Brief on Kaluvelly Watershed and Promising Development Strategy

From: Auroville Water Service – Harvest

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Note: This document is based on a project writing developed since 1995 onward and mainly oriented around water resource management and activities. The main concept yet available is a follow. The program aims at researching methodologies for the protection of natural resources by creating a user-based watershed management organization. The different components are social mobilization and empowerment, rainwater harvesting, stormwater control, tank rehabilitation, groundwater recharge, irrigation management, wasteland reclamation, soil and erosion control, afforestation, organic farming, fish farming, sanitation and wastewater management etc which will be used to create an institutional model of watershed management in a coastal/rural/semi urban area. The main tools of scientific investigation are hydrology, hydrogeology and geology. Economic and social assessment, land use pattern and trend of evolution are also part of the general investigation means.

1. Summary

Today, India is having 6500 km of coastal areas that are threatened or contaminated by saline water intrusion.

This problem is increasing due to the pressure that is put on coastal areas by transfer of populations from interior areas, demographic trend, unchecked industrial and urban developments and over irrigation for agricultural purpose. Excessive exploitation of aquifers and neglect of surface water structures has resulted in saline intrusion in the coastal aquifers, with cause for concern in the interior region also. The use of chemical fertilizers, pesticides and other heavily toxic and health hazardous substances have been going for many years creating potential contamination of water, soil and food. This negligence of environmental concern and awareness has generated a deep deterioration of Nature on many sides, with an alarming impact on the human population.

In 1996, saline water was monitored in the coastal aquifers of Kaluvelly watershed area, which was the consequence of over-pumping of ground water and the decay of the monsoon harvesting tanks.

However, these physical causes are deep rooted in the way water is perceived and handled by individuals and society. Because of the intricate ways of life reality, the environmental, social, technical and economical challenges are all interconnected. The only way to maintain life and human activities along the coastal areas will be by strong and sustainable management of the already overexploited natural resources. Water balances will have to be made, and models will have to guide managers, planners, deciders and developers to handle this precious resource with

utmost care. Monitoring and fine-tuning of the models require acquisition of high quality data, particularly in the fields of geographical information, hydrogeology, hydrology, hydrochemistry, meteorology, pollution, agriculture practices and socio economic trend.

The impending environmental catastrophe provoked Auroville Water Service to embark on a strategy to control the ecological damage and devise management initiatives in a holistic perspective. Hence **"Harvest"**, Center for water resources management, an integrated development entity, was launched on 15th August 1996. Harvest is an apply research and development unit with a participatory approach that deals with water resources management in the Auroville bioregion.

The objective of the project aims at researching ways and means of improving the management of the ecosystem, integrating both rural and urban reality and development. This will be achieved through a thorough study of the bio parameters of the swamp and connected watershed, and their relation with surrounding ecosystems and human activities.

The program is aiming at developing methodologies and demonstration practices in order:

1. To fight the general degradation of lands, groundwater and surface water in a representative bioregion, by conducting an integrated watershed management program with as main components: tank rehabilitation, groundwater recharge, irrigation management, waste land reclamation, soil and erosion control,

2. To develop a model of sustainable development for a typical bioregion, including afforestation, innovative agricultural practice, social development and empowerment, low environment impact industries, sustainable urban practices etc.

- The area of concern is located in south India, in the State of Tamil Nadu and is to some extend overlapping the northern part of the Union Territory of Pondicherry. Because water is a State responsibility in India (not a federal one), two distinctive regulations are prevailing.

- The area constitutes the coastal watershed of Kaluvelly and is located between Marakanam, Tindivanam and Pondicherry towns, in the Tindivanam and Vanur blocks. It lies between 11°55 and 12°10 North and 79°35' and 79°55' East.

- This unique watershed of 764km2 area is flowing to Kaluvelly Swamp, with a single outlet to the sea, near Marakkanam.

- It is bordering the sea on a 35kms stretch on the Bay of Bengal between Marakkanam and Pondicherry.

- Its main geological features are: In the coastal area, a track, 15 km broad, running parallel to coast composed mainly of sedimentary materials, where the main storage of ground water takes place. Inland, a primary basement of charnockite is present, with a poorly exploitable ground water.

- The soils in the watershed area are mostly black and red soils. Alluvial soils are also found in the eastern side-bordering coast. Black soils with clayey texture are confined to low grounds in select pockets of Vanur taluk.

- The watershed is mostly flat though it has some hillocks in the central and northern part. The higher altitude of 50 meters above msl is seen in the northwest part of the watershed and it gently slopes towards the coast. Gullies and ravines are intersected the watershed widely through which run off water during the monsoon drain into the Kaluvelly swamp, which serves as an ultimate drain into the sea. Coastal areas are having older and younger flood plains and also beach land forms at some places.

- Surface water storage structures like irrigation tanks and Ponds are the major water resources of the watershed. It has a total number of 196 interconnected irrigation tanks, having a total of 34,500 acres of command area. In spite of some rainfed rivers there is no perennial river.

- There are 162 villages and three town panchayats on this area, and Auroville, a project of an international township. The actual total population of the area is 355,000 inhabitants.

- The main economic activity is agriculture, but Industrial activity is growing fast in the scattered area belonging to Pondicherry Territory.

- The Kaluvelly Swamp (72 km^2) is one of the last unpolluted water body of South India and a wintering place for migrating water birds (more than 100 different species).

- The swamp is a traditional source of revenue for the local population for fishing, thatch collection and also grazing of the cattle.

- Pondicherry, located in the southeast is having a fast increasing socio-economic and environmental impact on this watershed.

- Auroville International Township is having a recognize leading role in sustainable development and environment regeneration and is largely acting and promoting related practices and method in the bioregion.

Its particular location on coastal area and typical related degradation, attached to both Tamil Nadu and Pondicherry Territory, functioning as an agricultural area but also as a water feeder for industries and nearby towns, foreseen as a water supplier for Chennai metro, hosting one of the larger wetland of south India, and finally the cradle of the renown promoter of sustainability and appropriate technologies, Auroville, this very deteriorated watershed can be turned in a very successful story and an example of integration of Man and Nature.

2. Background of the project

Auroville

Auroville is an international township founded in 1968 by the Mother, aiming at Human Unity.

It is presently managed by the Auroville foundation.

During the last 36 years since the founding of Auroville, large projects are regularly handled by its different units and brought to successful conclusion and has steadily evolved and increased its capacity in managerial and development skills.

Auroville is a long lasting project and as such can offer a guarantee of carrying over responsibility once the project is completed.

Auroville Foundation

The Auroville Foundation as an organization has been created in 1988 by an Act of Parliament, for the purpose of encouraging, continuing and consolidating the activities of Auroville.

A bit of History

Auroville when it was started in l968, was hardly a welcoming scene: barren burnt dry red soil stretching to the horizon in every direction, with nary a tree to stand under. The whole area was at that time very poor. The land was denuded of nearly all vegetation, and frequent wind storms and monsoon deluges stripped it further of its meager topsoil, carving ravines as rain water poured down from the plateau into the sea. Under these very challenging circumstances, it was not long before many Aurovilians were fully engaged in tree planting, erosion control, water conservation and organic farming. In some villages people had to walk 2 kms to fetch water. Most were eating only a gruel made of the millets which they were growing on their infertile fields, and they were looking malnourished. At the same time, they were teaching the Aurovilians about the local agricultural practices, language and culture. Some Aurovilians began studying the history of the area – to find out when and why the trees were all cut. The French Institute in Pondicherry was the source of many treatises written by colonial scholars over the past centuries. It was discovered that 250 years ago the land on which Auroville is sited was a deep forest, with elephants and tigers. A mangrove was known to be present in Kaluvelly swamp, even a few years back. The last remaining plots of forest in the Auroville area - 2,000 mature neem trees - were cut down in the mid-fifties for timber to make boats.

It was clear, however, that the answer to the people’s poverty and degradation of the land was not lying in the past, but in the NOW, inspired by a new hope for the future.

The first needs that confronted Auroville's earliest settlers were for shade and water. However, it soon became clear that if the young seedlings were to survive, other measures had to be taken. They needed to be protected, for example, against marauding goats and cows, and some way had to be found to catch and control the monsoon rains so that they would not sweep away precious topsoil but would percolate into the water table. So 'bunds' (raised earth-banks to stop water flowing off the land) were born. In these early years it was a process of trial and error, and many mistakes were made. The lesson learned that time was that bunding had to be systematic and comprehensive, beginning on the top of the watershed and following the topography of the land.

Auroville's afforestation campaign began in the early 1970's. In the next ten years, as part of a massive soil and water conservation programme, over a million trees - timbers, ornamentals, fencing, fruit and fodder trees, nut trees etc.- were planted here. As the trees grew, and micro-climates formed, many species of bird-life and animals returned, further accelerating the dissemination of seeds and enriching the environment.

For now it became evident that Auroville had something precious to offer outside its own boundaries. Aurovilian have been increasingly going out into India to share their experience and help initiate new afforestation schemes.

Today, some 36 years later, many environmental working groups, undertakings, village oriented activities and development projects are ongoing.

Regional context

The development of water resources is becoming a major priority, both with national and international funding agencies. Accelerated programs to install borewells and subsidized electricity for water pumps have led to over-exploitation and to depletion of aquifers, especially in the coastal region. Therefore, improving the recharge of the aquifers has become a major interest.

In the coastal lands North of Pondicherry, Auroville has pioneered several land regeneration techniques leading to improve aquifer recharge. It is technically qualified to implement these all over the bio-region, and is attempting to raise the resources to do so. At the same time, the preservation of biological diversity is also a major national and international concern.

Given the concern with water, we would like to be able to understand the effects of human interventions as well as better practices. Kaluvelly watershed because of its size, location and various components provides the means to do this.

The active presence of various environmental groups of Auroville on the watershed, and the many rehabilitation and development programs conducted so far demonstrate the capacity of Auroville to play a leading and cohesive role in the betterment of the area and its population.

Auroville Water Service Harvest, a Center for Water Resources Management

Auroville has a population of about 1800 residents from 35 countries. To meet their increasing needs of water, Auroville Water Service (AWS) was started in 1986 as a service unit, with a non-profit motive. The continuous demands of installation and maintenance of water extraction mechanisms, in Auroville and the surrounding villages, were met through the creation of a skilled pool of technicians drawn from within and outside Auroville.

Auroville Water Service has been conducting researches, development programs and social mobilization in coastal waters management for the past eight years under Harvest structure. The trends of our research underline the need to be focused on the understanding of surface and underground water behavior in coastal ecosystems.

Multidisciplinary project teams tackle a broad array of water issues aiming at creating an action research and operational project structure, to develop new methodologies in the following fields:

- Rehabilitation of Irrigation Tanks
- Water Resource Management
- Coastal Management
- Groundwater Management
- Change of Policy
- Agriculture Development
- Environmental Protection
- Waste land reclamation
- Integrated Urban Planning
- Environmental awareness

- Social Mobilization and Development
- Water supply
- Sanitation and decentralized wastewater management
- Rainwater harvesting
- Stormwater management
- Facilitating water resources management in Auroville bio-region
- Research and Development of integrated water resources management in urban context and in rural context
- Water resources studies in Kaluvelly watershed,
- Environmental monitoring and pollution control.
- Social mobilization and empowerment

Today, a workforces of 35 skilled people are involved in drinking water supply & sanitation, hydrogeology, environmental awareness & education, community mobilization, social extension, rainwater harvesting, stormwater control, aquaculture, sustainable agriculture, eco-friendly solutions to the industries, urban water management etc.

Harvest shelter a regular flow of students from all over the world doing apply researches related to these matters.

In the larger area, Harvest has conducted the rehabilitation of 80 irrigation tanks plus other structures. 37 water user associations and 17 drinking water user associations created with multiple training programs, awareness campaign through street theatre. Organic farming development, as an attempt to convert the polluted soil into living soil to stabilize the water cycle and protecting groundwater overexploitation by regulating the irrigation in 10villages.

Various studies on water usage, agricultural practices, water resources etc., and a constant monitoring of the area have helped to constitute a systematic database as well as the tools for better management practices.

Harvest is also involved in the Tanks Rehabilitation Program of Pondicherry, financed by European Commission, and with various partners like Central Ground Water Board, the Collector, the Agriculture Department etc.

Other interventions in the area

Several other Auroville units play a major role in the improvement of the bioregion. It is Palmyra, acting mainly on land conservation and reclamation, Pitchandikulam with tropical dry evergreen reforestation program, the Health Centre and Dental Clinic with various activities on public health. All of these groups have attached social activities, and Auroville Village Action, focusing on social action as such, completes it.

In the project area other agencies are intervening. Beside the other Auroville units working in the bioregion, DANIDA (Danish development agency) is running drinking water programs. This program is reaching a end by march 2004.

Auroville units such as the Health Center and the CSR, (Center for scientific Research), are running sanitation programs with them.

3. Problem Statement

- Absence of watershed management. The concerned area is in a present state of total anarchic development and this is leading to an environmental catastrophe that may hit tens of thousands of people by depriving them of the supply of safe drinking water. In the absence of proper rural planning, huge amounts of water are extracted from the ground and natural resources are being abused.
- Lake of appropriate political tools. Local government and administration are helpless in the absence of proper policy guidance and sound methodologies to tackle the environmental problems. Indian society, which is essentially traditional, faces a lot of difficulties in trying to adapt itself to the postcolonial administration presently managing India's rural areas. Indeed, the actual institutional set up is unable to reach the problem areas with sufficient impact in order to offer sustainable solutions.
- Lack of relevant database. It is a fact that most of the database is outdated, inaccurate or incomplete. It is managed in a very static approach and collection of information is done too randomly. Information about the status of the development of the area are collected by the Village Administrative Officer's (VAO) and other department local officers. They are compiled at the taluk level and at the district level. It is found that however they give a general impression about the situation, their level of accuracy is far from being satisfactory, and even sometime in full contradiction with ground reality. The information collected by the VAO is transmitted up to the district statistic department in a manuscript way thus inducing a risk of error. Key information like the number and characteristics of the tube wells are inexistent. Most of the information about the tanks (such as tank capacity) is often irrelevant. Tank memoirs have not been prepared for this area. Maps are difficult to acquire, and their accuracy does not allow to use them in view of a computer modelisation of the watershed. Topographic maps are inaccessible (classified)
- Lack of ground water research in the project area. The project area, being classified as a backward area, has attracted very little interest from the concerned departments to explore the groundwater parameters in detail. Only two areas are known: the southeast, Auroville region where two studies have been conducted by the Central Ground Water Board (CGWB) .One in 1976 and the other one in 1984. These studies give broad knowledge about the behaviors and the conditions of our main aquifers, but are anyhow outdated looking at the actual reality. The northwest where DANIDA has conducted some drinking water schemes with TWAD (Tamil Nadu Water and Drainage Board). Other studies are available on Pondicherry territory and Tindivanam district, but do not address the central problem faced today. An in depth geological investigation has been carried by Oil and Gaz Corporation (ONGC) in this area, but the study is not available.
- Lake of adequate knowledge on the functioning of this particular kind of water system, the availability and the adequacy of the resources. Multiple coastal aquifers systems, prevailing on the area, are not well understood, because of lake of scientific publication on this subject.
- It is found that the people are unaware of the mechanism of water management, particularly ground water, and are ill trained to adopt remedial measures on their own. Moreover the pressure of modern society has eroded their traditional forms of management. People are actually unaware about natural resources degradation of the Kaluvely watershed. They need to understand the actual structure and relationship between rain, groundwater, ponds, ocean, saltwater intrusion, borewell, crops, erosion, trees, pollution etc. Then they need to understand the urgency of water problems. Moreover, farmers are not anymore really concerned by the

state of the village tanks and only when the tanks are full of water do they suddenly show some interest. This situation has a lot to do with the fact that the administration does not give much scope for the Users to express their views, get involved in the maintenance of the tanks and also have a sense of ownership over these rural assets.

- Water non availability. The receding availability of water will hit more than one hundred thousands people living in the coastal area by depriving them of the supply of safe drinking water. It will also affect interior towns that are pumping their drinking water. Farmers will be severely affected in the absence of suitable irrigation water to meet their requirements. This lack of safe drinking water is both, quantitative and qualitative.
- Quantitative problem. The quantitative problem of available water is mainly due to over exploitation of ground water and poor storage of surface water. Overexploitation of ground water. The ground water has been so over exploited that the free water table of the sedimentary portion is below Mean Sea level (MSL) and seawater has started to intrude in many sectors up to 8-km inland, thus threatening the main source of drinking water for the entire region. In the Kazhuvelli watershed, recent new developments have taken place in agriculture practices, mainly due to availability of modern equipment (rotary drilling rigs, submersible pumps), which have enabled the farmers to draw water from deeper aquifers. Further, the farmers being supplied with free electricity by the Tamil Nadu Electricity Board (TNEB) are pumping without restriction round the clock thus extracting massive amounts of groundwater. Moreover it is found that they are most of the time totally unaware of the problems that they are generating. The capacity of all the irrigation tanks is so reduced that their potential for surface irrigation and groundwater recharge is minimal. Recent major meteorological events (December 1996, 1997) have demonstrated that the tanks do not perform anymore their flood regulation potential, thus leading to extensive damage in the watershed and heavy losses of sweet water flowing directly to the sea.
- Qualitative problem: pollution of ground water. Farmers, misinformed, are making abusive use of fertilizers and pesticides thus spoiling the quality of the groundwater. Recent analyses have shown a serious increase of pesticide load in the water. The salty intrusion that has started in the south of the Kaluveli swamps is today affecting severely the quality of the ground water of the region.
- Overexploitation of ground water. Through the Green Revolution in the 60th and 70th, decision was taken to give electricity for free to the farmers. While everybody knows today that it is absolutely mortal for the country, no politician is willing to change this decision at state or federal level because of the anticipated population reaction. In the absence of proper rural planning, huge amounts of water are extracted from the ground and this vital resource is being depleted. Farmers are attracted by modern equipment but do not use them rationally (i.e. submersible pumps).
- Over irrigation. In the areas where paddy, sugarcane or coconut trees are grown, it is common to observe irrigation up to 10 times the water demand of the crop, because of lack of adequate knowledge and awareness of the farmers.
- Poor storage of surface water. Most of the tanks are heavily silted up; they cannot hold the rainwater that is running off to the sea.
- Most of the data concerning the tanks is outdated. Tank memoirs have not been prepared for this area.
- Qualitative problem. Pollution of ground water and surface water. A large area is now contaminated by salty water due to over extraction. No enforcement mechanisms exist or are

exercised to oblige industries to take care of their pollutants before dumping it to the environment.

- In the coastal area salt intrusion is taking place in many places and is increasing every day because of fast water withdrawal of the dune formation.
- The farmers are also making abusive use of fertilizers and often unauthorized pesticides (DDT, endolsulphan…) thus spoiling the quality of natural resources as well as the production, and causing a stress on public health.
- Local Industrial development does not follow Central Pollution Guidelines and is generating important water and soil pollution.
- The swamp of Kaluvelly is itself not anymore protected from direct seawater contamination because of the deterioration of the existing shutter.
- A heavy encroachment is ongoing in all the tanks of the watershed.
- Kaluvelly wetland is facing since a few years fast growth of unauthorized shrimp farming.
- Degradation of land trough overexploitation of biomass and inappropriate agricultural practices. Overgrazing and high consumption of fuel wood leads to deforestation, then to erosion of the land, and finally to a decreasing recharge of the groundwater.
- In the Auroville region, farmers used to grow pulses and ground nuts in their fields. With time this practice has been replaced by intensive cultivation of cashew. Soon cashew became a monoculture and pest particular to that crop became rampant. In order to tackle this problem farmers started using all kind of pesticides (38 different kind), most of them have been banned in India because of their excessive toxicity. Now, it is common to see children and adults developing lung problems because of the constant inhalation of the toxic substances.
- Similarly in other areas where rice and sugar cane are being cultivated, abundant use of fertilizer and pesticide generate a slow poisoning of the environment. It is found that local laboratories are often unable to handle this problem due to equipment or personnel problems, and the quality of the results that they produce is never certain.
- Farmers of the area started also to shift to utilization of Pondicherry garbage as a source of compost.
- Population increase has also aggravated the pressure on land and resources (wood for fuel and fodder, water, etc.), resulting in deforestation, erosion, larger runoff and therefore siltation of tanks. It was acknowledged that the circle of deforestation, erosion, tank siltation, groundwater use and saline intrusion could be broken if certain measures were taken.

4. Population

The population of the area is mainly rural based, with rural communities organized in small villages. The villages are divided into main villages and colonies where the Dalits are living (formerly known as ‘untouchable’).

Ongoing rural desertification, mainly for the male population, generated by neighboring industrial estates and cities, is depriving the area of the labor force needed for agricultural activities and induces negatives changes in the farming system. Some years, in the Vanur taluk (administrative division), 70% of the cultivated area has been put under casuarinas plantation, because of the

vanishing labor force available and the high benefit expected. Today, while the market fails, casuarina is removed but the lands are now turn fallow as nobody is available to work on.

75% of the population does not own a significant amount of agricultural land, 20% do not own a house plot. The leaders of the dominant community (upper caste) control common lands; in many villages the dalit community has poor access to fields or even burial grounds.

The sector of rural management, water management, etc. is entirely in the hands and under the control of the government administration, both at the state and national level.

The Agriculture Department takes care of the agriculture extension, but its general approach is very traditional and promotes mainly the use of high yielding varieties, monoculture and the use of chemical fertilizers and pesticides as a key to bountiful crops. No attention is paid to the quality of the environment and the ecological balance. Production is the only motto. Because of the heavy cost of the proposed techniques and products, it is not affordable to most of the farmers.

Traditionally the local people knew their environment. Now, farmers grow "IR20" and they are linked to “experts” to get information about what fertilizers to use, what to spray etc. Hence a near total illiteracy as regards to varieties and agronomic practices reigns. Today in the Vanur taluk 70% of the cultivated area is under casuarina, and 33% of it is under (useless) irrigation. In the same way the diversity in the cropping pattern is reduced. The same crop occupies now, large tracks of land where before more than 20 different crops would have been found.

Management of the forest and promotion of the social forestry is done by the forest department. Protection of the environment is taken care by the Ministry of Forest and Environment. But for the time being they are mainly concerned by the industrial pollution and give little or no attention to the rural pollution from other sources such as fertilizer, pesticides, salt intrusion etc. There seems to be a lapse in the concept of pollution.

Irrigation tank and drainage structure maintenance is in the hand of Agriculture Department and Public Work Department. No systematic effort is done to use these devices in an appropriate ways, but only reaper of breaches in tanks bunds if any.

While on Pondicherry Territory an administrative authorization is needed to drill a bore well, it is completely uncontrolled in Tamil Nadu State.

Central bodies like Ministry of Water Resources and related organisms work mainly on investigation and monitoring but hardly on practical issues.

Demographic position

The total population of the watershed region is 3,13,351 as per the 1991 census. Of which 51% is male and 49% is female.

28% of Scheduled Caste, 1.3% of Scheduled Tribes and 70.7% of others are the distribution of community in the watershed.

Out of the total population 80.35% are living in the rural areas and 19.65% are in the urban area of the watershed.

Economic base (main economic features of the project region agriculture, livelihood resources)

The main economic base of the project region is agriculture (60%). Though most part of the watershed is relying on surface water bodies for irrigation (supply depends upon the rainfall), the returns of agriculture income are uncertain.

The main livelihood resource of the population in the project region is agricultural labor but there is a shift toward services and industrial activities.

Land use, farming systems and cropping patterns

Out of total geographical area of the watershed (76,000 Ha), the following are the area available in each category of land use pattern.

Sl.no	Land use pattern	Area in Ha.
1	Community land/ Govt revenue land roads & gully	2770.00
2	Agricultural land (i) Crop land	22975.00
	(ii) Plantation	30665.00
3	Forest land	418.00
4	Water bodies	13480.00
5	Waste land (i) Barren land	3192.00
	(ii) Problem soil	2233.00
	Total	75733.00

As far as the agricultural practices are concerned, crops are being cultivated in all the three types of land such as wet, garden and dry.

The **farming system** of the watershed region is single, intercrop, and multi crop. For e.g.,

a) Paddy followed by pulses (black gram, green gram, etc.)

b) During the initial stage Casuarina is intercropped with groundnut or pulses.

c) The multi cropping is varied from village to village in the watershed.

The **general cropping pattern** of the watershed region is as follows:

Sl. No.	Type of Field	Irrigation status	One Year		
			I[st] season	II[nd] season	III[rd] season
1.	Command area of the minor irrigation tank	Irrigated	Paddy	Fallow	Fallow
			← Casuarina →		
			← Sugarcane →		
2.	Non command area of the minor irrigation tank	Irrigated	• Paddy • Paddy	Groundnut Black gram	Paddy Paddy
			← Sugarcane →		
			← Casuarina →		
3.	Non command area of the minor irrigation tank	Rainfed	• Groundnut • Millets • Pulses	Fallow Fallow Fallow	Fallow Fallow Fallow

Livestock rearing/Fodder availability:

- The average livestock population in each village of the watershed region is around 500 including milch and draught animals, etc.
- There are an adequate number of livestock populations in each village of the watershed region.
- Since the availability of grazing lands (0.47 % of the total geographical area of the watershed) is inadequate, the agricultural produce and locally available fodder and forage crops fulfill the actual requirement of livestock feeds.

Economic activities (other than agriculture i.e. forestry, rural handicrafts etc.)

The other type of economic activities are local commerce and marketing.

i. Quarry works

ii. Cattle / Poultry rearing.

iii. Rural handicrafts like Pottery, Basket making, etc.

Infrastructure (Water, electricity, institutional arrangements., e.g. roads)

i. Water: The minor irrigation tanks are the major water resource for the irrigation. Besides groundwater is also supporting a part of the irrigation requirement of the watershed area.

Groundwater is the major source for drinking. Ooranis (Drinking water ponds) is

also used in few villages.

ii. **Electricity:** Almost all the villages in the watershed region have been electrified.

iii. **Communication:** Panchayat roads connect the villages of the watershed. But the present condition of the roads is far from satisfactory. The postal and telephone services are inadequate.

iv. **Institution:** Primary schools in the revenue villages' level and the middle to higher secondary schools at Panchayat union level providing education.

v. **Health services:** Traditional health services and medicines are practiced in most part of the watershed area. Nevertheless, the Government Primary Health Centers' services are also available.

vi. **Transports:** The transport services are adequate in semi urban areas and inadequate in remote villages.

vii. **Housing:** Generally the type of houses exist in the villages of the watershed region are thatched and tiled houses. The deprived community is generally living in huts.

viii. **Other infrastructures:** The other infrastructures like Community halls, village libraries, veterinary services, etc., are also available in some of the villages of the watershed.

5. Local administration set up

State level

The director for rural development is working under the ministry of rural development of the state. His role is to coordinate the rural development at the state level.

District level

The rural development, at the district level is with the District Rural Development Agency (DRDA) and the chairman is the district Collector. A project officer coordinates it.

DRDA has divided the district into blocks.

Block level

For each block, a block development officer represents the agency and is assisted by a union engineer to cater with the technical problems. A block is composed of around 65 panchayats (approximately 130 villages and hamlets for a population of 150 000).

Panchayat level

Recently, 1996, in the wake of the Panchayati Raj, powers of decision have been transferred with the village panchayat presidents concerning the management of the village infrastructures (minor roads, drinking water supply, schools, small irrigation tanks etc.). Unfortunately the panchayats are highly politicized and represent only a faction of the village. This hinders considerably their managerial capacity, and also the fact that some of

the political leaders are more concerned with their own benefits. Many are not at all prepared for taking responsibility.

6. Technical management of the natural resources

In order to manage the natural resources, the government has created different departments specialized in Water, agriculture, Forest and environment.

The water management is under different umbrellas:

- Central Ground water board for continental hydrogeological assessments and major research schemes,
- State ground water board for the same at the state level
- Public Work Department (PWD) ground water division, monitoring of the state ground water.
- PWD Water Resource Organization (WRO) management of the minor and major irrigation infrastructures
- Tamil Nadu Water Supply & Drainage Board is responsible for supply and distribution of drinking water in the urban rural areas.
- Agriculture Engineering Department is responsible for soil and water conservation programs.

Most of the time these departments work very independently and the coordination of their activities is done at the top level and rarely in the field. It is not rare also to see departments competing with each other or duplicating activities.

The agriculture department takes care of the agriculture extension, but its general approach is very traditional and promotes mainly the use of high yielding varieties, of fertilizers and pesticides as a key to bountiful crops. No attention is paid to the quality of the environment and the ecological balance. Production is the only motto.

Management of the forest and promotion of the social forestry is done by the forest department. Protection of the environment is taken care by the ministry of forest and environment. But for the time being they are mainly concerned by the industrial pollution and give little or no attention to the rural pollution from other sources such as fertilizer, pesticides, salt intrusion etc. There seems to be a lapse in the concept of pollution.

Government sector policy

In the rural development sector, each ministry and department has its own set of policies, aiming at different goals:

- Ministry of rural development is concerned mainly by creation of employment and alleviation of poverty in rural areas.
- Ministry of agriculture will promote food production and cash crops.

- Ministry of forest promotes the production of wood of industrial characteristic.

The water policies are more complex in nature since they are designed by many different departments, based on the recommendations of the Ministry of Water Resources. However, some departments will be concerned only by drinking water availability and others mainly by irrigation potential. The common parameter for these policies, is a major interest for quantity more than quality.

In the absence of a practical holistic approach to water resources management, anarchy is prevailing. Indeed, the basis of water related legislation in India, needs to be reinterpreted in the light of perceived societal necessities of the time.

7. Beneficiaries

The program is contemplating to address the main features of the rural development sector and having water, as its main axis will benefit the entire rural population through:

- Water management, drinking and irrigation water
- Agriculture
- Fuel & fodder
- Forestry
- Land management

It will also benefit the urban population by protecting the main source of drinking water both in quality as well as in quantity.

Government developing agencies will benefit from the institutional support dimension, by disposing of a dynamic management tool to implement their development programs in direct relation with the users.

8. Aim and objectives

The program aims at creating an action-research and operational project to develop new methodologies in the field of:

* Rehabilitation of Irrigation tanks and related infrastructure
* Water management
* Coastal management
* Groundwater management
* Change of policy
* Agriculture development

* Environmental protection
* Waste land reclamation
* Afforestation / agro forestry
* Environmental and water management awareness
* Social development

The program is an upstream program, aiming at preventing an environmental catastrophe.

- Its main vertical axis is water

⇒ Surface water
- Tank rehabilitation
- Irrigation
- Farming
- Afforestation
- Erosion control
- Wasteland reclamation
- Meteorology
- Urban development
- Monitoring of surface water
- Modelisation of surface water management

⇒ Groundwater
- Recharge
- Prevention of over exploitation
- Monitoring of groundwater resources
- Modelisation of groundwater management

- Its main horizontal plan is human activity, agriculture, nature / wildlife.
- Its main focus is research, development, and management: how to restore a balanced water budget that could bring back a future for the area.
- Its centrifugal force is: participation, awareness campaigns, training, social development.

9. Strategy

To support this programme it is proposed to conduct the following activities:

- Collection of all existing data.
- Systematic survey of all tanks and supply channels for evaluation for rapid acquisition of topographical information (presently lacking)
- Evaluation of natural resources-agriculture, forest, wildlife, etc.
- Thorough study of Kaluvelly Swamps to make an impact assessment of present situation on wildlife.
- Evaluation of agricultural practices as well as irrigation practices.
- Evaluation of present policies in regard to water management/social development/protection of environment etc.
- Implementation of water saving irrigation practices.
- Implementation of tank bed desilting and structural devices repair through manual and mechanical means in order to increase rain water storage and recharge to the aquifers, and to conduct action research on this approach to tank rehabilitation.
- Creation of social organizations to provide a local managerial structure for maintenance of tanks and other infrastructures, together with self organization and empowerment capacity.
- Creation of a User Federation at regional level (sub-watershed) in order to coordinate the efforts of proper management.
- Creation of a computer model to help manage natural resources at a bioregional level as well as local level.

10. Implementation Program

1. Research

- Bio-region - definition of the area

- Collection of primary / secondary data

- Impact assessment

- Sociological / economical survey

- Information / awareness campaign through PRA (Participatory Rural Appraisal)

2. Water conservation and management implementation

2.1. Surface water

2.2. Groundwater

2.3. Soil moisture augmentation

3. Social development

3.1. Organization

3.2. Participation

3.3. Upliftment

2. Water conservation and management implementation

2.1. Surface water (Irrigation tanks)

2.1.1. Catchment area

2.1.2. Tank / water spread / bund

2.1.3. Command area

2.1.4. Water management practices

2.1.5. Water saving techniques

2.1.1. Catchment area

Soil and water conservation measures through:

- Afforestation/ agroforestry/nurseries (fruits, fuel, fodder, timber, landscaping, etc.)
- Erosion control (terraces bunding, trenching, check dams and vegetative barriers)
- Clearing supply channels
- Stabilization of gullies and canyon reclamation
- Redistribution of the soil from the water spread

2.1.2. Tank / water spread / bund

- Eviction of settlers on encroached lands
- Desilting
- Deepening and increasing dead storage (recharge, wildlife, fisheries)
- Creation of dikes and islands (wind breaks)
- Protection of existing indigenous vegetation
- Afforestation of the foreshore / bund
- Creation of steps on the bund near the sluice
- Repair or creation of leading channels in front of the sluice
- Repair of sluice and weirs
- Repair or creation of the stone revetment
- Sectioning of the bund
- Maintenance of the top level
- Gravel casing as required

2.1.3. Command area

- Delivering and spreading the soil

- Lining the main channels
- Provision of distribution boxes and channel stabilizers
- Checking and cleaning the surplus courses

2.1.4. Water management practices

- Communal practices survey
- Training / demonstration / exposure visits
- Reestablishment of regular staff to operate the sluice (Neerkutti)
- Gradual shift to daytime irrigation (12 hours from 6 a.m. to 6 p.m.)
- Development of water saving practices

2.1.5. Water saving irrigation techniques

- Information campaigns
- Training farmers to design installation maintenance
- Assisting farmers with maintenance teams
- Making use of on going Government irrigation systems schemes.

2.2. Groundwater

2.2.1. Hydrogeological survey

2.2.2. Water pricing (policy research)

2.2.3. New bore well sinking (policy research)

2.2.4. Reduction of pumping from the wells (policy research)

2.2.5. Awareness campaigns

2.2.6. Adaptation and calibration of a computer model with a view to permanent assessment water availability at bio-region level

2.2.7. Sanitation and Pollution control (demonstration site and policy research)

2.2.7. Recharge of groundwater

- Rehabilitation of tanks: creation of dead storage
- Creation of check dams and minor water harvesting structures
- Trenching and bunding
- Creation of recharge tube wells

2.3. Soil moisture augmentation

2.3.1. see # 2.2.7.

2.3.2. Improvement of agricultural practices:

- Organic farming
- Proper rotation practices
- Contour ploughing

- Strip cropping
- Summer ploughing
- Sub soiling
- Grass implantation in buffer strips

3. Social development

3.1.Organization

- Creation of WUA's (Water User Associations)

at the: tank level

sub watershed

watershed

- Creation of water board (bio-region)

3.2. Participation

- PRA (Participatory Rural Appraisal)
- Building capacity

stake

interest

endurance

3.3. Uplifting

- Create betterment of living conditions
- Ecological awareness
- Education / training
- PRA
- Empowerment of managerial rights on the tanks to the farmers

11. Project Sustainability

Institution

The Auroville Foundation as an organization has been created 1988 by an Act of Parliament and has steadily evolved and increased its capacity in managerial and development skills. During the last 36 years since the founding of Auroville in 1968, large projects are regularly handled by its different units and brought to successful conclusion. Auroville is a long lasting project and as such can offer a guarantee of carrying over responsibility once the project is completed.

Activities:

Most of the activities of the project are of a rural and traditional nature: excavation, tank rehabilitation, afforestation, organic farming, etc,..

The creation of social structures require on the contrary a follow up which will be assured by the presence and the on-going activities of Auroville in the region.

Replicability:

The proposed project and its components are eminently replicable under any similar local conditions. Already many other groups and organizations have taken inspiration from the land and water conservation work of Auroville and its implementing agencies.

The proposed project has to be tailored to be replicable: creation of teams of proper size to be competent, manageable, capable and efficient, making use of local knowledge, skills and indigenous equipment selected on a quality basis.

Moreover, the methodology study of the various components of this program will demonstrate ways and means to design new strategies which could be adopted by other areas in the fields of tank rehabilitation, water management, social development, environmental protection, etc.,…

Cost effectiveness

The cost effectiveness of this project will bear on the following socio economic lines:

- Village life
- Health
- Agriculture
- Forest and social forestry
- Wild life and environmental protection.
- Small scale industry

The main agents of improvement of the general socio-economic context will be:

- Water conservation and management
- Soil conservation and management
- Rehabilitation of the green cover and development of social forest for fuel and fodder supplies
- Training and formation of the Watershed development organization staff and the farmers and villagers in natural resources management.
- Promotion of proven techniques in the field of water management, soil conservation and biodiversity protection
- Promotion of health related issues
- Awareness programs and educational activities.
- Generation of funds from private to public sector through participative approach.

The generation of economic return from the project will take place in:

- Water availability for public and agriculture,
- Improvement of agriculture outputs and reduction of agriculture inputs
- Increase in biomass production in terms of timber, fuel and fodder, and natural forest.
- Stabilization of labor migration through employment generation
- Reduction of heath related social costs.
- Human resource development, creation of improved managerial skills
- Generation of employment for senior capabilities in rural areas
- Creation of "Self Help" groups for financial management independence.

Credential

UNESCO Recognition and support

UNESCO recognizes and supports the value of Auroville's purpose even prior to its official inception the 28th of February 1968. The first resolution from general assembly of UNESCO date of 1966, then was renewed in 1968, 1970 and 1983. A UNESCO Chair on "Earthen Architecture – Constructive Cultures and Sustainable Development" was created in 2000, with on of the research unit of Auroville as one of the partners. Various seminars on Human Unity was sponsored in 1984, 1985 and 1993.

Sr. Federico Mayor, former Director-General of UNESCO, was on this capacity member of the International Advisory Board of Auroville.

Finally, on the occasion of the 35th anniversary of the founding of Auroville Universal Township, the Director-General of UNESCO, Koïchiro Matsuura, participated in the celebrations at UNESCO Headquarters. Mr Matsuura said that « as an intellectual and ethical organization, UNESCO cannot fail to be fascinated by this experience ». Noting that UNESCO had supported the foundation of Auroville and, over the years, has continued to show interest in the unfolding development, the Director-General stressed the similarities between UNESCO's ideals, values and principles and those underpinning this unusual community. He pointed to the way in which key aspects of the Auroville experiment resonate strongly with some of UNESCO's major priorities and concerns such as dialogue among civilizations, cultures and religions ; cultural diversity and culture as a factor for development ; poverty eradication ; quality education and lifelong learning ; and renewable energies.

12. Water availability

Increasing water availability will have two fold effect.

One will be on village life with the stabilization of the quantity and the quality of the supply of drinking water.

The other on agriculture with a stabilization of the supply for irrigation needs from the surface and from the ground in both quantity and quality.

The expected outputs of the project are:

- Generation of additional storage capacity at ground level of 2,304,000 m3 through tank rehabilitation program.
- Generation of 600,000 m3 additional storage capacity for domestic purpose through an Ourany and temple tank rehabilitation program
- Increase of ground water recharge though soil and water conservation programs and catchment area treatment by 10%.
- Long-standing environmental management of the area.
- Innovative model of rural/ urban integration to an eco region.

Agriculture

The contribution of this project to the agriculture sector will be:

- Improvement of water availability for irrigation both at the surface and in the ground.
- Improvement of irrigation practices generating savings up to 40% in water consumption
- These improvements will generate savings of 30% in Electricity consumption
- Improvement of soil fertility through low external input techniques (LEISA) reducing the demand of the sector in chemical fertilizers and other industrial products, and also the demand for irrigation water.
- Improvement of the phyto-sanitation reducing the needs for chemical pesticides to locally available plant extracts, thus curtailing the expenses for costly chemical pesticides.
- Organization of the farmers in associations or cooperatives that will improve the commercialization of their products thus generating better returns to the villages.

Forestry

Catchment area treatment and wasteland development will generate more biomass through afforestation programs and social forestry programs.

Adequate soil conservation measures will arrest erosion of topsoil and in the long run augment the land qualities and characteristics leading to higher productivity.

Employment generation

This project will generate 5,000,000 man days over five years and to a certain extent play a vital role in reducing the labour migration from this region. Focus here would be on the landless SC/ST population. This project will also provide opportunities for permanent employment for about 200 persons (at the level of Diploma, Bachelor, postgraduate and few at PhD level) of this region at

Federation level and Watershed Development Organisation level. This project will also aim at augmenting the income generation capacities through allied activities like dairy, aquaculture etc.

Health

Most of the common diseases are water borne and generate a substantial cost to the government budget estimated at 60 % of the health budget (WHO).

Improving safe drinking water supplies will therefore cut down the "Health related bills" of the government and improve the energy level at the human resources development for this area.

Capacity building

This program has a large component of training and capacity building that will generate additional skills, particularly in the managerial sector. This will improve the economy of the area by curtailing wastage and promoting more efficient methods of management. This project will utilise traditional knowledge and local capabilities in conjunction with modern techniques. This project will also provide opportunities for bringing people from the lower strata closer to decision making process.

Financial management

Management of the development fund will help conserving the energy of the area and avoid unnecessary drainage of finances to other areas by carefully evaluating the local needs and potentials and bridging them with locally available energy reducing the need for external dependence.

Self help groups at the village level can offer a cost effective and reliable alternative to the banking system, and this can be extended to the farm sector thus curtailing the drainage of funds through heavy interest rates levied by banks and money lenders.

As we have enumerated, the benefits of this project are innumerable in different sectors like agriculture, forestry, ground and surface water, health, local resources management etc,. These benefits are both direct and indirect. Benefit cost analysis for tanks rehabilitation and Drip irrigation components has been done.

BENEFIT COST ANALYSIS FOR TANKS REHABILITATION :

The following are the major criteria considered for this analysis.

1) Total no. Of tanks in Kaluvelly Watershed	192
2) Total ayacut of these tanks	10,162 Hectares
3) Present operating efficiency of the tanks	60 %
4) Proposed efficiency of the tanks after rehabilitation	100 %
5) Gap area proposed to be brought under irrigation	4065 Hectares
6) Incremental benefits due to this additional area	Rs. 221.95 Lakhs
7) Benefit cost ratio --	1.16

BENEFIT COST ANALYSIS FOR DRIP IRRIGATION :

The major factors considered here are

1). The area under plantation crop (Block-wise)

Marakanam - 13,000 Ha

Vanur - 31,900 Ha

Olakkur - 3,600 Ha

Mailam - 6,400 Ha

2) Proposed area to be brought under Drip irrigation -- 2500 Ha

3) Coconut , Cashew and other fruit crops are considered for drip irrigation (the calculation here is based on coconut only).

4) The system cost per Hectare -- Rs. 20,000 (approx)

5) The benefits due to this component are

   a) Increase in yield up to 15 %

   b) Savings in water consumption -- 40 % (this water could be used for cultivation of additional area)

   c) Savings in labour cost up to Rs. 500 / Hectare

6) The total incremental benefits due to drip irrigation -- Rs. 269 Lakhs

7) Benefit cost ratio -- 1.71

Annexure I

TANKS HISTORY OF KALUVELLI REGION

REVIVING THE KUDIMARAMATH: A BETTER OPTION FOR TANK SYSTEM MANAGEMENT

L. Marisamy , Auroville water service - Harvest, Auroville , June 2000

Historically the state of Tamil Nadu has 40,000 medium to small tanks.

The percentage of command area irrigated through tank irrigation system before and during the last 50 years was 70 and by other sources 30. Now the recent data on source of irrigation for agriculture shows that nearly about 60 percent of the area is under well iirigation and the remaining through the tank irrigation. The rapid growth of number of bore wells in the tank command area is a direct verifiable indicator to justify the above statement. No longer the tank systems are dependable as they were in the early periods of the last century.

Most of the tanks of the region are several hundred of years old.

The early Rulers gave top priority to repair and maintenance of water storage structures which were common properties then an easy source for irrigation during that period. The responsibility of management and maintenance of tank system was entrusted to the beneficiaries and the stake holding in tank command area locally was called as ayacut was basis for deciding the contribution towards the share of work. This system worked well and was followed for a long period. Every year before the on set of monsoon the ayacutars used to carry out the annual repair and maintenance of the supply channel, sluice repairing and bund strengthening works. The ayacutars who could not give their labour to the repair and maintenance work would compensate by way of contributing in kind or cash equivalent towards their share of labour as per their holding in the command area. This created a sense of belonging among the beneficiaries. The programme of periodic maintenance and management of tank is locally called as ***"Kudimaramath".***

The tank's day to day management including sluice opening ,closing and guiding water to fields undertaken by a "Neerkatty" ,who was appointed for the same purpose and he received remuneration from the stakeholders while harvesting their crop or in some cases a portion of land in ayacut was allotted to him to sustain his livelihood. This work in the village was carried for years by his heirs even after his death and further to next generations. This system worked very well for a long period of time till the British regime took control of the system.

The British rulers declared that all the common resource properties belonged to the State only and would be administered through the State Revenue department and later they imposed a land tax and water cess on the ayacutars for enjoying the benefits from the tank. The repair and maintenance of the tank system became a State subject and beneficiaries were not involved in any work. This coupled with other social changes caused neglect in the tank system and the traditional annual periodic repair and maintenance was completely ignored.

The Revenue collected from the tank and Water cess contributed to the State over the tanks also helped to augment the Exchequer. The land tax amount was fixed based on the type of land soil especially its irrigability and capability class. After Independence, the same administrative system has been adopted which was followed during the British regime.

The tank systems are classified into 2 groups. One is Public Work Department administered tanks and second one is Panchayat administered tanks. Tanks which are having the command area less than the 40 ha or more are classified as a PWD tanks and tanks which are having the command area less than the 40 ha under the purview of Panchayat unions.

Most of the tanks of today are in a neglected condition and are heavily silted up having lost their original storage capacity caused primarily by non periodic repair and maintenance of the tank which was once an annual feature followed by our ancestors. An institution at the village level comprising of all beneficiaries will help to resolve all the issues related to tank repair and maintenance at the village level itself without much dependence on external Govt. agencies even for minor works.

Eri

Approximately one-third of the irrigated area of Tamil Nadu is watered by eris (tanks). Eris have played several important roles in maintaining ecological harmony as flood-control systems, preventing soil erosion and wastage of runoff during periods of heavy rainfall, and recharging the groundwater in the surrounding areas. The presence of eris provided an appropriate micro-climate for the local areas. Without eris, paddy cultivation would have been impossible.

Till the British arrived, local communities maintained eris. Historical data from Chengalpattu district, for instance, indicates that in the 18th century about 4-5 per cent of the gross produce of each village was allocated to maintain eris and other irrigation structures. Assignments of revenue-free lands, called manyams, were made to support village functionaries who undertook to maintain and manage eris. These allocations ensured eri upkeep through regular desilting and maintenance of sluices, inlets and irrigation channels.

The early British rule saw disastrous experiments with the land tenure system in quest for larger land revenues. The enormous expropriation of village resources by the state led to the disintegration of the traditional society, its economy and polity. Allocations for maintenance of eris could no longer be supported by the village communities, and these extraordinary water harvesting systems began to decline.

Ooranis

The tanks, in south Travancore, though numerous, were in most cases ooranis containing just enough water to cultivate the few acres of land dependent on them. The irregular topography of the region and the absence of large open spaces facilitated the construction of only small tanks unlike large ones seen in the flat districts of the then Madras Presidency, now Tamil Nadu.

Annexure II

Kaluvelly Wetland

Unique Points

- Seasonal wetland with a salinity gradient from fresh to brackish water.
- Diverse landforms – The coast, Dunes, Charconite hillocks etc.
- The plateau supports the last vestiges of the Tropical Dry Evergreen Forest (TDEF).
- Important stop on the migratory flyway and a breeding ground for many species of water birds.

Kaluvelly tank and Yedayanthittu estuary are situated about 20 km to the north of Pondicherry along the coast towards Marakkanam in the Villupuram district of Tamil Nadu. Broadly speaking three ecosystems exist in the area.

-The Plateau: A mainly dry land agricultural area with a maximum elevation of 55m and a system of Tanks and Ponds through which the run-off water is fed into the Tank.

- The Tank: A non tidal seasonal brackish water habitat of about 7040 ha. It is partially filled during the south west monsoon and usually fills up totally during the winter monsoon. Excess inflows go into the sea through a narrow channel via the estuary. The mean water level is about 0.91 m.

- The Estuary: An area of about 567 ha including a tidal salt water habitat with mangroves and a saltpan complex.

Kaluvelly has a typically dissymmetric climatic regime with February to May being the statistically dry season when day-time temperatures can cross 40° C. Mean precipitation per year is c.1200mm, the majority of which is received due to cyclonic depressions in the Bay of Bengal in the months of October and November. This is followed by two months of dew which are the coolest months when the min. temp recorded is about 17° C.

The lake and the estuary are state owned; adjacent land is partly private and partly owned by the state, and there are many areas of encroachment around the lagoon.

In addition to the newer dunes and coastal sands along the coast, the soils of the lake bed, estuary bottom and surroundings can be termed slightly saline and hydromorphic. They are poor in organic matter, and if deprived of vegetative cover rapidly dry out. Thus even slight disturbances are sufficient to radically change their properties.

Biotic Factors

Many old-timers testify that Kaluvelly once supported a large and lush mangrove forest which was gradually cleared to make way for agriculture.

There are now a variety of sedges, grasses, shrubs, trees and herbs interspersed with barren sandy areas and muddy margins. Aquatic plants germinate and grow when the lake receives rainfall during October and November, especially in the northeast near the estuary.

The striking abiotic factors dictated the evolution of an unique forest type in the region- more than 600 floral species are known to exists in this region alone(refer Appendix) a phenotype found nowhere else and containing many endemic floral species. The Plateau now supports a few of the last remaining vestiges of the TDEF (Tropical Dry Evergreen Forests) that are now mainly scattered in the form of sacred groves and reserve forests. Oorani has a typical climax forest type while Puthupet and Kurumburam are of the disturbed climax type. Many of the species have medicinal uses; others have cultural and religious uses.

A stone slab bearing inscriptions dating from the 18th century was discovered in a village close to the tank, with a description of how a king was hunting elephants in the surrounding forest. This is indicative of the wildlife that must have once existed in the ancient forests.

Many species of fish, amphibians, and reptiles are found in and around the tank, some of which find prominent mention in the IUCN Red Data Book (Refer appendix for details).

The tank plays an important role in the migratory patterns of many bird species. Not only is it a staging point on the migratory flyway, but is also a breeding site to some migrants (for e.g. Terns). (Refer Appendix for details)

Some resident species breed in the nearby sacred groves (for eg. Cattle Egrets and Grey Herons). According to surveys conducted by Perennou (1987, 1989) and Perennou & Santharam (1990) in 18 major and some smaller wetlands all along the Coromandel Coast, Kaluvelly, along with Pulicat Lake, was described as the most important wintering site for migratory water birds in South India. The area regularly holds over 30,000 Ducks in winter, 20,000- 40,000 shorebirds and 20,000 – 50,000 terns during the migratory season. Other bird counts and sightings include 1,400 Egrets, 500 Black Winged Stilts and the Greater Spotted Eagle.

The tank also provides the background for a constant interaction between ecosystems- for example transfer of nutrients in the form of guano by herons that feed in wetlands but roost in the forests.

Traditional Subsistence

The villagers make diverse use of the wetland in traditional activities including

- Extensive fishing, especially during the high water level period.
- Reed and grass harvesting for building purposes, firewood and fodder.
- Salt manufacture
- Cultivation of crops (mainly paddy) in the drier parts.

- Catching fresh and brackish water fish and prawns for consumption.

- Many species of plants are of economic importance to the local population.

The villagers have also used much of the flora in traditional systems of healing. The Kaluvelly watershed is also the protector of many temple tanks, associated legends and stories. There is an inherent symbiotic relationship between the Kaluvelly, its ecosystem, biotic components and the surrounding villages that has its basis in a rich spiritual tradition.

Threats to the Wetland

The fragile balance of the Kaluvelly ecosystem is being threatened by increasing commercial interests. The watershed area has greatly shrunk and continues to do so at an alarming rate due to encroachment by rice farms. Intensification of agriculture along with overgrazing and an increased use of fertilizers and pesticides in the vicinity of the lake area have led to further contamination. An ancient semi ruined fort guards the mouth of the estuary (near Kaddapakkam). It is a fragile micro-ecosystem and is highly vulnerable to inappropriate developmental activities.

In spite of a prohibition on hunting, there is a considerable amount of poaching activity as a clientele for such game exists in the markets of Pondicherry and Marakkanam. The trade continues to flourish despite the efforts of the judiciary and constabulary.

Destruction of the last indigenous forest areas in the upper catchments and replacement by monocultures has increased erosion and lead to increased siltation of the lake.

Lately there has been an unprecedented increase in prawn farms around Kaluvelly. Much vegetation has been destroyed, land has been dug up and bunded and inlets of seawater leading into the tank have been dug to increase levels of brackish water. The antibiotics in these farms seep into the tank and kill much of the natural life there. The fragile fresh and seawater balance is also being destroyed.

Management

Interventions Needed

A management committee to oversee and facilitate the conservation and management of all activities pertaining to the tank needs to be formed. The management committee must include all the players in the Kaluvelly story. The most important precaution to be taken is that it must be independent of local political influences.

The committee must relate to the Centre, the State, International bodies & Research institutions. There must be a zoning of areas in order to aid sustainable management practices.

General Plans

Kaluvelly is not just an important bird migration site but it is also a holistic biotic entity. The lives of many people, flora and fauna are closely interwoven into the fabric of Kaluvelly and this makes the conservation and protection of the tank not only vital but also multidimensional. Many economic concerns also point to the need of an integrated watershed management plan with a focus on sustainable use of resources

The plans include the establishing of a bird sanctuary, Lake Foreshore planning and afforestation.

In 1983 Auroville made a recommendation to make Kaluvelly into a Bird sanctuary. FERAL (Foundation for ecological Research, Advocacy and Learning) has followed up the same since 1997. Several bodies including the French Institute at Pondicherry, Pondicherry University and NGOs such as COPDANET (Coastal Planning and Development Action Network) have also recommended that Kaluvelly be made into a Bird sanctuary.

This would help to protect, enhance, restore, and manage an appropriate distribution and diversity in the wetland ecosystem, provide and maintain a habitat for migratory birds and fish in the tank. It is necessary to have effective management of impoundments to provide optimal breeding, nesting, roosting, and feeding habitat for all species of migratory birds that use this wetland. Water tolerant tree species to provide roosting and future nesting sites need to be extensively established in the southern parts of the wetland.

- Barringtonia acutangula, indigenous Acacia species, Albizia amara etc

The recognition of Kaluvelly as an aquatic habitat would require further research. This would involve schools, colleges, universities, along with the local authorities and communities mainly involved in fishing. Research partnerships with universities and other organizations should be encouraged to further identify research needs and objectives. Coordination and broad participation in wetlands and aquatic habitat research projects will assist in gaining a better understanding of management needs.

Monitoring and implementation of action plans including restoration and enhancement of TDEF and Mangrove habitats require coordination with governmental and non-governmental organizations in planning efforts and projects. Benefiting from the extensive experience of the Forest Department and The M.S Swaminathan Research Foundation Mangrove restoration programs could be greatly expanded.

A clear management plan of the extensive upper catchments of the western slopes draining into the Kaluvelly tank, which are Reserve and Cooperation forest, needs to be made. This would include, in addition to planting of TDEF species, intensive soil erosion control measures - gulley plugging, check dams, bundings, etc.

Over the last ten years a concerted effort towards social mobilization, community participation and environmental education has laid the foundation for stakeholder involvement in the restoration of the Kaluvelly habitat. The PRA exercises and resource mapping through

community register information (already gathered in forty villages) has to be expanded and sustained.

Summary

In conclusion, not only is Kaluvelly one of the largest wetlands of peninsular India but also one of the largest semi-permanent water bodies of India with a very rich fauna. Yet, awareness of its problems and of its pivotal role in the ecological balance and climatologically important buffer is low.

The need of the hour is for appropriate recognition of Kaluvelly and its wetlands by governmental and international agencies, which would in turn facilitate research and study, spread of local initiatives and people's participation to restore and protect this wetland.

Annexure III

BIODIVERSITY OF KALIVELI AND YEDAYANTHITTU ESTUARY

K S GOPI SUNDAR, M S ECOLOGY
8A, SYNDICATE BANK COLONY END,
VIJAYANAGAR NORTH,
BANGALORE - 560 079.

INTRODUCTION

Wetlands have long been known to be storehouses of a large diversity of life-forms and have a somewhat legendary reputation in being able to sustain a large number of life-forms. The convention in Ramsar added impetus to the already growing concern about the rapidly declining status of wetlands the world over and consequently, a number of tanks, marshlands and lagoons have been adopted as Ramsar Sites. However, the situation presently is far from satisfactory and wetlands are being lost to increased rates of industrialisation and the growing population at an alarming rate.

Wetlands are temporary water bodies and are extremely important to a host of organisms. The water is necessary for the amphibians to mate and lay their eggs in, fish and prawns breed in them and a variety of birds utilise the areas for wintering, feeding, roosting and nesting. In India, the wetlands form important areas for wintering birds in the months of November to February and breeding grounds for the resident species in the months of March to September. Amphibians breed during the rainy period, and fish and prawns spawn immediately after. Molluscs are found throughout the year in coastal wetlands.

DESCRIPTION AND CLIMATE

Kaliveli Tank and the Yadayanthittu Estuary are part of the Kaliveli watershed which extends from Auroville Plateau south for about 30 kms. and is estimated to have an area of 25,000 ha. The Tank is filled with fresh water by the returning or the South-west monsoons in the months of October to December. The north-east part of the tank in made up by the Estuary and the water is saline. As the water levels begin to recede in the months of March and April, the water begins to get increasingly saline due to the effects of the sea. The lagoon is occasionally flooded by cyclonic disturbances and results in sea water permeating to the interior portions of the Tank. Until as recently as 25 years ago, the regions were heavily forested with mangrove vegetation but this has been cleared and replaced by cultivated fields and scrubby thorn vegetation. The climate is described as tropical monsoon climate with an average annual rainfall of 1,200 mm . Mean temperatures range from 38^0C in the winter to 39^0C in the summer.

FAUNA

The area is a treat for the amateur naturalist and the professional biologist alike. A variety of life abounds throughout the year. The following tables describes specific groups found in the region and includes information like breeding etc. wherever observed.

LEPIDOPTERA (BUTTERFLIES)

Abundance: A- 1-2, B- 3-10, C- 11-30

Life Stage (apart from adult): E - Eggs, L - Larva, P - Pupa

Status: R - Resident, W - Winter, LM - Local Migrant, S - Straggler, U - Unknown

Latin Name	Common Name	Abundance	Life Stage	Status
FAMILY PAPILIONIDAE				
1. *Graphium sarpedon*	Common Bluebottle	B	-	S
2. Graphium agammamnon	Tailed Jay	C	L	R/LM
3. *Graphium doson*	Common Jay	A	-	W
*4. Pachliopta aristolochiae**	Common Rose	B	-	R
5. *Pachliopta hector**	Crimson Rose	C	-	R
6. *Troides minos**	Southern Birdwing	A	-	S
7. *Papolio demoleus*	Lime Butterfly	C	E,L	R
8. *Princeps polymnestor*	Blue Mormon	A	-	S
9. *Princeps polytes**	Common Mormon	B	-	R
FAMILY PIERIDAE				
10. Leptosia nina	Psyche	C	-	R
11. Pieris canida	Indian Cabbage	A	-	U
12. Pareronia valeria	Common Wanderer	A	-	U
13. Cepora nerissa	Common Gull	B	E	R
14. Ixias pyrene	White Orange Tip	B	E	R
15. Catopsilia pomona	Common Emigrant	C	E	R
16. Catopsilia pyranthe	Mottled Emigrant	B	-	U
17. Eurema brigitta	Small Grass Yellow	B	-	R
*18. Eurema laeta***	Spotless Grass Yellow	A	-	U
*19. Eurema hecabe**	Common Grass Yellow	B	-	R (?)
FAMILY LYCAENIDAE				
*20. Spindasis vulcans***	Common Silverline	A	-	S
*21. Jamides celeno***	Common Cerulean	A	-	S
*22. Castalius rosimon**	Common Pierrot	A	-	S
23. Chilades laius	Lime Blue	B	E	R
FAMILY NYMPHALIDAE				
24. *Melanitis leda**	Common Evening Brown	B	-	R
25. Ariadne ariadne	Angled Castor	C	E	R
26. Ariadne merione taprobana	Common Castor	B	-	R

27. Araidne merione merione	Common Castor	B	-	R
*28. Precis hierta**	Yellow Pansy	B	-	LM
29. Precis orithya	Blue Pansy	A	-	S
*30. Precis lemonias**	Lemon Pansy	C	-	R
*31. Precis almana***	Peacock Pansy	B	-	R
32. Precis iphita	Chocolate Pansy	C	-	R
33. Hypolimnas misippus	Danaid Eggfly	B	-	LM
*34. Acraea violae**	Tawny Coster	C	E	R
35. Tirumala limniace	Blue Tiger	B	E	R
*36. Danaus chrysippus**	Common Tiger	B	E	R
*37. Euploea core**	Common Crow	B	E	R
FAMILY HESPERIIDAE				
38. Spialia galba	Indian Skipper	A	-	S
39. Udaspes folus	Grass Demon	A	-	U
*40. Suastus gremius***	Indian Palm Bob	B	-	U
*41. Gangara thyrsis***	Giant Redeye	A	-	R
*42. Cephrenes chrysozona***	Palm Dart	B	-	U

* - Seen in the marshy areas as well

** - In agricultural fields

Rest of the butterflies were seen on the thorny scrub and associated vegetation bordering the wetland.

AMPHIBIANS

Detailed surveys were not carried out for this group. A simple checklist of the amphibians identified is given below.

1. Bufo melanostictus	*Common Toad*
2. Polypedatus maculatus	*Common Tree Frog*
3. Rana hexadactyla	
4. Rana cyanophlyctis	*Skipper Frog*
5. Rana temporalis	*Common Bull Frog*

REPTILES

*1. Lissemys punctata**	*Soft-shelled Turtle*
*2. Calotes versicolor**	*Garden Lizard*
*3. Psammophilus dorsalis**	*Rock Agama*
*4. Sitana pondicerianus**	*Fan-throated Lizard*
*5. Chameleon chameleo**	*Chameleon*
6.	*Snake Skink*
7.	*Buff-striped Keelback*
8.	*Olivaceous Keelback*
9. Ptyas mucosa	*Rat Snake*

* Observed breeding in the area.

AVES

Kaliveli is an extremely important site for water birds as their wintering grounds. As many as 78 species of water birds have been observed in the area by Perennou. The following features reflect the importance of the wetland:

- The presence of a large number of large water fowl every year.
- The endangered Spot-billed Pelican is seen in numbers exceeding 150.
- White Storks have been recorded in excess of 250 every year since 1986.
- The presence of the Greater Flamingo continuously. About 7000 birds were recorded in 1987.
- Birds like the Spoonbill, White Ibis and Open-billed Stork are found in hundreds.
- The regular feature of 20,000-30,000 dabbling ducks every year.
- Recording of the Bar-headed Goose.

The table below shows the comparison of waterfowl counts over years at the Kaliveli Tank.

LATIN NAME	COMMON NAME	1986 - 87	1988	1989	1996-97
Pelecanus philippensis	Spot-billed Pelican	200	-	-	163
Ardea cinerea	Grey Heron	330	130	87	112
Ardeola grayii	Pond Heron	100	10	-	17
Ciconia ciconia	White Stork	340	39	1	468
Anastomus oscitans	Open-billed Stork	160	1000	10	-
Mycteria leucocephala	Painted Stork	250	10	-	364
Platalea leucorodea	Spoonbill	150	2	-	16
Plegadus falcinellus	Glossy Ibis	80	60	-	-
Threskiornis aethiopica	White Ibis	230	-	9	4
Phoenicopterus ruber	Greater Flamingo	880	-	-	39
	Ducks (Diving and dabbling)	33000	33170	10000	10960
Himantopus himantopus	Black-winged Stilt	1500	200	15	389
	Waders (Stints, Sandpipers, Curlews, Godwits, Plovers, Avocets, Pratincoles, Coursers)	40000	2380+	1348+	2200+
	Egrets (Large, Little, Cattle, Intermediate, Reef Heron)	1400	11	122	1267
	Terns (Caspian, River, Common, Gull-billed, Little, Lesser Crested, Whiskered, White-winged, Black-bellied	3000	418	144	586+

- The regular sightings of rare birds of prey such as the White-bellied Sea Eagle, Osprey, Montagu's Harrier, Pied Harrier and the Greater Spotted Eagle.
- Smaller wading birds are found in thousands each year.
- Counts of Terns and Gulls of 10,000-15,000 every year.
- Nesting of the Indian Courser, Yellow-wattled Lapwing, Red-wattled Lapwing and the Little Ringed Plover in the drier months on the tank bed.
- Sightings of birds like the Peregrine Falcon and the Grey-headed Lapwing.

Given below is a consolidated checklist of birds found in Kaliveli and adjacent areas.

Status: W - Winter, R - Resident, B - Breeding, S - Straggler, U - Unknown.

Latin Name	Common Name	Status
FAMILY PODICIPEDIDAE		
1. *Tachybaptes ruficollis*	Dabchick	R
FAMILY PELECANIDAE		
2. *Pelecanus philippensis*	Spot-billed Pelican	W
FAMILY PHALACROCORACIDAE		
3. *Phalacrocorax niger*	Little Cormorant	W
4. *Phalacrocorax fuscicollis*	Indian Shag	W
FAMILY ARDEIDAE		
5. *Egretta garzetta*	Little Egret	R
6. *Egretta gularis*	Reef Heron	W
7. *Egretta intermedia*	Intermediate Egret	W
8. *Egretta alba*	Large Egret	W
9. *Bubulcus ibis*	Cattle Egret	R
10. *Ardeola grayii*	Pond Heron	R
11. *Ardea cinerea*	Grey Heron	W
12. *Ardea purpurea*	Purple Heron	W
13. *Nycticorax nycticorax*	Night Heron	W
FAMILY CICONIIDAE		
14. *Anastomus oscitans*	Open-billed Stork	W
15. *Ibis leucocephalus*	Painted Stork	W
16. *Ciconia ciconia*	White Stork	W
17. *Ciconia episcopus*	White-necked Stork	W
18. *Ephippiorhynchos asiaticus*	Black-necked Stork	W
FAMILY THRESKIORNITHIDAE		
19. *Platelea leucorodia*	Spoonbill	W

20. *Plegadis falcinellus*	Glossy Ibis	W
21. *Threskiornis melanocephalus*	White Ibis	W
FAMILY PHOENICOPTERIDAE		
22. *Phoenicopterus ruber*	Greater Flamingo	W
23. *Phoeniconaias roseus*	Lesser Flamingo	W
FAMILY ANATIDAE		
24. *Anser indicus*	Bar-headed Goose	W
25. *Dendrocygna javanica*	Lesser Whistling Duck	W
26. *Tadorna ferruginea*	Ruddy Shelduck	W
27. *Nettapus coromandelianus*	Cotton Teal	W
28. *Anas peocilorhyncha*	Spot-billed Duck	W
29. *Anas crecca*	Common Teal	W
30. *Anas querquedula*	Garganey	W
31. *Anas acuta*	Pintail	W
32. *Anas penelope*	Wigeon	W
33. *Anas clypeata*	Shoveller	W
34. *Aythya ferina*	Common Pochard	W
35. *Aythya fuligula*	Tufted Pochard	W
36. *Netta rufina*	Red-headed Pochard	W
FAMILY ACCIPITRIDAE		
37. *Neophron percnopterus*	Scavenger Vulture	W
38. *Haliastur indus*	Brahminy Kite	W
39. *Milvus migrans*	Pariah Kite	W
40. *Elanus caeruleus*	Black-shouldered Kite	W
41. *Hieraatus pennatus*	Booted Hawk-Eagle	W
42. *Haliaeetus leucogaster*	White-bellied Sea Eagle	W,B
43. *Circaetus gallicus*	Short-toed Eagle	W
44. *Aquila clanga*	Greater Spotted Eagle	W
45. *Circus aeruginosus*	Marsh Harrier	W
46. *Circus melanoleucos*	Pied Harrier	W
47. *Circus macrourus*	Pale Harrier	W
48. *Circus pyrgargus*	Montagu's Harrier	W
49. *Accipiter badius*	Shikra	R
FAMILY PANDIONIDAE		
50. *Pandion haliaetus*	Osprey	W
FAMILY FALCONIDAE		
51. *Falco tinnunculus*	Kestrel	W
52. *Falco perigrinus japonensis*	Peregrine Falcon	W
FAMILY PHASIANIDAE		
53. *Francolinus pondicerianus*	Grey Partridge	R,B
FAMILY RALLIDAE		

54. *Fulica atra*	Coot	W
FAMILY RECURVIROSTRIDAE		
55. *Himantopus himantopus*	Black-winged Stilt	W
56. *Recurvirostra avocetta*	Avocet	W
FAMILY BURHINIDAE		
57. *Burhinus oedicnemus*	Stone Curlew	W
FAMILY GLAREOLIDAE		
58. *Cursorius coromandelicus*	Indian Courser	R,B
59. *Glareola lactea*	Little Pratincole	R,B
60. *Glareola pratincola*	Large Indian Prarincole	W
FAMILY CHARADRIIDAE		
61. *Vanellus cinereus*	Grey-headed Lapwing	W
62. *Vanellus indicus*	Red-wattled Lapwing	R,B
63. *Vanellus malabaricus*	Yellow-wattled Lapwing	R,B
64. *Pluvialis dominica*	Lesser Golden Plover	W
65. *Pluvialis squatarola*	Grey Plover	W
66. *Charadrius dubius*	Little Ringed Plover	R,B
67. *Charadrius dubius*	Kentish Plover	W
68. *Charadrius leschnaultii*	Great Sand Plover	W
69. *Charadrius mongolus*	Lesser Sand Plover	W
70. *Gallinago gallinago*	Common Snipe	W
71. *Gallinago stenura*	Pintail Snipe	W
72. *Tringa hypoleucos*	Common Sandpiper	W
73. *Tringa glareola*	Wood Sandpiper	W
74. *Tringa ochropus*	Green Sandpiper	W
75. *Tringa stagnatilis*	Marsh Sandpiper	W
76. *Tringa terek*	Terek Sandpiper	W
77. *Tringa totanus*	Redshank	W
78. *Tringa erythropus*	Spotted Redshank	W
79. *Tringa nebularia*	Greenshank	W
80. *Philomachus pugnax*	Ruff	W
81. *Calidris minutus*	Little Stint	W
82. *Calidris temminckii*	Temminck's Stint	W
83. *Calidris subminuta*	Long-toed Stint	W
84. *Calidris ferruginea*	Curlew-Sandpiper	W
85. *Calidris alpina*	Dunlin	W
86. *Limosa limosa*	Black-tailed Godwit	W
87. *Limosa lapponica*	Bar-tailed Godwit	W
88. *Numenius arquata*	Curlew	W
89. *Numenius phaeopus*	Whimbrel	W
FAMILY LARIDAE		
90. *Larus argentatus*	Herring Gull	W
91. *Larus ridibundus*	Black-headed Gull	W

92. *Larus brunnicephalus*	Brown-headed Gull	W
93. *Larus ichthaetus*	Great Black-headed Gull	W
94. *Chlidonias hybrida*	Whiskered Tern	W
95. *Chlidonias leucopterus*	White-winged Black Tern	W
96. *Gelochelidon nilotica*	Gull-billed Tern	W
97. *Hydroprogne caspia*	Caspian Tern	W
98. *Sterna hirundo*	Common Tern	W
99. *Sterna albifrons*	Little Tern	W
100. *Sterna bergii*	Large Crested Tern	W
101. *Sterna benghalensis*	Lesser Crested Tern	W
FAMILY COLUMBIDAE		
102. *Columba livia*	Blue Rock Pigeon	R
103. *Streptopelia tranquebarica*	Red Turtle Dove	R
104. *Streptopelia chinensis*	Spotted Dove	R
FAMILY PSITTACIDAE		
105. *Psittacula krameri*	Rose-ringed Parakeet	R
FAMILY CUCULIDAE		
106. *Clamator jacobinus*	Pied Crested Cuckoo	W
107. *Cuculus varius*	Common Hawk-Cuckoo	R
108. *Cacomantis merulinus*	Indian Plaintive Cuckoo	U
FAMILY STRIGIDAE		
109. *Tyto alba*	Barn Owl	R
110. *Athene brama*	Spotted Owlet	R
FAMILY APODIDAE		
111. *Cypsiurus parvus*	Palm Swift	R
112. *Apus affinis*	House Swift	R
FAMILY ALCEDINIDAE		
113. *Ceryle rudis*	Lesser Pied Kingfisher	R
114. *Alcedo atthis*	Common Kingfisher	U
115. *Halcyon smyrnensis*	White-breasted Kingfisher	R
FAMILY MEROPIDAE		
116. *Merops philippinus*	Blue-tailed Bee-eater	W
117. *Merops orientalis*	Small Green Bee-eater	R
FAMILY CORACIIDAE		
118. *Coracias benghalensis*	Indian Roller	R
FAMILY UPUPIDAE		
119. *Upupa epops*	Hoopoe	R
FAMILY CAPITONIDAE		
120. *Megalaima viridis*	Small Green Barbet	R

121. *Megalaima haemacephala*	Coppersmith	R
FAMILY PICIDAE		
122. *Dinopium benghalense*	Lesser Golden-backed	
	Woodpecker	R
FAMILY ALAUDIDAE		
123. *Mirafra javanica*	Singing Bush Lark	R
124. *Mirafra sp.*	Bush Lark (unidentified)	U
125. *Mirafra erythroptera*	Red-winged Bush Lark	U
126. *Eremopterix grisea*	Ashy-crowned Finch-Lark	R,B
127. *Ammomanes phoenicurus*	Rufous-tailed Finch-Lark	R
128. *Alauda gulgula*	Small Skylark	R (?)
FAMILY HIRUNDINIDAE		
129. *Hirundo rustica*	Swallow	W
130. *Hirundo daurica*	Red-rumped Swallow	R
131. *Riparia riparia*	Collared Sand Martin	W
FAMILY ORIOLIDAE		
132. *Oriolus oriolus*	Golden Oriole	W
FAMILY DICRURIDAE		
133. *Dicrurus adsimilis*	Black Drongo	R
FAMILY ARTAMIDAE		
134. *Artamus fuscus*	Ashy Swallow-Shrike	R
FAMILY STURNIDAE		
135. *Sturnus pagodarum*	Brahminy myna	W
136. *Acridotheres tristis*	Common Myna	R
FAMILY CORVIDAE		
137. *Dendrocitta vagabunda*	Indian Tree Pie	R
138. *Corvus splendens*	House Crow	R
139. *Corvus macrorhynchos*	Jungle Crow	R
FAMILY CAMPEPHAGIDAE		
140. *Lanius cristatus*	Brown Shrike	W
141. *Coracina melanoptera*	Black-headed Cuckoo-Shrike	R
142. *Tephrodornis pondicerianus*	Common Wood-Shrike	R
FAMILY PYCNONOTIDAE		
143. *Pycnonotus cafer*	Red-vented Bulbul	R
144. *Pycnonotus luteolus*	White-browed Bulbul	R,B
FAMILY IRENIDAE		

145. *Aegithina tiphia*	Common Iora	R
FAMILY MUSCICAPIDAE		
146. *Turdoides affinis*	White-headed Babbler	R
147. *Turdoides malcolmi*	Large Grey Babbler	R
148. *Terpsiphone paradisi*	Paradise Flycatcher	S
149. *Prinia socialis*	Ashy Wren-warbler	R
150. *Cisticola juncidis*	Streaked Fantail Warbler	R,B
151. *Orthotomus sutorius*	Tailor Bird	R
152. *Copsychus saularis*	Magpie-Robin	R
153. *Saxicoloides fulicata*	Indian Robin	R
FAMILY MOTACILLIDAE		
154. *Anthus novaeseelandiae*	Indian Pipit	R
155. *Anthus campestris*	Tawny Pipit	R
156. *Motacilla indica*	Forest Wagtail	W
157. *Motacilla maderaspatensis*	Large Pied Wagtail	R
158. *Motacilla flava*	Yellow Wagtail	W
159. *Motacilla citreola*	Yellow-headed Wagtail	W
FAMILY NECTARINIIDAE		
160. *Nectarinia zeylonica*	Purple-rumped Sunbird	R
161. *Nectarinia lotenia*	Loten's Sunbird	R
FAMILY PLOCEIDAE		
162. *Lonchura malacca*	Black-headed Munia	W
163. *Lonchura malabarica*	White-throated Munia	W
164. *Ploceus philippinus*	Baya Weaver	R,B
165. *Passer domesticus*	House Sparrow	R

DISTURBANCES

The wetland is shrinking due to increase of agriculture along the banks. Overgrazing, extensive use of fertilisers in the immediate vicinity, are becoming threats of considerable magnitude. Reed collection is extensive and plays its role in disturbing the birds. Poaching is fairly regular. Even though few birds are killed, the disturbance is significant and results in the moving away of birds to adjoining fields and tanks. Poisoning birds using fish as bait is picking up and could have disastrous effects on the birds as well as the human population consuming the birds after purchase in the Pondicherry market. A new salt pan has been planned by SPIC and could affect populations of the White Storks and the Pelicans since the proposed pans are in the foraging grounds of these birds.

CONSERVATION MEASURES

None have been taken so far and the lands remains partly private and partly state owned. Poaching is prohibited but no action is taken to see that it does not take place. The following measures would go a long way in preservation and maintenance of the wetland.

- Declare the area as a bird sanctuary and take immediate action against poaching and poisoning of the birds.

- Control the grazing, encroachment, use of fertilisers and excessive reed harvesting.

- Desilt the lagoon area and try to re-establish a mangrove forest. The desilting would help the diving ducks and the trees would serve as roosting areas for the birds.

- Create small artificial lagoons in the tank area. This would increase foraging space for the waders and provide valuable breeding areas for the amphibians.

- Construct log cabins and hides in appropriate places to facilitate easy watching of the birds without disturbing them. This would serve as a conservation education tool and provide access to ecological data about the birds without disturbance. Researchers, photographers and the common man would benefit.