pondicherry between 11 42' and 11 43' N and 75 31' and 75 33' E at 653 Km. away on the west-coast near Tellicherry in Kerala.

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### **Karaikal Region**

Forming part of fertile delta, the region is completely covered by the distributaries of Kaveri river. Covered completely by a thick mantle of alluvium of variable thickness, the lie of the region is flat having gentle slope towards the Bay of Bengal in the east. It is limited on the north by the Nandalar and on the south east by the Vettar. The group of rocks known as Cuddalore formations is met with in the area contiguous to Karaikal region in Tanjore District.

### **Yanam Region**

The region is bounded on the east and south by the river Godavari which discharges itself into the Bay of Bengal after flowing about 14 km. towards south east. The town of Yanam is located at spot where the River Coringa and Godavari separate to divide the region into two parts, one on the east and the other on the west. The entire region is composed of a flat, monotonous terrain without any distinct topographical feature.

### **Mahe Region**

Mahe is a small area bounded on the south west by the Arabian Sea, on the north by the River Ponniam (Moolakadavu) and on the other sides by a stretch of calcareous hills of medium height which are linked to the ghats by a series of wooded hillocks. The river Mahe which flows towards the west, divides the region into two parts.

## 2.3 Resources

### 2.3.1 River systems and water resources

**Gingee river:** Pondicherry and its surrounding enclaves lie on the drainage basin of Gingee river crossing diagonally from north-west to south-east. This river is also called “Varaha Nadhi” presumably after Varaha, the *avatar* of Sri. Vishnu. Sankaraparaniar or the “ornament of Sankara” is the other name by which the same river is known. It takes its sources on the western borders of Gingee Taluk in Tamil Nadu, and is made up of two affluents at its head, one emanating from Pakkamalai Hills in the south-west and the other from Melmalayanur tank fed by the Malayanur Hills in the north-west zone of Gingee taluk. Both the streams join together and the combined river flows in an eastern direction, then takes a turn towards the south on the eastern borders of Singavaram village, crosses the Tindivanam – Tiruvannamalai road near Gingee and then turns again towards the east. At this reach it takes in Nariar tributary. Lower down, the Tondiar tributary flowing from the east joins Gingee, a little north east of Vidur in the Tindivanam taluk in South Arcot District in Tamil Nadu. The Pambaiar joins a little north west of Elayandapattu of this Territory.

At a distance of about 6 Km. from its mouth, the river breaks off into two branches, known as Ariyankuppam river in the north and Chunnambar or Kilinjalar in the south. The Ariyankuppam river finally empties into the sea north of Veerampattinam and Chunnambar a little south of Chinna Veerampattinam. Although the total length of the river is 78.89 Km. it has a run of only about 34 Km. In this region, This is not a perennial river with flow only during rains and floods.

**Ponnaiyar:** Ponnaiyar is referred to as “Thenpennai” in Tamil literature. In Sanskrit it is called “Dakshina Pinakini”. The word Pinakini is derived from the word ‘pinaka’ which means the bow of Lord Shiva. The Ponnaiyar, originating from the Nandidurga Hills of Karnataka, runs a distance of about 89 Km. Before entering Tamil Nadu near Hosur. From there it runs another 177 Km. In Salem district, about 34 Km. In North Arcot district, and about 122 Km. In North Arcot district and falls into Bay of Bengal about 4 km. North of Cuddalore.

In olden times the flow of Ponnaiyar used to be harnessed for purposes of irrigation through a system of korambu which consisted of an earthen bank across the river in an inclined position with its upper end towards upstream to draw, supplies and to lead water into off-take channels.

The Kuduvaayar which branches off from the Ponnaiyar enters the territorial limits of Pondicherry a little north of Kilur and merges with Chunnambar (or Kilinjalar) near Thirukanji, a little west of Pondicherry – Cuddalore road. The flow of Kuduvaayar which runs a distance of 16.2 Km. is harnessed for irrigation by the anicuts at Kilur, Mangalam and Thirukkanji.

The Malattar which takes off from the Ponnaiyar north of Valavanur in Villupuram Taluk, touches the southern fringes of Nettapakkam and Ariyankuppam communes before it falls into Bay of Bengal near Pannithittu after running a distance of 28 Km.

The Mooliar is an outspread of the lagoon formed near Pudukkuppam.

**River Kaveri:** About 16 Km. West of Thiruchirappalli, at the head of the delta, the river Kaveri bifurcates as Kaveri and Coleroon. The former serves as an irrigation canal and the later as a flood carrier. The main branches of Kaveri below Grand Anicut are the Kudamurutti, Arasalar,

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Virasolanar and Vickramanar. Although Arasalar and its branches spread through Karaikal, the waters of Kudamurutti and Virasolanar also meet the irrigation needs of the Karaikal region.

The Arasalar having a total run of 24 Km. enters Karaikal region, a little east of Agalangannu. It forms the natural boundary line separating Niravy Commune from Thirunallar on the north-west and Karaikal on the north-east. It is said that the construction of Kannambadi dam and Mettur dam has reduced the flow of water in Araslar.

**River Mahe:** The Mahe river gathering the flows around Velliyod, Naripatta and Kavilumpara *amsams* adjoining the Western Ghats, runs a distance of about 55 Km. Towards the west emptying into the sea, north of the hill by the side of the Administrator's residence. The river forms the northern boundary of Mahe town, separating it from the enclaves of Kallayi and Naluthara on the north.

**River Coringa:** Coringa river which is the branch of river Gauthami Godavari runs along Yanam. The water from the Kotipalle or Bank canal which starts from the Dowleswaram dam on the Godavari near Rajamundry, is brought to Yanam through a small canal known as the Pillanka Kaluva or French Channel which branches into two channels, i.e., Meraka Kaluva or Panta Kaluva, which is discharge channel and Pallapu Kaluva or Outa Kaluva an irrigation channel and both of them join Coringa river, flow of which divide the town into two.

### **2.3.2 Underground water resources**

**Pondicherry Region:** The ground water resources of Muthirapalayam first came to be utilized as early as in 1863 for providing good drinking water for the people of Pondicherry. The existence of three

artesian wells in continuous operation with in a circle of 600 yard radius, close to the sea is recorded in the records of the Government of India. The ground water has been under continuous exploitation for more than number of years in Pondicherry region. With the improvement in the supply of electricity, tube wells have been on the increase. Pondicherry town is fed by the water works at Mutirapalayam, Ellapillaichavadi and Muthialpet. The general water table in this region is said to be shallow, about 3 to 4.5 mts. It drops down by few meters during the lean months. Artesian and sub artesian aquifers are commonly encountered, particularly in the coastal area between Pondicherry and Cuddalore. Around Pondicherry, Thengaithittu and Ariyankuppam artesian aquifers are encountered at the depths between 20 to 45 mts. With many artesian wells around Thengaithittu. The water from these artesian aquifers is generally alkaline with a slight sulphurous smell and is stated to damage the casting pipes leading to collapse of the sides of the tube well and stoppage of flow. Due to heavy pumping of ground water only a few wells around Pondicherry flow round the year. Many tube wells sunk in the past are so irregularly distributed that some of them do not yield water while adjoining ones are pumped. If this is continued for long, this is said to lead to localized subsidence and this could be avoided by putting gravel packed wells that are now in vogue.

***Karaikal Region:*** Karaikal region gets most of its water for irrigation from Karaikal and as such ground water resources in the region have not been fully developed. The quality of shallow ground water is rather poor. Several attempts were made to tap ground water by means of deep tube wells for drinking and agricultural purposes. Ground water in Karaikal is developed chiefly by means of dug wells or filter point wells piercing blown sands and alluvium. Karaikal town gets its water by means of battery of

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shallow interconnected open wells and an infiltration gallery in the bed of Arasalar. A few villages between Akalangannu and Karaikal also get their water supply from this source.

**Mahe Region:** Depth of the water in the thick alluvium overlying the Laterite, along the river bank varies from 1 to 1.5 mts. below ground level and in the Laterite areas it varies from 4.5 to 8.00 mts. below the ground level, during the dry months. The salt water intrusion in the near surface aquifer or the dug well zone during the summer months is noticed.

**Yanam Region:** Yanam region is occupied by the alluvium consisting of sands, clay and gravel. Ground water occurs both under water table and confined conditions in the granular beds in the alluvial deposits, and is developed by means of shallow filter point wells with in a depth of nine meters.

### **2.3.3 Socio – Economic Profile**

#### **Area**

The area of the Union Territory of Pondicherry is 492 Sq. Km. According to 1991 census the population of the Union Territory of Pondicherry is 807785, consisting of 408081 males and 399704 females, resulting a sex ratio of 979 females for 1000 males.

The schedule caste (SC) population is placed at 16.25% of the total, numbering 131278 . Out of the above, Pondicherry region has the maximum number of SC population of 101298.

**Break up population – Region wise.**

( As on 1 st March 2000 )

Region	Area (Sq.Km.)	Population	Rural	Urban
Pondicherry	293	806982	274455	532527
Karaikal	160	173498	99900	73598
Mahe	9	38736	#	38736
Yanam	30	29417	#	29417
<b>TOTAL</b>	<b>492</b>	<b>1048633</b>	<b>374355</b>	<b>674278</b>

#. Not available.

The Directorate of Economics & Statistics, Government of Pondicherry, projects that the estimated total population in 2007 will be 1.28 million with 6.5 lacs. male and and 6.35 lacs. female. Out of this 64 % will be in urban areas while 36% will be in rural areas.

**Literacy**

The rate of literacy is estimated as 90% and literacy rate among male is 94% and among female 86%.

**2.3.4 Climate, Soil and Rainfall**

Agro- climatically all the four regions, although not contiguous, fall under east coast plains and hills with semi-arid climate, red loam,

coastal deltaic alluvium, red laterite, etc. are the major types of soil of the four regions. Major source of rain fall is from north-east monsoon.

**The average rainfall of the UT is as below.**

Region	Normal (mm)	Actual Rainfall (mm)			
		1995-96	1996-97	1997-98	1998-99
Pondicherry	1250	784	2016	2212	1968
Karaikal	1259	1399	1717	2158	1523
Mahe	3377	2737	2987	4052	3173
Yanam	1099	1216	2012	1313	1912

#### **Socio – Economic Indicators**

<b>Parameters</b>	<b>Data</b>
Density of Population	1642 per Sq. Km.
Sex Ratio	979 females per 1000 males
Literacy Level	74.74 %
Infant Mortality rate	21 per 1000 live births
Birth Rate	18.2 per 1000 population
Death Rate	7.8 per 1000 population
Total production of food grains	54260 Mt.
Per capita agri. Production	278.21 Kg.
Per capita annual Income	Rs. 23135/- at 1998-99 prices

## 2.4 Political Profile :

### Administration

(a) Revenue Administration:

The Union Territory of Pondicherry constitutes a single District consisting of 264 Census villages, 129 Revenue villages in 2 taluks and 4 sub taluks.

(a) Development Administration:

For the purpose of Development Administration, the UT is divided into 6 blocks .

Region wise Blocks are as below:

Region	Blocks
Pondicherry	1. Ariyankuppam 2. Ozhukarai 3. Villianur
Karaikal	1. Karaikal
Mahe	1. Mahe
Yanam	1. Yanam

( c ) Local Administration.

Pondicherry Panchayat Act of 1973 & Municipalities Act of 1973 came into force in 1974. There are 5 Municipalities, namely Pondicherry, Oulgaret, Karaikal, Mahe and Yanam. There are 10 Commune Panchayats : Five in Pondicherry region, Villianur, Mannadipet, Ariyankuppam, Bahoor and Nettapakkam and five in Karaikal. They are Thirunallar, Neravy, Nedungadu, Kottucherry and Thirumalairayanpattinam.

### 3. Current status of Biodiversity of Pondicherry region.

#### 3.1 AGRICULTURE

##### 3.1.1 Land Holding Pattern

The most important occupation in the Union Territory of Pondicherry is Agriculture, which provides livelihood for about 35% of the rural population. The Union Territory of Pondicherry is characterized with large portion of small holdings of less than 1 Ha.

##### Land Holding Pattern of Pondicherry.

Land Area	No. of Holdings	Area in Ha.
Less than 1 Ha.	26096	9299
In between 1 and 2	5011	7105
Above 2 Ha.	3468	16874
<b>TOTAL</b>	<b>34575</b>	<b>33278</b>

##### 3.1.2 Land Use Pattern :

Land Use	Area in Ha.
1. Geographical Area	48842
2. Land put to non Agri. Use	15069
3. Barren Lands	114
4. Permanent Pastures	27

5. Cultivable waste	2962
6. Other fallows	3273
7. Current fallows	1702
8. Net Area sown	24863
9. Total Cropped Area	42184
10. Area sown more than once	43804

Above data pertains to the year 1998-99

### 3.1.3 Major Crops :

Paddy, Sugarcane, Groundnut, Pulses and Cotton are the major crops in the Union Territory of Pondicherry.

Crop	Area in Ha.	Production in Mt.	Yield / Ha.
Rice	26349	51463	1953 Kg.
Millets	362	786	2171 Kg.
Pulses	5825	2011	345 Kg.
Food grains	32536	54260	1667 Kg.
Oil seeds	3777	6673	1766 Kg.
Cotton	459	344	749 Kg.
Sugarcane	2397	191253	79.79 mt.

The main dry crops are as follows:

Bajra	- <i>Pennisetum typhoides</i> . (Tamil- Kambu)
Groundnut	- <i>Arachis hypogaea</i> (Tamil- Verkkadalai)
Gingelly	- <i>Sesamum indicum</i> (Tamil- Ellu)
Cashew nut	- <i>Anacardium occidentale</i> (Tamil-Mundri)

The main wet crops are,

Rice	- <i>Oryza sativa</i>	(Tamil-Nellu)
Ragi	- <i>Eleusine coracana</i>	(Tamil-Kambu)
Sugar cane	- <i>Saccharum officinarum</i>	(Tamil-Karumbu)
Bananas	- <i>Musa sp.</i> ,	(Tamil-Valai)
Betel vine	- <i>Piper betel</i>	(Tamil-Vettilai)

#### 3.1.4. Fertilizer Consumption

The fertilizer consumption in the UT has been estimated at 400 / Ha.

#### 3.1.5 Irrigation

In the Union Territory, 82% of the net area sown is irrigated by canals and tube wells . Net area irrigated is 21583 Ha. As such there are no major irrigation projects in the Union Territory of Pondicherry. The following is the irrigation pattern by various methods

Irrigation Method	Irrigated Land
By canals	8392 Ha
By tube wells	13105 Ha.
Others	86 Ha.
<b>Total</b>	<b>21583 Ha.</b>

#### 3.1.6 Ground Water Resource

Ground water availability in Pondicherry region is 152 MCM. ( Report on Water resources of Pondicherry region and its Management by Agriculture Department of Pondicherry ) The potable water to the urban and sub urban is supplied by the Public Works Department of the Government

of Pondicherry. Around 60 MLD potable water is drawn through bore wells, which are maintained by Public Works Department. The normal per capita consumption of water is 140 lit /day.

As the ground water level is gradually becoming low, it is time to change the cropping pattern and the available scarce resource has to be shifted to those crops which consume less water. In this regard, more effective water management techniques has to be followed by making use of sprinklers, drip irrigation system etc., Water harvesting structures have to be developed. Also, the balance between the growth of Agriculture and Industry is to be maintained by adopting appropriate land use pattern.

## **3.2 HORTICULTURE:**

### **3.2.1 THE BOTANICAL GARDEN.**

The oval shaped Botanical Garden situated in the south-west of Pondicherry town, between the south Boulevard and the Oupar river was created in 1826 by the French botanists. In 1838, Mr. S.G.Perottet, an eminent botanist enriched the garden with new and rare species, which were procured from Kolkata, Chennai, Sri Lanka and has created a live herbarium. Later, Mr. Countest Lacour (1870), Mr. Petlet (1875) and Mr. Reynaud (1885), pharmacist of navy, who succeeded Mr. S.G.Perottet were instrumental for the introduction of a number of plants like vanilla, pepper and conducted agricultural experiments on cacao, coffee of Libya, indigo of Java, etc., In 1890, Mr. Achart was appointed as the first chief of Agriculture in Pondicherry and in 1900 he was appointed as the Director of Botanical Garden. Other eminent botanists who contributed are Rev. Father Dessaint, Monseigneur Levellé, Dr. Paramananda Mariadassou,

Mr. Soupramania Poulle, Mr. Giblon, an army pharmacist and Dr. Biot, who was responsible for publishing a booklet on "The Botanical Garden of Yanam" During this period a lot of species were brought from the French occupied North Africa and the now conspicuous *Khaya senegalensis* in the Botanical garden is one among the introduced species. The above mentioned botanists took keen interest in the development of the botanical garden by enriching the collections with rare plants, medicinal plants besides maintaining it as an horticulture experimental garden. After the merger of Pondicherry with the Union of India in 1954, the Director of Agriculture was entrusted with the responsibilities of maintaining the Botanical Garden. There are mixture of indigenous and exotic trees ranging from deciduous to evergreen species. Introduction of *Khaya senegalensis* from Central Africa by the French has spread through out the garden. The *Bombax malabaricum* (Silk cotton tree), *Roystonea regia* (The royal palm), *Astonia scholaris*, (Devil tree) *Couroupita guianensis*, (Cannon ball tree) a native of St. Vincent Island with its fruit like cannon balls and long flowering shoots arising from old wood. The varieties of Ficus such as the massive *Ficus bengalensis* (Banyan), *Ficus religiosa* (Sacred peepul tree) and *Ficus benjamina* are also seen. In addition to these some of the following are in existence. They are, *Kigelia pinnata*, *Crescentia cujata*, *Adenonthera pavonina*, *Peltophorum pterocarupum*, *Polyalthia longifolia*, *Santalum album*, *Delonix regia*, *Caesalpinia pulcherrima*, *Cocus nucifera*, *Borassus flabellifer*, *Areca catechu*, *Caryota urens*, *Cassia fistula*, *Sweitenia mahagoni*, *Thespesia populnea*, *Azadiracta indica*, *Wrightia tinctoria*, *Mimusops elengi*.

Apart from the collection of trees there are rich collections of Bougainvillea, Roses, Hibiscus, Varieties of Croton, and other annuals and perennials. Shade loving plants, cacti and succulent are seen in the green house. A plot of medicinal plants is also being maintained and

some of them are *Ocimum spp.*, *Justicia adhatoda*, *Clitoria ternatea*, *Solanum trilobatum*, *Cassia spp.*, *Datura metel*, *Lawsonia inermis* etc.,

Annual Flower show is conducted to create a healthy competition among the garden lovers.

This garden also houses the Department of Fisheries, Department of Forests and Wild Life, a part of Department of Agriculture and Jawhar Bal Bhavan, and a joy train to entertain the young and old and parking lot for the departmental vehicles. The human interferences to Botanical Garden destroys the aesthetic value.

### **3.2.2 MEDICINAL PLANT INTERPRETATION CENTER AT HORTICULTURE FARM , MADAGADIPET.**

As an initiative, a Medicinal Plant Interpretation Center has been established in an area of 5 acre of land at Government Horticulture Farm, Madagadipet.

The objectives of establishing the Medicinal plant Farm are

1. To educate the people on the importance and the uses of medicinal plants for primarily health care.
2. .To motivate the farmers to take up the cultivation of medicinal plants.
3. To maintain the germplasm of wild, rare, endangered and threatened species as mother plants from which future selections of vegetative propagules, seeds etc. will be made.

4. To develop Agro- techniques for selected species for future cultivation.
5. To carry out research activities on crop improvement based on the selection of best ecotype from the germ collection.

In this centre , about 300 medicinal plant species including trees, shrubs, herbs and climbers have been planted adopting poly cultural method of planting similar to that of natural forest ecosystem. A medicinal plant information house exhibiting different kinds of seeds of medicinal plants, raw drugs, photos of medicinal plants and various information panels has been set up. Various theme gardens such as Anti venom plants and rare endangered plants of South India and mother and child health care plants have been established for equipping the knowledge of the people. The wealth of traditional system of Indian medicines has also been exhibited.

### **3.3 FLORA AND FAUNA**

#### **3.3.1 Flora and Fauna Diversity in the Union Territory of Pondicherry**

**FLORA:** The flora of Pondicherry has a remarkable diversity which may be attributed to the diverse soil types comprising the hydromorph soil (rich in clay), the halomorphic soils (terrains more or less saltish), the sand dunes and the very dry soils developed on the red sand stones of Kalapet, Dhanvantrinagar (Gorimedu) and Ousteri. The red sand

stones are unknown in Karaikal and Yanam. Added to this a large number of exotic varieties was introduced by the Europeans in the course of last three centuries. This ecological diversity is reflected in the land use.

The flora is listed under six categories, viz., hygrophytes, halophytes, plants of sandstones, avenue trees, hedge plants and ornamental plants.

**3.3.1.1 The hygrophytes** (Aquatic plants.): The hygrophytes are the species in which certain organs or organisms develop entirely under water. Mode of dispersal of seeds is effected through water. (hydrochorous). Two species of the family of Nymphaeaceae with large floating leaves, *Nymphaea stellata* and *Nymphaea nouchali* are very common in ponds or pools with still water surface, *Nelumbium speciosum* is the biggest Nymphaeaceae with floating leaves. Though not common sacred lotus is cultivated in some gardens. The more striking vegetation is probably *Lemna polyrrhiza*, very tiny floating green plant covering the entire surface of small pools. Another plant is *Eichornia crassipes*. (Tamil-Akasathamara) met with here and there along the water courses. The trees commonly growing in tanks which remain most of the time, dry are *Acacia nilotica* (Tamil.-Karuvelamaram.), with black bark. The tall *Vetiveria zizanioides* (Tamil.-Vettiver) with big tufts of leaves could also be spotted in these region. One of the most characteristic species is a small bamboo called *Arundo donax*.

Among the same group of species growing along the water course are two very characteristic trees or shrubs, they are *Butea monosperma* (Tamil-Palasararam) which abounds in flowers in the beginning of March giving magnificent reddish orange colour to the

banks, and *Pongamia pinnata* (Tamil-Pungamaram) which is totally deciduous for a few days in every year.

### 3.3.1.2. Halophytes

#### Plants of halomorphic soils

The halomorphic soils are alluvial which may be periodically inundated by a film of brackish water. These salty terrains are sandy and clayish. Their flora is particularly well represented in the neighborhood of lagoons in the south Pondicherry town. The vegetation is a short green sward of which three species of Cyperaceae and three of Gramineae. Viz., *Fimbristylis spathacea*, *Kyllinga monocephala* – (Tamil-Muttaikkorai) *Cyperus arenarius*, *Eragrostis riparia*, *Tragus biflorus* and more common *Aeluropus lagopoides*.

In Ariyankuppam area one would come across a good number of herbaceous or semi woody species tolerating the slightly saltish soils: *Portulaca pilosa*, *Pedaliium murex*, *Jussieua perennis*, *Corchorus actuangulus* and *Pupalia lappacea*.

With the decrease in the clay content of the soil, the floristic composition changes. *Boerhaavia diffusa* (Tamil-Sattaranai), *Physalis minima* (Tamil-Thakkali), *Acalypha lanceolata*, *Leucas aspera* (Tamil-Thumbai), *Commelina benghalensis* (Tamil-Kanavalai), the two most common Gramineae, *Chloris barbata*, (Tamil-Mayil Kondai Pul) and *Brachiaria distachya*, the four Compositae – *Tridax procumbens*, *Emelia sonchifolia*, *Eclipta alba*, (Tamil-Karisalankanni), *Vernonia cinerea*, and the three small sized shrubs *Abutilon hirtum* (Tamil-Tutti), *Corchorus Urticaefolius* and *Crotalaria verrucosa* (Tamil-Gilugilupai).

Wherever the drainage is inadequate plants like *Prosopis juliflora*, *Clerodendrum inerme*, a small bush and *Avicennia officinalis* which is a species of mangroves are seen growing. In some localities *Pandanus tectorious* (Tamil-Thazhampoo) grows along the watercourse.

### **Plants of the Sand – dunes**

The only woody plant group noticed near the sea is that of *Casuarina equisetifolia*, characterized by its needle like leaves. They are grown along the sea coast and are mostly cultivated for fire wood. Among the herbs growing on the sand, mostly is spinous Graminae, *Spinifex littoreus* (Ravananpul–Tamil). More often *Ipomea pes-caprae* which is quick spreading creeper, *Bulbostylis barbata*, growing in tufts, and *Gisekia pharnaceoides* (Manalkirai–Tamil)

#### **3.3.1.3. Plants of sandstones**

The soil is very poor in organic matter and rich in quartz gravel. The vegetative landscape is essentially composed of tall palms. *Borassus flabellifer* (Panai maram–Tamil), *Phoenix sylvestris* (Ichai maram–Tamil) the small Phoenix with very short stipe *Phoenix humilis var pedunculata* (Kattu-Ichai maram– Tamil) and cashew trees *Anacardium occidentale* (Mundri–Tamil) which are distributed widely on these soil.

#### **3.3.1.4. Avenue trees**

The trees growing along the road sides is considerably rich in woody species. It consists of a number of very beautiful trees, some with straight and regular trunks reaching upto 20 mts. and others with shorter trunks but of great of economic value. Commonly existing road side trees are *Azadirachta indica* (Tamil–Veppa maram), *Ficus benghalensis* (Tamil-Ala maram), *Ficus religiosa* (Tamil–Arasa maram),

*Samanea saman* (Tamil–Thoongumungi maram), *Tamarindus indica* (Tamil – Pulia maram), *Thespesia populnea* (Tamil–Poovarasu maram), *Delonix regia* (Tamil–Sigappu konnai maram), *Peltophorum pterocarpum* (Tamil–Manjakondrai), *Madhuca longifolia* (Tamil–Eluppai maram), *Syzygium cumini* (Tamil–Naval maram), *Ficus glomerata* (Tamil–Athi maram) *Albizia lebbek* (Tamil–Vagai) etc.

### 3.3.1.5 Hedge plants

The common hedge plants grown in Pondicherry region are, *Justicia adhatoda* (Tamil–Adatodai), *Ipomea carnea* (Tamil–Neyveli Kattamanakku), *Jatropha curcas* (Tamil–Kattu amanaku) *Opuntia dillenii* (Tamil–Nakatali), *Euphorbia antiquorum* (Tamil–Sadurakkalli), *Agave sisalana* (Tamil–Kathalai), *Lantana camara* (Tamil–Unnichi), *Vitex negundo* (Tamil–Nochi), *Ricinus communis* (Tamil–Amanaku), etc.

### 3.3.1.6. Ornamental plants

The ornamental plants more are less rare, grown in the gardens, parks and backyards for ornamental and economical purposes. It includes *Caryota urens* (Tamil–Koondhal panai maram), *Corypha umbraculifera* (Tamil–Kudaippanai), *Areca catechu* (Tamil–Pakku maram), *Borassus flabellifer* (Tamil–Panai maram), *Cocos nucifera* (Tamil–Thennai maram), *Pandanus tectorius* (Tamil–Thazai maram), *Moringa oleifera* (Tamil–Murangai) *Allamanda cathartica* (Tamil–Manjal patti) *Antigonon leptopus*, *Bougainvillea spectabilis* (Tamil–Kahithapoo), *Hibiscus rosa-sinensis* (Tamil–Sembaruthi), *Caesalpinia pulcherrima* (Tamil–Mayilkondrai), *Lawsonia inermis* (Tamil–Maruthondri), *Plumeria alba* (Tamil–Alari), *Quisqualis indica* (Tamil–Rangoon malligai), *Jasminum grandiflorum* (Tamil–Malligai), *Polyalthia longifolia* (Tamil–Asoka maram), *Nyctanthes arbor-tristis* (Tamil–Pavazhamalli) *Rosa damascana* (Tamil–Roja), *Michelia champaca* (Tamil–Shenbaga maram)

### 3.3.2 MANGROVES.

#### Status of mangroves in Pondicherry region :

Species diversity of mangroves is very much limited in Pondicherry region. It is present in the estuaries and the riverine sides of Ariyankuppam river and Malattar. A well developed *Avicennia* patch is present in Thengaithittu and Murthikuppam.

*Avicennia* and *Clerodendrum* is present in all the deltaic regions of Pondicherry region. However, only *Excoecaria* in Murthiuppam river and *Bruguiera* at Ariyankuppam are only seen in this area. *Rhizophora* is found on the sides of Ariyankuppam bridge and in Veerampattinam region.

It is observed that few birds like common Myna, Pied Kingfisher, Little Egret, median Egret, common sand Piper and Red wattled Lapwing are commonly notice in the *Avicennia* patch Thengaithittu.

The wildlife in mangroves include insects , molluscs, fishes, amphibians, reptiles and even microscopic plankton.

Except in Chunnambar where the soil is sandy , the remaining river beds are ideal for mangrove development in future.

In order to develop these river banks into a mangrove area, awareness should be created among the local people about the mangroves which are breeding grounds for fingerlings, crabs, reptiles molluscs, and the role played by the mangroves in the coastal area as shelter belts, which also play a major role in protecting the inland coastal villages from tidal waves, besides acting as a guard against cyclone.

The existing mangrove species and associates in Pondicherry region are as follows:

<i>Avicennia marina</i>	<i>Clerodendrum inerme</i>
<i>Avicennia officinalis</i>	<i>Hibiscus tiliaceaus</i>
<i>Bruguiera cylindrica</i>	<i>Pandanus tectorius</i>
<i>Rhizophora apiculata</i>	<i>Suaeda martima</i>
<i>Rhizophora mucronata</i>	<i>Suaeda monoica</i>
<i>Excoecaria agallocha</i>	<i>Sesuvium portulacastrum</i>
<i>Acanthus ilicifolius</i>	

### 3.3.3 SACRED GROVES

#### Sacred groves of Pondicherry Region.

Pondicherry bio-region with a land mass of 293 sq.Km, devoid of natural forest, but has been bestowed with patches of sacred groves which may be termed as natural islands of climax vegetation, maintained and preserved for centuries in the name of God and usually looked after by the local communities.

The sacred groves appear in different forms in different parts of India, they are known as "Koilkaddu" in Tamil Nadu / Pondicherry, Kaavus and Pambu Kaavus in Kerala. Devara kaadu, Hulidevara kaadu and Pavithravana in Karnataka.

The presiding deity of Tamil Nadu / Pondicherry sacred groves is Aiyandar in the centre, flanked by his two consorts Poorani and Porkalai in a stone slab. Terracotta images of horses and elephants are also seen, which are generally offered by the people who conduct festivals annually. The temple structures had been started without any images, then a stone

slab with images which were housed initially and later they were built in big way, which is seen nowadays everywhere, after clearing the existed vegetation.

From the environmental point of view the small patches of forest were often left untouched, because people repose immense faith in God and believe that God will be infuriated if the vegetation or the wild animals are harmed. Unfortunately due to modern developmental activities and Anthropoic pressures in the form of timber extraction, fuel wood collection, collection of medicinal plants and encroachment of land for agricultural thrashing, these groves faced destruction.

Recent enumeration of sacred groves in Pondicherry region has revealed that it possess nearly 250 species of higher plants. The distribution of species is varied from grove to grove. Despite signs of degradation they harbour some rare, endangered and threatened plants. The following plants are observed.

*Derris ovalifolia* of Fabaceae has been rediscovered after a Century from the type locality i.e., from Pondicherry.

*Santalum album* of Santalaceae, which is threatened taxon, is seen in Pooranankuppam and Sedarapet grove.

*Mallotus philippensis* of Euphorbiaceae and *Agalaia elaeagnoides* of Meliaceae, which are mountainous ever green species are seen in Pondicherry.

Tropical dry evergreen species like *Atlantia monophylla*, *Pamburus missionsis*, *Glycosmis pentaphylla*, *Lepisanthus tetraphylla*. *Diospyros ebnum* are generally seen in this region.

\*\* *Amorphophalus sylvaticus*, an endangered species has found asylum in Karasur grove.

The regionally threatened taxa namely, *Gloriosa superba* and *Gymnema sylvestre* which possess high medicinal value, are seen as a part of ground vegetation in a couple of sacred grove .

Valuable medicinal tree, "*Crateva religiosa*" which is also used for carving toys and "*Salvadora persica*" are found in good population, surviving in alkaline soil at Kizhur grove.

Very huge lianas with Girth at Breast Height (GBH) more than 45 cm. indicates the age and the climax condition of the nature in a few groves. The lianas such as *Combretum ovalifolium*, *Derris scandens* and *Derris ovalifolia* are confined only to the groves and not in the surrounding plains.

Two species of *Dioscorea* viz., *D. oppositifolia* and *D. pentaphylla* which have been over exploited for the medicinal purposes resulting in endangered category, also occur in the groves.

### **3.4. FORESTRY**

Union Territory of Pondicherry does not have forest resources in abundance and in fact there is no recorded forest area in Pondicherry. But this scenario does not adequately reflect the actual plant and animal diversity existing in Union Territory. Detailed data is not available, as no exhaustive inventory of diversity has been taken up in Pondicherry till date. There are indications that Pondicherry does have a significant diversity in plants and animals existing in all the four regions. The biodiversity in Pondicherry, for forestry and wildlife purposes, may be classified and studied under different heads.

#### **3.4.1. Social Forestry**

Social forestry can aptly be defined as forestry of the people, by the people and for the people. Since September, 1986, the social forestry programmes have been implemented by the Department of Agriculture, Local Administration Department, Animal Husbandry Department and the

Public Works Department in Pondicherry. The Local Administration Department planted trees in their own land, while the Animal Husbandry Department planted trees in Ossudu and Bahour regions and Public Works Department planted the trees along the road sides and the banks of the tanks. Though many departments were involved in this programme, complete data is not available.

In the national level there is no projection of green cover status of the Union Territory of Pondicherry because of non availability of forest area in Union Territory of Pondicherry as well as any data on other plantations in complete shape. In the year 1997, a separate "Department of Forests and Wild Life " was created. Now the Department feels that there should be complete data of plants created by the different Departments / Institutions / Quasi Government Organizations / individuals to focus it in the national level. The Forest Department is very enthusiastic about taking up various projects in order to document forests and forestry activities.

#### **3.4.2. Productivity**

Any dynamic and successful forestry programme would reduce the stress on our natural forests. The productivity of wood per unit ha / per unit time could be enhanced by the following initiatives.

- ( i ) proper manipulation of silvicultural and nutritional requirements ( use of fertilizer, irrigation, bacterial and mycoryhizae inoculations
- ( ii ) disease and pest management
- ( iii ) advanced techniques in forest tree breeding for superior genetic strains, and
- ( iv ) the use of tissue culture methods.

The major objectives of the social forestry are

( a ) use of public and common land to produce fire wood, fodder, and small timber for the local poor men and also to manage soil and water conservation in a decentralized way

( b ) to relieve pressure on conservation of forests. This programme, in fact is for the poor, which aims at intensification of nursery operation at village level for multipurpose species, for fire wood, fodder, poles, fruits etc., by involving school children and villagers

The regions of Union Territory of Pondicherry fall in three different geo – climatic regions. Therefore, while natural vegetation in Pondicherry and Karaikal region comprises species of Tropical Dry Evergreen Forests, in Mahe region it corresponds to Tropical Wet Evergreen Forest.

Although in Pondicherry and Karaikal and Mahe regions no large tracts of forest are available there are small patches of protected forests still existing in the form of private forests (such as Swadeshi Cotton Mill premises) or sacred grooves (such as Ayyappan Kavu, Chembra Hills, Mahe) etc, Plant diversity in such patches needs to be ascertained by identification and enumeration and also it should be preserved.

### **3.5 WILD LIFE**

#### **3.5.1. Wild Animals Diversity**

Wild animal population in Pondicherry comprises small mammals, birds, reptiles and amphibians as well as insects, but vivid data is not available. Significant bird populations may be spotted near wet lands, such as tanks, well wooded areas such as Botanical Garden. Two of the tanks, viz. Oussudu and Bahoor tanks, have been declared to be areas closed for hunting under Wildlife Protection Act (1972)

Bird population at Oussudu has been surveyed in the past during winter season but no other study is available to indicate details of native and migratory bird diversity. However, instances of poaching of animals nomadics and tribals are reported.

### **3.5.2. Status of Wildlife in Pondicherry**

Though Pondicherry State is neither having reserve forest nor scrub jungle to support Wild Animals, but it has wetlands such as Ousteri and Bahour Tank (fresh water) , the marshy area near light house (brackish water) and extended backwaters found in Karaikal, which attract huge number of migratory water birds, both migrants and residents. They include mainly ducks, teals ,pochards waders which are mainly coming from very far off places mostly from north and central Siberia. These water fowls arrive here in late August and in early September and depart in mid April after spending their winter in India.

The following wild animals other than birds are known to occur in this state.

They are, Jackal, Black Napped Hare, Bonnet Macaque, Jungle Cat, Civet Cat, Mongoose, Monitor Lizard, Olive Ridley Turtle and Leather Backed Turtle.

The endangered marine reptiles like Olive Ridley Turtle and Leather Backed Turtle are believed to breed along the shores of Pondicherry and Karaikal. Among the birds, the rare birds like Pelican, White necked stork and Glossy Ibis are recorded in good numbers in Ousteri tank. The crested Pochard which is considered to be rare species in South India is found in thousands in Kaliveli Tank and in hundreds in Ousteri Tank.

### 3.6 ANIMAL HUSBANDRY

For the last two decades, due to the efforts taken in the Cross Breeding Programme there is substantial increase in the cross bred population.

Livestock	population as per census 1997
Cross bred cows	49852
Non descriptive cows	22917
Buffaloes	4042
Sheep	1929
Goats	40719
Pigs	1256
Horses and ponies	85
Donkeys	18
Dogs	13218
Rabbits	654
<b>TOTAL</b>	<b>134684</b>
<b>Total No. of Poultry</b>	<b>121276</b>

#### 3.6.1. Dairying

Due to the efforts taken by the Dept. of Animal Husbandry, Government of Pondicherry, and The Pondicherry Co operative Milk Producers Union .Ltd , the dairy development in the Union Territory has shown a remarkable improvement and increase in the milk production. The

milk production has gone up to 84150 liters per day in 1998 from 15814 liters per day in 1980. 50000 liters of milk is collected from 110 Primary milk Co operatives, with in the radius of 30 Km. Under the jurisdiction of The Pondicherry Cooperative Milk Producers Union.

### **3.6.2. Poultry**

There is no significant development in Poultry in the Union Territory. The egg production is 0.90 lakh. per annum, which accounts to 20% of the total requirement. The remaining 80% is received from the neighbouring states. The broiler industry is fairly widespread with capacity of birds ranging from 200 to 1000. The total number of birds is approximately is 1.21 lakh..

## **3.7. MARINE BIODIVERSITY**

The Union Territory of Pondicherry comprises a costal line of 45 Km. with 675 Sq. Km.of in-shore waters, 1347 Ha. of inland water and 800 Ha. of brackish water fisheries. The production of fish was 900 MT. in1954 as against 4,350.000 MT of Inland fishing and 38,950.000 MT of Marine fishing. There are 27 Marine fishing villages with a population of about 43,395, out of which 10,000 marine fishermen are actively engaged in fishing. At present about 7300 traditional crafts are engaged in marine fishing. The Union Territory is promoting development of sustainable and responsible fisheries. The Main varieties caught are Mackerel, Sardines, Perches, Ribbon fish, Flying fish and Shrimps.

The major varieties of fishes landed during the different months are as listed below:

<b>Type of fish</b>	<b>Month of catching</b>
Sardine	: October to April
Anchovies	: May to November.
Seer fish	: October to March.
Flying fish	: May to July.
Silver Bellies	: August to April.
Shrimps	: January to August.

The ocean forms the largest environment for living organisms on earth. The forms of animals and plants life in the waters are incredible in their biological diversity. The ocean provide shelter to different kinds of life forms thereby acting as a greater reservoir of Marine Biodiversity. The biodiversity of the seas around India is very rich with diverse species of flora and fauna.

Diversity of coastal system is affected directly or indirectly by human activities, which include over exploitation of fishes, costal aquaculture, physical alteration of the habitant by trawling, dredging, drilling, dumping etc.

It is noticed that the following varieties were caught either less in number or found rarely.

<b>Tamil name</b>	<b>Scientific name</b>
Sudumbu	Lactarius lactarius
Kala	Polynemus sp.
Mayilkola	Histiphorus sp.
Yamankola	Xiphias sp.
Sudai	Pellona sp.
Kuthuwa	Ilisha fligera
Vellai vavva	Stromateus cinerus.

This is due to over exploitation, climatic factors, sudden changes in water current and indiscriminate fishing during breeding season. In order to conserve the above fishes the administration of Union Territory of Pondicherry has issued a ban order for 45 days to restrict fishing operation from 15 th April to 29 th May of 2001.

In the recent past , the population of the turtles is diminishing due to large consumption of the eggs by people as well as non- human predators, poaching of adults for leather, hide and shell. Moreover loss of beach erosion and change in habitat have contributed to the reduction in the population of the turtle. They have been serving as an important source of protein for those who dwell in the costal area, specially fishermen community.

Turtles totally depend on aquatic existence excepting while egg laying, during that time they face grave danger. Because of this turtles are recognised as endangered animals by the International Union for the Conservation of Nature and Natural Resources. Among the turtle species available in Indian waters, the Olive Ridley is circum global and widely distributed. The turtle species frequenting Pondicherry coast was identified as Oliver Ridley.

### **3.8. POLLUTION**

The density and the percentage increase in population here are comparatively higher than the other parts of the country. Literacy rate and per capita income are also higher. Initially agriculture and fishing formed the major source of income but now the trend is more towards greater involvement in industrial activities.

Even though the contribution of industries, to the environmental problems of Pondicherry is high there are other factors which also contribute substantially to environmental problems. These factors which are the result of population growth and the deficiency of infrastructure needed to cater to the ever growing population in the Union Territory. Some of the other factors which contribute to environmental degradation in Pondicherry are the absence of proper facilities for the treatment and disposal of Domestic waste water, Municipal solid waste, Bio-Medical waste, Vehicular pollution, Noise Pollution, and the other issues like, the location of industries.

The other sources of pollution like Municipal solid waste, liquid effluents, bio-medical waste, vehicular exhausts and the other related sources also make a major contribution to the environmental problems of Pondicherry town. Most of the major cities and towns of the country do not have proper inventorization of these sources of environmental problems. The other sources of pollution like Municipal solid waste, liquid effluents, bio-medical waste, vehicular exhausts and the other related sources also make a major contribution to the environmental problems of Pondicherry town. Most of the major cities and towns of the country do not have proper inventorization of these sources of environmental problems. The process of urbanization is visibly more in the city and is on the increase , day by day in the city, consequently the solid and liquid waste generation is more, resulting in major environmental problems.

Unplanned development of our towns and cities has created serious environmental problems, leading to lowering of living standards. Scarcities of basic requirements like drinking water, proper drainage facilities for wastewater, inadequate sewage treatment and disposal facility puts our towns environmentally in a tight spot. The waste water generated from the domestic sources in our towns poses a major threat to the water resources, as this waste water is a potential source of water borne diseases. If the wastewater is not

treated and disposed of properly, this problem is going to affect our life considerably. Thus the proper sewage treatment and disposal systems become a prime necessity of today's society. In Pondicherry also the treatment and disposal of domestic sewage poses a difficult task for the authorities, with the constant increase in population the task of managing domestic waste water has become a major issue of the day.

Quantity of domestic Waste water generation in the city :

*At the national level ground water resources are estimated at 26.5 million-hectare meters. (Source: New dimensions in water Environment and ecology by R.K.Gurjar) Ground water availability in Pondicherry region is 152MCM (Report on water resources of Pondicherry region and its Management by Agriculture Department Pondicherry).*

Public Works Department of the Government of Pondicherry supplies potable water to the urban and suburban regions of Pondicherry. Around 60 MLD potable water is drawn through bore wells, which are maintained by Public Works Department. The normal per capita consumption of water in Pondicherry is 140 lit/day.

The waste water generation is generally quantified in two ways, they are:

1. Taking 80% of the total water supply.
2. Monitoring of actual wastewater generation.

*The first option was not taken, as the actual water supply could not be estimated because, huge amount of ground water being extracted in this region is unaccounted. Therefore, the second option was chosen in this study and the sewage flowing through various drains was monitored to assess actual wastewater generation.*

The total quantity of domestic sewage generated in the Pondicherry town and out skirts is around 50 MLD. Out of 50 MLD, 10 MLD is collected through proper sewer lines and treated.

### **Extent Of Sewerage And The Present Practices Followed For Treatment And Disposal**

The total quantity of domestic sewage treated at the oxidation ponds is around 10 MLD. The Pondicherry underground sewerage system is in operation since 1980. At the initial stages, sewer lines were laid within Pondicherry Town Boulevard, covering a population of 1.25 lakhs. The outskirts of the town and its fringes, newly developed areas like Thirumudi Nagar, Govindasalai, V.O.C Nagar, Muthialpet, T.V. Nagar, Kuruchikuppam, Vaithikuppam, Sinnayapuram and Ganesh Nagar etc. were added subsequently to cover a population of 1.25 lakhs. In Pondicherry town 5962 houses are connected with under ground sewer lines and in the sub-urban area and town fringes 3101 houses are connected.

The remaining quantity of sewage water is flowing through upper canal ,grand canal into the Karuvadikuppam drain. The sewage flowing through these canals are discharged into the sea.

### **Present Mode Of Disposal Of Domestic Sewage:**

The sewage water from the houses is being collected through underground sewer lines and pumped into a series of three oxidation ponds at sewage farm Lawspet, near Airport for bio-chemical treatment. The treated water is being disposed to the Horticultural farm through Irrigation drains and is used to irrigate various crops in the sewage farm having an area of about 225 acres. The crops raised in the farm are fodder, grass, tapioca, cashew nuts, and coconut grove, mango, bamboo and silk cotton trees.

The entire collection of sewage water from zones I & II is collected in the main pumping station collection wells. The sewage is passed through screen well and let into two suction wells from where it is being pumped to an Intermediate pumping station located about 4Kms away and about 10mts height from the Main pumping station on the way to oxidation pond.

The present mode of disposal of sewage will lead to contamination of coastal water as well as ground water. So, it is necessary to collect the entire sewage for treatment and proper disposal, by this way environmental degradation could be avoided.

### **3.9. WASTE MANAGEMENT**

#### **3.9.1. SLAUGHTER HOUSE WASTE**

. The management of solid waste and slaughter houses is one of the essential public health services and it is the statutory duty of municipal bodies.

The present population of Pondicherry town is 3.3 lakhs including floating population and its area is 20.8 sq. km. Pondicherry Town has only one slaughterhouse under the control of Pondicherry Municipality at Dr. Ambedkar Nagar. Oulgaret Municipality has a future proposal to establish a slaughterhouse.

The slaughter house maintained by the Pondicherry Municipality is manual, where "Halal" method of slaughtering is followed and the animals are slaughtered by bleeding and the blood is collected and sold on the spot. Approximately, 30 – 40 animals are slaughtered per day and on Sundays 200 – 250 animals are slaughtered.

A veterinary doctor controls the slaughterhouse, under whose supervision slaughtering is done. As per the IS 4393 – 1979, the slaughter Halls and ancillary accommodation rules were followed.

Drainage facilities are available, lighting and ventilation is adequate, safe-potable and constant supply of fresh water is available and also stamping ink is issued the approval after examining that the animals are free from diseases.

#### **3.9.1.1. Drainage**

All parts of the floors where wet operations are connected with good drainage facilities and the floor is well constructed to enable easy drainage of the liquid coming out from the washing of carcasses.

#### **3.9.1.2. Supply of water**

A sufficient safe, potable and constant supply of fresh water is available throughout the premises with adequate pressure. A thorough and efficient washing of carcasses, and floor washing of the slaughter floor and working environment is being done. Persons working in abattoir have sufficient facilities for washing their hands and equipments.

#### **3.9.1.3. Consumption of water**

Water is used during the slaughtering of animals i.e. for carcass washing, washing of hands, etc. The per capita consumption of water required is 60-70 liters / Bovine and 30-40 liters for sheep and goat.

#### **3.9.1.4. Waste water generation and disposal**

As far as this slaughter house is concerned, little wastewater is generated. Spillage of body fluids is being washed and cleaned using bleaching powder and discharged into Upper Canal. This drainage now carries the domestic sewage and acts as a domestic sewer. A part of the Pondicherry waste water is let out into this canal and it reaches the sea. The quantity of the waste water generated due to slaughtering of each animal is about 60-65 liters / Bovine and 30-35 liters per sheep or goat.

#### **3.9.1.5. Slaughter House Waste Water Analysis Report**

To assess the quality of waste water generated in the slaughterhouse, samples have been collected from the slaughter house and analysed for some specific parameters. The waste water generated in the slaughter, its odour is very strong, the TSS, oil and grease value is found to be very high when compared to the standard. But BOD is within the prescribed standard limit.

At present, the slaughter house waste is being let out into municipal sewer, without any treatment. Before being let out into the sewer, the slaughter house waste should undergo primary treatment such as screening, oil and grease separation etc.

#### **3.9.1.6. Solid Wastes**

Solid waste generated by goat, sheep, and large animals from the slaughterhouse is nearly 20 to 25 Kg/day. These solid wastes are purely organic. Hence it is collected separately and dumped in the manure pit. After accumulation of a certain load it is auctioned to the public and used as agricultural manure.

### **3.9.2. BIO MEDICAL WASTE**

Bio-medical waste may be defined as: “any solid, fluid or liquid waste, including its container and any intermediate product which is generated during the diagnosis, treatment or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biological and the animal waste from slaughter houses or any other like establishments”. The rapid urbanization and haphazard urban development has led to over crowding of towns and cities. The stress and strain of modern life has caused health impacts of both general and serious nature. To restore the community's health there has been a spurt in the number of hospitals both in the private and public sectors. The growth in hospitals has accentuated the problem of bio- medical wastes and their management.

Though hospitals are meant to restore human health, the disposal of hospital wastes is a matter of concern. Hospital wastes generated from different units of hospitals cause serious health hazards. Common people are exposed to improperly handled bio-medical wastes, which are responsible for causing communicable diseases. Skin contact, injection and inhalation are possible routes of exposure, which could cause chronic effects and acute health problems. Hepatitis “B” and AIDS are two such blood borne infectious diseases which could spread if bio-medical waste is not properly treated.

The total BioMedical Waste generated by the health care establishments in Pondicherry is estimated to be approximately 88,433 Kg/month and that there is no uniform method for the disposal of Bio medical wastes. As there is no special mode to transport health care wastes, workers who are employed by the Municipality for handling municipal wastes are also engaged for Hospital waste collection, transport and disposal. At present due to non-segregation of the wastes, hospital wastes gets mixed with general garbage in the city and since the organic content of domestic garbage is high there may be chances for contamination of all the waste.

In majority of the health care establishments, hospital wastes are collected in plastic bags but colour coding and labeling of containers is not followed. Recently Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) and Vector Control Research Centre ( VCRC) have started separate containers to handle biomedical waste and incinerators are used to dispose it off.

Of the different categories of waste produced, solid waste forms a major portion (92%). Of the total waste generated, 52% belongs to solid waste consisting of items contaminated with blood and body fluids and 40% belongs to the solid waste is either being incinerated/buried. Animal waste & biotechnology waste form a very small percentage, of the total waste generated.

About 62% of the hospitals generating waste sharps, mainly of needles, syringes, scalpels, blades etc. are not being disinfected/ mutilated prior to their disposal. The waste comprising discarded medicines and cytotoxic drugs are either being buried as sent by the suppliers. In about 62% of the hospitals liquid waste is being discharged into drains without any preliminary treatment. The study also shows that about 73% of the health care establishments dispose their wastes within hospital premises and the rest is given to Municipality.

#### **3.9.2.1. ORGANISING TRAINING / AWARENESS PROGRAMMES FOR PUBLIC AND FOR AUTHORITIES DEALING WITH MANAGEMENT OF BMW**

To familiarize medical practitioners & others dealing with handling biomedical wastes, with the provisions of these rules and procedures to be adopted for proper treatment and disposal of Biomedical wastes, Pondicherry Pollution Control Committee has conducted two workshops one at JIPMER and the other at General Hospital, Pondicherry. Senior medical professionals and other health workers involved in handling biomedical wastes from Government Hospitals and JIPMER participated.

### **3.9.3. VEHICULAR POLLUTION**

A rapid increase of the industrial, commercial and the day to day activities has caused an explosive growth in the vehicular population. There has been a steady increase in the vehicular population from 6.5 to 12.2% per year. Vehicular Population has doubled during the period 1990-1999 . As in other parts of the country the trend in increasing vehicle population is the same in Pondicherry also year after year. The total number of vehicles on the road in 1999 was 1,67,263 of which 1,26,875 were two wheelers.

Pollutants emerging from automobile exhausts draw the attention of Scientists, technologists and communities primarily because these Pollutants contribute to photochemical smog and significantly to air pollution.

The pollutants emitted by automobiles are both of primary and secondary nature. The primary pollutants include carbon monoxide, hydrocarbons, oxides of nitrogen, sulphur-di-oxide, lead, and carbon particles. The secondary pollutants include the photochemical smog. The sources of air pollution from the automobiles are exhaust pipe, crank case, fuel tank and carburetor

During the period from 1992 to 1999, twenty series of vehicular exhaust monitorings were conducted in which more than 2,000 vehicles were monitored.

During the year 1999 alone, 1132 vehicles were monitored in the city at several important locations during day time. CO/HC Analyzer was used for monitoring of petrol driven vehicles and smoke density meter was used for monitoring diesel driven vehicles. During the monitoring, it was found that some vehicles particularly three wheelers emit high density of environmental pollutants.

### **3.9.3.1 Petrol driven vehicles**

In the year 1999 alone, 804 petrol driven Vehicles were monitored which included 590 two wheelers, 166 three wheelers and 48 four wheelers of different makes. It was observed that a total of 712 vehicles were meeting the standards.

Altogether 88.6 % of the petrol driven vehicles were meeting the specified standards and 11.4 % of the petrol driven vehicles were not meeting the stipulated standard. About 7.8% of the two wheelers and 14.1% of the three wheelers did not comply with the standards. The emission status of four wheelers was found alarming as 43.7% of the four wheelers were not meeting the standards.

### **3.9.3.2. Diesel Driven Vehicles**

A total number of 328 diesel driven vehicles were monitored in 1999 which included 6 two wheelers, 35 three wheelers and 287 four wheelers (Buses, Lorries, Mini lorries, Vans etc. of different makes) at peak hours in commercial and traffic area. It was observed that 184 vehicles (56.1%) were meeting the standards. However 144vehicles (43.9 %) fail to meet the standards.

It is noticed that among the diesel driven vehicles, 66.6 % of two wheelers 85.7% of three wheelers and 38.3 % of four wheelers were not meeting the standards.

During the vehicular exhausts monitoring a report on the vehicular exhausts was handed over, in respect of the monitored vehicles, to the concerned vehicle owners with clear-cut instructions about the emissions levels. In case vehicles are not meeting the stipulated standards, the owners were asked to tune their vehicles for achieving the full combustion of fuel. A copy of the report is also marked to the traffic control unit of Police Department for taking necessary legal action.

### **3.9.4. NOISE POLLUTION**

Noise is measured on a logarithmic scale called “decibel”(dB). According to WHO standards a level of 45dB is considered to be a safe noise level for a city. By international standards a noise level up to 65 dB can be taken as tolerable.

The sources of noise pollution, are many. Major ones of these are vehicular sources, commercial activities, construction activities, and others. Noise is described as any unwanted sound that has deleterious effects on health and affects the physical and psychological well being of the person. Traffic is the main source of noise pollution in the city. Noise intrusions are especially annoying when they are needless, for example, loud speakers or the acceleration of a noisy motor bike or a car operating without a muffler or the blow horns. Increasing noise levels are also resulting in major social problems. Thus there is a great need for regulating noise pollution.

#### **3.9.4.1. Rules**

The union Ministry of Environment & Forests has notified the Noise Pollution (Regulation & Control) Rules, 2000, under the Environment (Protection) Act 1986. The Rules have since come into force in Pondicherry also with its publication in the Government Gazette. The notification stipulates that, loud speakers or public address systems, shall not be used without written permission from the competent authority. It bans the use of these systems at night between 10.00 P.M. and 6.00 A.M., except in closed premises such as conference rooms.

The notification also bans the use of vehicular horns, musical & other public performances, beating of drums and use of sound amplifiers in silence zones, defined as an area 100 m around hospitals, educational institutions and courts.

The notification stipulates that the State Governments may categorize areas into industrial, commercial, residential & silence zones for the implementation of noise standards. The categorization of areas to be notified in Pondicherry is in progress with the assistance of the Town Planning Department.

The Government of Pondicherry has been monitoring the noise levels in different areas. Some of the findings are given below.

#### **3.9.4.2. Residential Area**

In residential areas, Muthialpet, Lawspet, JIPMER quarters and Mudaliarpet are the four different locations. Except Muthialpet, in all other locations, the day time noise levels exceed the ambient noise standards of 55dB(A). The  $L_{eq}$  values, which represents noise energy, varies from place to place and from time to time. The daytime (6.00A.M to 10.00P.M)  $L_{eq}$  values in Muthialpet, Lawspet, JIPMER quarters and Mudaliarpet was 52.8,61.3,59.0 and 65.0 respectively. While night time  $L_{eq}$  value for Muthialpet, Lawspet, Jipmer quarters and Mudaliarpet at 51.6, 71.7, 55.0 and 73.3, respectively are higher than 45dB(A) standard for residential area during nighttime.

The higher noise levels in the residential areas were mostly due to traffic movement and the residents in the areas situated near main roads with high traffic density are exposed to higher noise levels.

#### **3.9.4.3. Commercial Area**

The representative commercial area, which is also a high traffic area, identified for monitoring of noise levels was New Bus Stand, Ajantha Theatre crossing, Raja Theatre crossing and Chief Secretariat. Noise levels in all the areas are exceeding the prescribed standard limit. The day time  $L_{eq}$  values in New Bus Stand, Ajantha Theatre crossing, Raja Theatre crossing and Chief Secretariat were found to be 85.4,88.4,75.5 & 65.9 units respectively, which are much higher than 65 dB(A) specified in the standards.

The night time  $L_{eq}$  values in New Bus Stand, Raja Theatre crossing, Chief Secretariat & Ajantha Theatre crossing were found to be 78.5, 73.6, 51.2 & 77.8 units respectively, which are much higher than the prescribed limit of 55 dB (A). But when compared to the daytime  $L_{eq}$  values they are less. The higher noise levels during the day as well as night are due to the noises from the large number of motor vehicles plying in these areas. The higher noise levels in almost all the commercial areas are mostly due to heavy traffic.

#### **3.9.4.4. Industrial Area**

In Mettupalayam and Thattanchavady Industrial Estates, the noise levels have been measured. The  $L_{eq}$  values were found to be less when compared to the standard noise levels (75dB (A)). The daytime noise levels ( $L_{eq}$ ) in Thattanchavady and Mettupalayam was found to be 60.8 and 63.5, respectively. This may be because of destructive interference of different types of noise in daytime  $L_{eq}$  Values. Out of four different areas, only these areas have shown noise levels below the specified standards. The night time noise levels in Thattanchavady and Mettupalayam were observed to be 66.6 & 65.5 which are above the day time noise levels but falling within the standard limits.

#### **3.9.4.5. SILENCE ZONE**

A representative silence zone at Children's park and Bharathi park was identified for monitoring the noise level. The Raj Nivas, Legislative Assembly, Public Library, Pondicherry Memorial and Govt. Hospital are situated in near proximity. In both the locations the day time noise levels ( $L_{eq}$ ) are found to be exceeding the standard value, which are 50dB (A). The daytime noise levels in Children's Park and Bharathi Park are 68.4 and 64.2, respectively. The night time noise levels in Children's Park and Bharathi Park were found to be 62.5 and

53.2, respectively which are higher than the standard limit of 40 dB (A). This may be due to the fact that general noise level in this area is not mainly due to traffic and possibly different patterns of noise interference during day and night hours.

### **3.9.5. INDUSTRIAL POLLUTION**

The Union Territory of Pondicherry is having 40 large industries, about 115 medium and about 6199 small-scale industries. There are 6 major industrial estates, 2 growth centres, and 3 industrial clusters have been developed. Of the existing industries in the Union Territory of Pondicherry 11 industries come under the category of highly polluting ones classified by the Ministry of Environment and Forests and 15 industries are handling hazardous wastes. The contribution of industries to the environmental problems of Pondicherry, is comparatively more than any other source due to the existence of large number of industries in a small area and the consequent growth in population.

#### **3.9.5.1. Monitoring of Industrial Emissions**

During the year 1999 alone 66 air quality monitoring have been conducted. It has been observed from these monitoring results, that in general all the pollutants are within the permissible limits except in some units like Steel Ingot Units, Calcium Carbide Units, and Ferro alloys Units. These units were not meeting the stipulated standards mainly because of lateral emission and also due to their poor maintenance and irregular operation of air pollution control systems. In order to ensure regular operation, it has been ensured that the energy meters are installed along with air pollution control systems.

### **3.9.6. WATER POLLUTION**

The effluents discharged on to the land lead to seepage or percolation, which contaminate the ground water .

#### **3.9.6.1. Ground water contamination in Mettupalayam Industrial Estate**

High fluoride contents and low pH values have been noticed in the industrial estate Mettupalayam. Source of pollution were identified and further contamination was prevented. In order to assess the extent of damage caused to the ground water and to take remedial measures, a study has been conducted.

#### **3.9.6.2. Ground water contamination in Sederapet Industrial Estate**

High sulphate content was noticed in the ground water at Sederapet. This was due to over drawl of ground water. Further, there are no proper disposal points in the Industrial Estate. In order to control further contamination, high water consuming units and effluent discharging units were not permitted in Sederapet area.

#### **3.9.6.3. Ground water contamination in Kirumampakkam Area**

Based on several complaints from the public about pollution problems by the units in 1992 to 1993, an environmental impact assessment study was conducted in Pillaiyarkuppam and Kirumampakkam areas. The report revealed that air and water in the area were highly polluted and the report had recommended not to permit new pollution potential units or expansion of pollution potential units, therefore, no units were permitted in the area. Firm enforcement actions were taken against the existing pollution potential units for operating their anti pollution control systems for effective control of pollutants. A few units were closed down as per the Pollution Control Acts. Now, the area is under monitoring, and it is observed that there is improvement in the environmental quality of the area. In view of improvement, the ban is lifted for green category of units.

#### **3.9.6.4. Major polluting Industries operating in residential areas**

Pollution causing industries operating in residential areas of Pondicherry town are mainly two major pollution potential units & one modern rice mill. These units were permitted for the industrial activities long back, when there was no residential / Commercial development. Those units are:

M/s. Anglo French Textiles, Mudaliarpet - Textile unit of Government of Pondicherry.

M/s. Shri Bharathi Mills, Mudaliarpet - Textile unit of NTC.

M/s. Vinayaga murugan Modern Rice Mill

M/s ANGLO FRENCH TEXTILES (AFT).

AFT is one of the ISO 9002 largest Textile units in manufacturing of bleached dyed, printed & blended fabrics. It was commissioned in 1898, when there were hardly a few houses existing in that area. There is emission from the coal & lignite burning. The cyclone separators and dust collectors have been installed to control particulate emissions and a stack of 30 meters is provided for safe disposal. Stack monitoring conducted reveals that pollutants are within the standard limits. The effluent generated from the process is treated based on the extended aeration and activated sludge process. The effluent analysis also reveals that the system meets the standards and effluent is discharged into the municipal drain that reaches to the sea. Periodical monitoring of stack emissions, ambient air & effluent analysis are being done by the PPCC.

M/s SHRI BHARATHI MILLS.

It is a branch unit of the National Textile Corporation Ltd. New Delhi and commissioned in 1982, which manufactures polyester, cotton, viscose blended fabrics and cotton fabrics. Now residential/ mixed use development has come up around the unit. There is emission from the coal & oil burning activities. A multi cyclone separator has been installed at the boilers to control the particulate emissions & a stack of 30 Mts. height is provided for safe disposal. The stack monitoring results reveals that the pollutants are within the prescribed limits.

The effluent from process as well as domestic sources is treated through the aeration process. The treated effluent which is discharged into the Municipal drain finally reaches to sea. The treated effluent meets the standard limits except oil & grease. PPCC has directed the unit to provide additional oil & grease traps to meet the standards.

M/s VINAYAGA MURUGAN MODERN RICE MILL.

This is a paddy boiling and hulling unit commissioned in 1982. Now residential and commercial activities have come up around the unit. There was Air pollution problem from rice husk burning. A stack of 20 meters height has been provided for the disposal of emissions. As per the direction of the Pondicherry Pollution Control Committee (PPCC), the unit has provided a settling cum scrubbing system in the emission line for Suspended Particulate Matter (SPM) emission under check. The monitoring conducted after the above control system reveals that the Suspended Particulate Matter (SPM) in the ambient air is within the prescribed limits.

### **3.9.7. Plastic pollution**

One of the serious problems at present we are facing today is indiscriminate use and disposal of plastics. As we know that it is very harmful to health and environment, it is time we think seriously about the usage of it. People use plastics in daily life, like carry bags, plates, covers, disposable tea cups etc., with or without knowing the hazards it can cause to one's health and environment on the whole. One cannot miss heaps of used plastic waste almost everywhere and also scattered and thrown everywhere near almost every tea shop in our town. As it is non-biodegradable and does not decompose, the improper disposal of used plastics mainly clogs the drains in the city which ultimately results in regurgitation of sewage and domestic waste water which causes serious health hazards. The Government of Pondicherry has taken initiatives to ban the use of plastics, it has to exercise the rule with stringent measures. The government should consider this as a serious problem and it should take appropriate action to ban plastics completely so that we can save our planet from the danger.

## **4. STATEMENT OF PROBLEMS RELATING TO BIODIVERSITY**

Lack of awareness and pre sights and callous attitude towards nature as well as lack of criteria for economic evolution of bio-resources constitute the core from which many negative impacts on biodiversity conservation emerge. So it is important to identify the factors affecting the biodiversity and then to suggest the solutions.

### **4.I. AGRICULTURE**

Ever since the year 1958–59 the area put under plough in Pondicherry has been gradually decreasing while the area sown more than once has been steadily on the increase over a period of preceding two decades and then started declining or stabilizing in comparison with the net area cultivated. With the increase in the intensity of cropping, there has been continuous depletion of soil resources, particularly, the major plant nutrients as well as micro-nutrients. To replenish these nutrient resources, huge quantities of chemical fertilizers are applied to the soil continuously for years together, thereby changing the soil reaction constantly in terms of soil pH. which is one of the reasons for inhibiting the survival of the micro-flora and micro-fauna of the soil.

It is observed that there has been a drastic reduction in the area irrigated by surface water resources and there has been a corresponding increase in the area irrigated by ground water sources through the net work of bore wells. Consequently, large quantities of solvable salts including toxic substances like sulphides and iron compounds are increasingly brought about and deposited on the soil surface which are also responsible for inhibiting the growth of micro organisms to a larger extent.

Normally, following of cultivable lands for a specific length of period is a desirable agronomic practice to enable the soil to replenish its wear and tear and to recoup the plant nutrient resources for supporting the crop growth in the succeeding years. The statistics reveal that even though that the current fallows, other fallows and culturable waste are gradually increasing year after year, there is no restoration of cultivable land. It reveals the fact that these fallowing lands are nothing but unauthorized conversion of land use from agriculture to non agriculture uses like housing etc., which have become irreversible and it is quite obvious that the fallowing lands in the Union Territory is not being for the purpose of leaving any period of rest to the lands and the associated micro organism but only for other reasons and such of those lands on which cultivation is being practiced are continuously put under stress and strain with out any gap.

#### **4.1.1. WATER POLICY**

Of all the resources on earth, water occupies a prime position. Three-fourths of our planet is made up of water and yet only a small fraction of it is potable. Today the quality and quantity of our drinking water is in great danger. It is estimated that nearly 500 kinds of chemicals and bacteria affect the quality of water. Even after purification, some 200 of these still remain, some cancer causing. With increasing pace of industrialization, development of newer and deadlier chemicals and fertilizers, the situation is sliding from bad to worse. Apart from humans, all other living things like animals, fishes, birds, plants are also affected by the poor quality of water. Various factors contribute towards pollution of our water resources. Chief among them are – untreated effluents from industries, indiscriminate use of fertilizers, household waste like detergents and plastics, human waste and acid rain.

#### **4.1.2. OVER EXPLOITATION OF GROUND WATER RESOURCES**

Due to neglect of maintenance of irrigation tanks in Pondicherry region the entire burden of irrigation of all crops fell on ground water resources. Apart from this , the requirement of drinking water and industries are also met from the ground water resources. The net result is over development of ground water resources and decline of water table in the coastal aquifers and salinization of aquifers due to salt water intrusion. The water table has declined by 5 to 23 meters from the east to the north west of Pondicherry region between 1981 and 2001.

There is a telling effect on agriculture biodiversity due to over-exploitation of water resources and the damage caused to the coastal aquifers is irreversible. If the trend continues, the agriculture activities with in 6 Km. zone to the coast will be seriously affected with salt water intrusion and probably no irrigated crops could be grown with ground water in future.

Overuse of water resources , pollution of water and subsidy on water and power results in the change in cropping pattern and varieties, loss of native varieties and change in water table in certain areas and stagnation of water in certain areas.

Around 84 irrigation tanks is expected to be rehabilitated by the end of December 2004, under Tank Rehabilitation Project ( The European Union aided Project ), which would be able to irrigate 6000 hectares at least for one crop. Apart from this there would be enhanced recharge of the ground water aquifers by not using the tube wells and from the return flows of

the irrigated fields under the tank command areas. In order to conserve the ground water resources, field schools are conducted in the villages in participatory mode in crop water management and thereby awareness is created among the farmers to use water for irrigation of crops judiciously.

#### **4.1.3. EXCESSIVE USE OF PESTICIDES**

After the introduction of high yielding varieties from 1960s, the need for applying external inputs like chemical fertilizers and usages of pesticides for control of pest and diseases to get better productive in rice crop was inevitable. Extensive cultivation of paddy crop was undertaken in the Union Territory of Pondicherry for the past 25 years. Single crop had become as double crop and triple crop in this region and stage has come now where plateauing yields in rice crop.

Extensive damage done to the micro-environment of the agriculture fields by destroying predators, while controlling pest and diseases, caused total imbalance of various organisms in the field of agriculture Bio diversity.

Intensive campaigns were conducted for the past five years to control indiscriminate use of pesticides in the crops through Field Schools by adopting Integrated Pest Management concept (IPM). The usage of pesticide have come down form 106 MT. to 66 MT. over a period of 6 years. Integrated Pest Management (IPM) is proposed to be followed in the years to come to cover the other crops like groundnut, cotton, vegetables etc.,

To tackle the above said issues, the Dept. of Agriculture has conducted a detailed soil survey in the Union Territory of Pondicherry and the same has been documented. A detailed study of the status of

micronutrients available in the soils of Pondicherry region was conducted and documented. Inputs like green manure seeds, biofertilizer and enriched compost, neem cake and micronutrients are made available to the farmers at 75% and 50% subsidized cost. Integrated Pest Management practices are strongly advised to the farmers.

Non availability of adequate quantity of the raw material like garbage for the preparation of enriched compost and the inputs like green manure seeds for timely distribution to the farmers, is the major gap which is inhibiting the desired level of achievement

## **4.2. HORTICULTURE**

Horticulture crops occupy nearly 9.5 % of the total cropped area. The introduction of the high yielding varieties in this area for the economic benefit of the farmers and the over use of resources has resulted in the population reduction of indigenous seed materials of native species and thus the indigenous varieties have disappeared.

## **4.3. POLLUTION**

### **4.3.1. Consequences of Open drainage**

The pathogens that gain entrance into bodies of water arrive there via intestinal discharges. Further more *Escherichia coli* and related organisms designated as coliforms, fecal streptococci and *Clostridium perfringens* are normal inhabitants of the large intestine of the man and other animals. Thus the

presence of any of these bacterial species in water is evidence of excreta of fecal pollution of human or animal origin. Sewage containing human excreta, however is the most dangerous material that pollutes the water, people with communicable disease of many eliminate, the causative organisms in their excreta. The most important microbial, communicable diseases transmitted through polluted water are typhoid, paratyphoid, amoebic dysentery, bacillary dysentery, cholera and infective hepatitis.

The quality of waste water in grand canal, upper canal mixes with sea, the dissolved oxygen content is found to be nil in both upper & grand canal water, whereas in the mixing point D.O value is 5.8 mg/l it may be due to wave motion and improper mixing. In the sewage sea and river mixing point the total coliform count is 475 and the faecal coliform count is 130 which is not satisfactory. Faecal coliform is one of the indicators of faecal contamination and disease risk. This situation could be attributed mainly to the untreated sewage. In all the, three places, the oil and grease contents are observed to be above the standard values and in upper canal it is found to be very high.

#### **4.3.2. Effect of drain clogging and overflow**

During monsoon season, the clogging and overflow of drains is observed. Not only during monsoon, but also, now and then drains get clogged and cause overflow. This is because of the dumping of garbage, plastics etc. into the gutter. The clogging of drain leads to foul smell and also provides conditions inevitable for breeding of vectors. Because of this condition, many diseases like malaria, filarial, dengue fever, viral fever, brain fever result.

#### **4.3.3. Vehicular Pollution**

The rapid increase of the city with Industrial, commercial and the day to day activities has caused an explosive growth in the vehicular population. As in other parts of the country the trend in increasing vehicle population is the same in Pondicherry also year after year. Pollutants emerging from automobile exhausts draw the attention of scientists, technologists and communities primarily because these pollutants contribute to photochemical smog and significantly to air pollution. Motor vehicles traffic is the major and most important source of pollution in Pondicherry. As far as air pollution due to vehicular emissions is concerned, it is dependent on the following important factors. Type of vehicular traffic and their numbers, design and condition of the vehicles, Intensity of vehicle movement.

Normal air pollution caused due to vehicular movement on the road leads to generation of dust including Suspended Particulate Matter (SPM) from the roads and emission of gaseous pollutants such as SO<sub>2</sub>, NO<sub>x</sub>, CO and Pb from the exhaust of the vehicles. Apart from this, pollution also results due to spillage of diesel, petrol, lubricants, etc. on the roads.

Ambient Air quality was monitored in eight locations in the city for Suspended Particulate Matter, SO<sub>2</sub>, NO<sub>x</sub>, and Lead. During day time (10 hours to 18 hours) 8 hourly monitoring was conducted Near Old Bus Stand, Near Patel Petrol Bunk, Near Vasanthi Petrol Bunk, Near Swedeshi cotton Mill, East coast road – Kalapet, Indira Gandhi Statue, Ashram Petrol Bunk, Indira Nagar, Gorimedu.

#### **4.3.4. Suspended Particulate Matter**

Suspended Particulate Matter (SPM) was found to be high Near Old Bus stand (960 µg/m<sup>3</sup>) Indira Nagar Gorimedu (443.8 µg/m<sup>3</sup>) Patel Petrol Bunk

(381  $\mu\text{g}/\text{m}^3$ ) Near Swadeshi Cotton Mills (368  $\mu\text{g}/\text{m}^3$ ), Indira Gandhi Statue (209  $\mu\text{g}/\text{m}^3$ ) and Ashram Petrol Bunk (204.3  $\mu\text{g}/\text{m}^3$ ). Thus from the 8 locations surveyed, in 6 places the SPM is exceeding the standard limits. This is mainly due to the heavy vehicular movement in these areas. The SPM value in Vasanthi Petrol Bunk (77  $\mu\text{g}/\text{m}^3$ ) and East Coast Road, Kalapet (166  $\mu\text{g}/\text{m}^3$ ) was recorded below the specified standard limit of 200  $\mu\text{g}/\text{m}^3$ . In the town due to the more frequency of the vehicular movement SPM is more when compared to the East Coast Road. The increased level of SPM is due to the vehicular exhaust, i.e. incomplete combustion of fuel, un burnt hydrocarbon and due to vehicular movement dust blown up from the roadside.

#### **4.3.5. Respirable Particulate Matter**

Ambient Air Quality monitoring was conducted to find out the respirable particulate matter in the ambient air, in the following four locations; Near Indira Gandhi Statue, Near Muruga theatre signal, Near Raja theatre signal and Near New Bus stand. The  $\text{SO}_2$  and  $\text{NO}_x$  were also monitored in the four locations. The respirable particulate matter and total suspended particulate matter is found to be above the standard limit, this is mainly due to the more number of automobiles plying in these areas near Indira Gandhi Statue, Near Muruga theatre signal, Near Raja theatre signal and Near New Bus stand. However, the  $\text{SO}_2$  and  $\text{NO}_x$  values are found to be within the standard limits in these areas. The  $\text{SO}_2$  concentration in ambient air was found to be satisfactory in all the 8 monitored locations well within the stipulated standards limits. The oxides of Nitrogen concentration were found to be slightly higher in the two locations. East Coast Road Kalapet the  $\text{NO}_x$  concentration is 86.33  $\mu\text{g}/\text{m}^3$  and the location of Ashram Petrol Bunk is 82.53  $\mu\text{g}/\text{m}^3$ .

#### **4.4. PROBLEMS RELATED TO MARINE ANIMALS DIVERSITY**

Pondicherry has a significant long coastline. Issues pertaining to conservation of Marine life ( Marine animals and plants ) need to be identified and a conservation strategy developed. In fact extremely little data is available in this regard as far as Pondicherry is concerned.

##### **4.4.1. Threats**

Beach erosion : Beach erosion is also one of the threats to nesting habitats of the turtles along the Pondicherry coast. Because of the shore erosion the slope of the beach has become a hindrance for the upward movement of the turtle from the high tide water mark. Beach erosion was intensive along the beaches of Moorthikuppam and between Kanagachettykulam and Kalapet villages.

Fearing the possible loss of buildings due to erosion led the use of many methods to stabilize beaches. Along the Pondicherry coast, Government has erosion preventive embankments by piling large stones all along the coast from the new harbour area to Vaithikuppam which makes the nesting habitat unavailable to the turtles.

One of the major threats to the turtle nesting habitat is the violation of the Environmental Conservation Act (which prohibits the construction / establishment of any sort of buildings on the shore within 500 mt. From the high tide water mark). But contrastingly in earlier time, most of the buildings were constructed on the shore. In certain places most of the houses and beach resorts are located within 100 – 300 m. from the seashore.

The other threats identified are disturbances and predators. Now a days, the sea shore is always bustling with the activities by fishermen,

throughout night due to different methods of fishing which they adopt, such as “crab fishing” by burning torches out of burning cycle tyres and also by the internal conflict and disturbance between the neighboring groups of the near by fishing villages, which is a common feature, due to some reason or other, at present.

The beaching of the “Catamarans” all along the beaches near their settlements which completely occupies the nestling areas available to the turtles.

Artificial lights and the menace of the feral dogs have been an perennial threat to the nesting turtles.

## 5. Strategy and Action Plan

### 5.1. Gaps in Biodiversity

1. Lack of knowledge on nutritional value of traditional crops among people.
2. Lack of awareness about the benefits of crop diversity & local solutions employed by the farming community to increase the soil fertility.
3. Lack of information about the risk involved by excessive usage of fertilizers and pesticides.
4. No information is available on areas where traditional crops are still grown.
5. By and large, watershed management technologies have not reached the farmers.
6. The status of humus content in soil in terms of the available organic carbon in order to give preferential allotment of the enriched compost. etc., to different areas.
7. The information about the status of microbial population in different kinds of soils, in order to channelize the limited available materials like enriched compost, green manure, seeds, etc. to areas where the intensity of microbial population is comparatively less, so as to step up the same on par with other areas.
7. The status of humus content in soil in terms of the available organic carbon in order to give preferential allotment of the enriched compost. etc., to different areas.
8. The above two surveys are required to be conducted and completed in any case with in a period of two years so as to make use of the findings for implementing the corrective measures with in the shortest time span.

9. Information about the localities deficient in the microbial population as well as humus content so as to motivate the farmers and to treat these areas on priority basis with the whole village adoption approach.

10. Lack of knowledge about the values of the medicinal plants and its importance as a crop.

11. The Government driven agriculture policies have led to ecological destruction through the excessive usage of nitrates, pesticides and other chemicals in soil & food by offering short term benefits instead of long term security of agriculture lands and health of human and cattle.

12. Traditional knowledge of farmers about seed selection, preservation, storage, etc. was not given importance.

13. The role of women in maintenance of crop diversity has been largely ignored.

14. Participatory research programme with regard to biodiversity need immediate attention .

15. The linkages with the various concerned departments need strengthening.

16. Educational curriculum does not include sufficient biodiversity information.

17. Practical orientation in formal education is lacking.

18. Participation of NGO's in biodiversity conservation is limited.

19. Training and orientation programmes need to be taken up for development, department personnel to ensure that the importance of biodiversity conservation is appreciated while planning developmental projects.

## **5.2. STRATEGIES FOR BIODIVERSITY CONSERVATION**

Biodiversity conservation is interrelated to conservation of life support systems and encompasses various sectors, cross sectoral and multi pronged approach is needed for its promotion. The approaches listed below are based on participatory feed backs from public at large, NGOs, Government departments, academicians, farmers, professionals.

1. Assessment of the status of existing domesticated resources & wild resources, if any.
2. Promotion of policies which link domesticated and wild biodiversity elements.
3. Promotion of policies which ensure that the degree of use of a resource remains at a sustainable level and does not exceed natural renewal rate and environmental policies.
4. Developing technologies which are resource efficient and less resource intensive.
5. Developing programmes to consider biodiversity conservation criteria and adopting compulsory provisions for carrying out strategic assessment for all plans and programmes.
6. Fostering public participation in policy decisions, identification of locale specific projects and implementation of the same.
7. Creation of mechanisms which ensures intellectual property rights of communities on the local bio – resources and traditional knowledge of use.
8. Inclusion of biodiversity issues in formal and non - formal educational and awareness programmes and creating awareness on benefits of biodiversity conservation amongst all section of societies, this includes farmers, government personals, students, women folk, NGOs and industry etc., by linking biodiversity issues with livelihood issues.

9. Capacity building through training / orientation programmes on biodiversity issues for all sectors of society.
10. Ensuring institutional and financial support for biodiversity based programmes.
11. Prime agriculture land should not be allowed to be diverted for urbanization and for industrial development.
12. The priority of production concept among agriculturist and support price of selective crops compel the farmers to stick to using the chemical fertilizers though they have the desire to use organic fertilizers and not willing to switch to organic farming. Increasing input cost due to deterioration of soil health leaves the farmers with no option but to restore to only to those crops where market support is available. Hence suitable effective strategies are to be developed by the Agriculture department involving all cross section of farmers.
13. A social security system for farmers and farm workers to be developed in addition to the existing insurance to several crops.
14. The public distribution system should reflect food and crop diversity to increase demand of diverse crops. This will motivate the farmers to grow diverse crops.
15. The agricultural policy should tackle the problem of excessive production.
16. Integrated pest management, traditional farming systems, biofertilizers and biopesticides should be promoted.
17. A holistic approach through micro watershed planning may be adopted including moisture augmentation, soil conservation, afforestation and reforestation.

18. Make all the vacant place, marginal and waste lands of the Government poromboke under tree cover, giving importance to the local popular varieties.
19. Identify endangered species of the trees and all care to be taken to conserve.
20. Identify more protected areas and mobilize community for active conservation efforts in the form of sacred groves and mangroves.
21. Conserve the ecosystem, by paying more importance to Ousteri and Bahour lake to help to provide the suitable area for the migratory birds.
22. Issues like illegal hunting, poaching, illegal felling of trees and encroaching the vacant lands need to be addressed at political and administrative level and by involving more local people of that area.
23. Prepare State Level Data base of existing wild & domesticated biodiversity and traditional knowledge systems.
24. Relevant biodiversity issues should be incorporated in the syllabus of the educational system from the primary level itself.
25. Awareness programmes to be integrated with the active NGOs.
26. Provide strict environmental law to control point and non point of pollution.
27. The Department of Science, Technology and Environment being the nodal department for biodiversity issues should take up the responsibility of liaison with State Planning Department to ensure adequate funding of biodiversity programmes. A budget provision of, at least 1% may be provided in the budget of all the departments.

### **5.3 Proposed Action Plan**

In response to the need to implement the strategies, the action to be taken to implement the strategies are listed below with priority.

Unacceptable environmental deterioration should be prevented to conserve biodiversity. The Department of Science , Technology & Environment being the nodal body, should coordinate with various departments in implementing the aspects of the biodiversity conservation.

A State Biodiversity Authority could be set up with the nodal department with the members of the participating departments. The inter departmental coordination will help the various departments of the Government as well as the coordination between NGOs, industry, Government organizations, academicians and scientists etc.

#### **5.3.1. Natural Resources & Land Use Planning**

Document the existing status of wild & domesticated biodiversity including the assessment of population status, distribution of the habitation, genetic variability, rare, threatened and vulnerable species risk factors involved. Information data bank, knowledge centre to be established at various educational centres and government departments etc,

Biodiversity monitoring project to identify the parameters to assess the changes / factors affecting biodiversity and assessing the current trends of loss or gain.

Guidelines to be developed for the use and management of natural resources, highlighting the issues such as unsustainable farming methods, ways to conserve the forgotten crops, judicious use of water, dangers in using the chemical fertilizers, advantages in using biofertilizers, biopesticides, highlighting specially the health aspects of human and crops. Encourage the farmers by giving incentives to conserve biodiversity.

Preparation of an action plan to promote sustainability on agriculture and animal husbandry practices.

Assess the status of hunting, poaching of birds and animals of commercial value, and to prepare a stringent law to prevent such activities with heavy penalty and an action plan for its conservation and specially with regard to the annual migrating birds in Ousteri lake.

### **5.3.2. Traditional knowledge system**

Document the traditional knowledge in farming systems and the farmers right, and to provide incentives for traditional agricultural activities that contribute to the biodiversity conservation.

### **5.3.3. In-situ conservation**

Plan to promote protection of specific areas where in the migratory birds and animals dwell, not only by placing warning or notice boards but by involving the local community to guard and supervise the area so as to prevent anti - social activities, specially in area like Ousteri and Bahour lake.

Assessment of the status of the urban biodiversity and draft the mandatory bylaws to be followed by the Department of Town and Country Planning and Commune Municipalities and Panchayats for its protection and conservation, specially stressing on the rain water harvesting.

#### **5.3.4. Institutional Reforms**

Developing cordial coordination between the various departments through the State Biodiversity Nodal Agency for better conservation of biodiversity.

Create knowledge centers and data bank on wild and domesticated bioresources of the state.

Ensuring biodiversity and social , cultural assessment and transparency for public participation in all the developmental projects.

#### **5.3.5. Legislative Reforms**

Operationalisation of National Biodiversity Bill after it is notified by the Central Ministry.

Reforms to be made through the accent of the Legislative Assembly for ensuring economic incentives for biodiversity conservation.

#### **5.3.6. Economic reforms**

Inclusion of biodiversity conservation in the state plan and separate budget provision under different head should be created by the Department of Planning and Research and Department of Finance to implement the programmes related to conservation of biodiversity.

A small percentage, at least minimum of 1% in the existing budget of various departments related to or having an impact upon biodiversity be compulsorily diverted to this head and specific action be taken up.

Introduce the schemes by providing financial incentives to farmers following traditional farming practices and for the communities actively participating in conservation of specific areas and or species.

Crop insurance schemes should be extended to traditional crops.

Packages of compensation schemes be designed to the farmers engaged in traditional farming related to conservation of biodiversity to the loss / damages incurred due to either natural calamities or otherwise.

#### **5.3.7. Education, Public awareness and Training**

The public is to be imparted with the adequate knowledge of information, train to understand and to actively participate in biodiversity conservation.

Set up an Environmental Information Knowledge Centre on biodiversity, with updated biodiversity data both in English and in Tamil for the benefit of public, students, farming communities and fisher folk and others. Prepare region wise reports on various aspects of Biodiversity.

Specialized training to all relevant sections of societies, Technical and Administrative staff of the various departments and NGOs involved in Biodiversity Programmes which will be taken up by the nodal department.

Promoting public participation in planning, implementation and monitoring of development programmes, especially with those having impact on biodiversity. Encouraging active NGOs participation in biodiversity conservation.

### **5.3.8. Research and Development**

Team of experts to assess suitability and priority of Research and Development projects relevant to the State and allot sufficient funds for biodiversity research.

Support the research to be conducted by the departments which need to collect enough data .

Setting up of scientific reference collections in gene / seed banks for local and forgotten varieties and wild biodiversity in existing institutions.

Organizing interactive meetings and symposia with technologists and farmers.

## **6. ROLE OF MAJOR ACTORS**

For the successful conservation of biodiversity, a holistic approach is needed with the cooperation of several, related Government Departments, Educational Institutions with likeminded academicians, scholars, scientists and NGOs and above all the Public. In this connection certain departments have to play a major role for the successful implementation of biodiversity action.

### **6.1. Department of Science, Technology and Environment**

The Government has identified this department as the State Nodal Agency, and a steering committee has been constituted with a nine member body to monitor the progress made by the nodal agency.

This Department will plan and prepare programmes from the biodiversity angle and facilitate in dissemination of information and create the Peoples' Biodiversity Registers for various regions of Pondicherry. This department will identify the Nodal Officers from various departments related with the biodiversity issues and in turn these nodal officers will be in constant touch with the state nodal officer.

With the help of the Departments of Agriculture, Fisheries, Forests and Wildlife, Animal Husbandry, Health, Town and Country Planning, Pondicherry University and Research institutions, a state level data base on existing biodiversity resources can be prepared. The data base thus established will help to identify the areas like groups of plants & animals where there is lack of information or less, to promote Research and Development projects in these areas.

Region wise and ecosystem wise inventories be prepared and the distribution pattern of the rare / threatened / vulnerable /endemic flora and fauna be recorded.

The respective regional Administration can help in preparing Peoples' Biodiversity Register and Community conserved areas to be identified. Encroachment of the wetland areas to be removed.

Providing in service training for the biodiversity related departmental personals.

## **6.2. Department of Agriculture**

Agriculture has the closest relationship with the biodiversity conservation. Activities of this production sector has influenced nature of the country side both on the positively and negatively. Transformation of the natural system through Agriculture activities gave rise to habitats and development of varieties and livestock breeds that did not previously exist in the natural ecosystems. Introduction of mechanization, intensification of agriculture and promotion of genetically engineered high yielding crop varieties have led to loss of traditional varieties. Adverse impacts were felt due to large scale habitat destruction, pollution of soil and water, high level usage of nitrates and pesticides for food crops resulting in the quality reduction of the soil flora and fauna. The policy of intensification of agriculture has led to the disappearance of the traditional agricultural systems and traditional varieties and livestock breeds best adapted to the environment as well as their management techniques. Hence it is necessary to reframe the current agriculture policies and practices to restore biodiversity in agriculture.

Suggested action points are,

1. Identify prime agriculture land and frame appropriate rules to prevent its diversion to other use.
2. Reorganizing the Agriculture Policy, giving emphasize on issues like, traditional vs. modern farming practices, Integrated Pest Management, crop diversity vs. diversification, organic farming, market support for traditional crops, removal of subsidies.
3. Develop village level storage facilities.
4. Establish soil testing and pesticide testing facilities at village levels and promoting its use by the farmers themselves.
5. Revival of traditional compost pits and management of animal dung for procuring organic manure.
6. Train the farmers for vermin-composting and motivating farmers to sort out the plastic bags and other non degradable materials during composting,
7. Use of information Technology in Agriculture to gather first hand knowledge on information / dissemination through the internet on soil & weather conditions, crop diversity and packages of practices.
8. Create awareness about Crop insurance and request the Insurance firms to provide cover for more crops and vegetables.
9. Conduct campaigns about farmers right, breeders right and plant variety protection.
10. Reintroduction of desi varieties along with hybrid and grafted varieties .

11. The existing botanical garden can be renovated by introducing new indigenous varieties, rare, endangered, threatened plants, and introducing more varieties of medicinal plants to create awareness and establish a separate herbal garden.
12. In order to protect the aesthetic value, the existing Government Departments can be shifted to some other area.
13. A new botanical garden can be established, preferably in a silent zone.
14. Promotion of kitchen garden.
15. Initiate water shed management, soil conservation and biodiversity conservation projects in collaboration with the community.
16. Encourage the usage of biogas and fuel wood plantation around villages to ensure the availability of fuel wood so as to prevent the felling of forest resources and
17. Documentation of success stories.

### **6.3. Department of Animal Husbandry**

Ever since the policy of introduction of white revolution and produce more milk and meat and other animal products, wide scale hybridization of cattle has taken up, resulting in loss of desi varieties of domesticated animals which are better adapted to local stress conditions, and with a minimum cost of maintenance. However Pondicherry state does not have a recognized breed of its own. Before the introduction of cross breeding programme in this state the desi breeds of neighboring Tamil Nadu state was said to be prevalent.

In farms of Sri Aurobindo Ashram, such as Gloria Farm in Pillayarkuppam village and Lake Estate in Kurumampet, certain Indian pure breeds like Sindi, Gir, Rathi, Hariyana are maintained for their own use. The proper breed records, breeding particulars and population records are maintained.

As cross breeding programme is popular with the public, Government of Pondicherry introduced exotic semen in the breeding programme in order to increase milk production.

However a scheme can be formulated to bring back the suitable Indian Breeds which can withstand stress and disease attacks. This programmes may help the small farmers to make use of the male calves thus produced can be used for ploughing purpose during seasons instead of sending them to slaughter.

Breed conservation centers can be set up.

Create awareness among local public by providing breed wise information and its importance .

#### **6.4 Department of Fisheries**

Diversity of coastal system is affected directly or indirectly by human activities, which include over exploitation of fishes, coastal aquaculture, physical alteration of the habitat by trawling, dredging, drilling, dumping etc. So the Department of Fisheries should take up the matter very seriously and action should be taken to prevent all these kinds of activities.

It is noticed that the following varieties were caught either less in number or found rarely in Pondicherry region.

(Sudumbu–Tamil) *Lactarius lactarius* , (Kala–Tamil) *Polynemus* sp., (Mayilkola–Tamil) *Histiophorus* sp., (Yamankola–Tamil) *Xiphias* sp. (Sudai–Tamil) *Pellona* sp.,(Kuthuwa–Tamil) *Ilisha fligera* , (Vellai vavva-Tamil) *Stromateus cinerus*.

It is suggested that action should be taken to multiply these varieties of fishes by saving the fingerlings for further breeding and prevention of over exploitation of catching the varieties as there is always a demand for the production of poultry feed.

#### **6.5. Department of Town and Country Planning**

Conservation of Biodiversity is closely related with this department as it is responsible for designing land use plan in the state.

Importance can be given to the following points during designing the city.

1. Identification and notification of prime agriculture lands and forest areas and ban their diversification in consultation with the department of Agriculture and Forest.
2. Unregulated urban development can be prevented with suitable laws in the conservation of biodiversity.
3. Specify the areas for industry.
4. Urban limits can be defined and ban further proliferation of urban areas.
5. Urban greening should be encouraged.

## **6.6. Department of Education**

In biodiversity conservation, education and awareness play an important role in promoting knowledge moulding attitudes and developing necessary skills. Hence the educational institutions can play a crucial role in promotion and preservation of biodiversity.

The actions proposed are,

1. The School Education Board can introduce local examples of biodiversity and add issues of conservation and sustainable use by making suitable modifications in the syllabi. The contents and classes where such issues need to be introduced in syllabi can be decided after conducting workshops for teachers, educationists in collaborating with the department of Environment.

3. Involve all school children in plantation work in school premises, neighbourhood, raise tree nurseries and study local ecosystem.

## **6.7. Pondicherry University**

Pondicherry University is planning to establish a medicinal plant garden with certain rare and endangered medicinal plants. This ex-situ conservation will be useful to understand the medicinal properties of several endangered species. Pondicherry University also tries to establish the botanical garden in the University campus to conserve rare and endangered plant species of indigenous and exotic in nature.

## **6.8. Pollution Control Board**

### **6.8.1. Disposal of Domestic Sewage**

1. An action plan can be drawn for sewerage in the urban area where the sewage disposal facility and treatment is needed and should be implemented at the earliest and necessary budget allocation should be provided.
2. Additional oxidation pond can be constructed to treat the anticipated load of 4.5 million liters per day sewage.
3. Discharging the sewage in upper, grand, Karuvadikuppam and Iyyanar Koil drain should be discontinued at the earliest fixing a target date.
4. Environmentally suitable trees can be planted along the sides of the drain involving NGOs, Public Works Department and Municipality.
5. Anti malarial measures can be taken by the Health Department.
6. The PPCC should stress that only properly treated industrial effluents are to be discharged into the municipal and public works department drains.
7. Anglo French Textiles and Bharathi Textile mill waste water which are discharged into the Municipality drains are to be monitored periodically.
8. Periodical sample testing of the sewage water should be carried out.
9. Educate the public to conserve water, use less water, Recycling of water by the industries, removal of slurry and other obstacles from the drains in order to arrest clogging of drains.
10. Prevent ground water contamination by lining of the canals and ponds.

### **6.8.2. Disposal of Biomedical waste**

- 1) All health care establishments should prepare comprehensive disposal plan for on-site and off-site disposal. This will be applicable to newly built hospitals or renovated old health care units.
- 2) Collection of information on various methods of disposal and updated technology should be made available to various health care units by computerized links.
- 3) National Standardization of color and coding will be helpful to eliminate hazard from waste and its adverse effects on health.
- 4) To develop guidelines for hospital waste management for implementing in all hospitals and clinics.
- 5) All sanitation personnel must undergo training programs for hospital waste management.
- 6) NGO's & voluntary sector which possesses expertise in the field should be entrusted with the hospital waste management function on contractual basis.
- 7) Awareness should be created amongst patients, attendants, medical personnel and people in general regarding importance of bio-medical waste management through various media devices.
- 8) An integrated approach with sharing treatment and disposal technology amongst a group of hospitals and medical units should be introduced. This will be cost effective and can cover more number of medical units.

- 9) A national level "Hospital waste Management Committee" should be formed. This could consist of various representatives from Government, scientists and medical experts, Non Government Organizations, private sector, communities and municipalities. The branches of this committee should extend up to state and district level.
  
- 10) Government should provide incentives to medical units for installing costly equipments for treatment and disposal of hospital waste. It should also provide land / space and financial help for such centers, which can be run on sharing basis by forming a cluster.

### **6.8.3. Vehicular Pollution**

1. Three wheelers in Pondicherry which are allowed to transport passengers, are carrying more than permitted number of persons which results in higher smoke emissions. This has to be checked and proper action has to be taken.

2. Pondicherry should also follow other States / Cities in checking vehicles periodically and all vehicle owners should be asked to obtain pollution under check certificate.

3. Optimisation of traffic flow and in improvement in traffic management i.e. Automatic traffic controls, Signal optimisation, tidal flow and removal of encroachments are to be taken. Frequent digging of roads and construction work also leads to congestion and pollution. These activities should therefore be planned properly in co-ordination with the traffic police.

4. Organizing interactive meetings with vehicle owners Association for reducing vehicular pollution.

5. Necessary amendment to the motor vehicles rules should be done. Rules to make automobile exhaust monitoring and obtaining pollution under check certificate mandatory.

6. Phasing out of grossly polluting vehicles.

7. During peak hours of traffic, specially during school time in the morning, to avoid traffic congestion and air pollution, specially when the vehicles are waiting in the junctions, the school timings can be staggered so as to avoid pollution and traffic congestion.

#### **6.8.4. Noise Pollution**

1. Rules regarding Electric & Air horns are to be implemented firmly.
2. Synchronized traffic signaling to be introduced.
3. Operation of Loudspeakers should be banned in sensitive areas.
4. Noise Pollution (Regulation&Control) Rules 2000 should be implemented firmly.
5. Mass awareness programmes should be conducted.
- 6 Well-designed silencers and mufflers are to be installed on the vehicles.
7. Generators should have noise muffling devices.
8. Selected species of trees should be planted on the road side wherever possible, as it controls noise pollution as well as absorption of exhaust emission.

#### **6.8.5. Industrial Pollution**

1. Identification and shifting of Industrial Units from the non-conforming areas to the conforming areas.

2. Strict enforcement of pollution control measures in the Hotels, Bakeries, Engineering works, and for the use of generators in the commercial activities.

3. Existing large units operating in the residential areas should be monitored closely.

4. No new Industrial units shall be permitted in the non-conforming area.

5. Clean production cell should be set up for small scale industries in the Department of Industry, Government of Pondicherry for promoting clean technology / waste.

6. Setting up of a separate industrial guild for the small-scale industrial units.

#### **6.8.6. Slaughter House**

1. As Oulgaret Municipal area does not have a proper slaughter house, one such slaughter house should be constructed at the earliest, with all proper facilities.
2. Modern or mechanized slaughtering of animals must be done to maintain a more hygienic environment.
3. Unauthorized slaughtering should be prevented in the city.
4. Fish market waste should not be mixed with municipal solid waste. It must be collected and buried separately after taking the necessary treatment measures.
5. Fish market waste can be used to manufacture poultry feed.