WETLANDS - A DEVELOPMENT PARADOX
The Dilemma of South Chennai- India

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Abstract
The present study aims to bring to light the damage being wrecked to the wetlands in the south of the Metropolis of Chennai, India. It tries to raise the plea for the Ecologically sensitive and beneficial wetlands. The setting of the study includes the burgeoning real estate haven of Velachery. These Wetlands are being eaten up by the rampant urban sprawl and unscientific solid waste disposal. The relative callousness coupled with the paradoxical approach of the authorities to development is baffling. Sparring some protests from concerned NGOs and People, there has been very little constructive work for the wetlands and their salvation.

The study has used Remote Sensing and Geographic information systems to analyse the extent of damage caused to the ecologically sensitive and essential wetlands. Specie Identification, Water quality analysis and Socio-economic surveys were carried out. It also suggests a Management Plan and hopes that this work would go a long way in the reclamation of this bountiful resource base. The authors of paper hope that this would be a valid step in the path to attain a much-needed salve for the wetlands that can at best remain mute witness to their own doom.

Keywords: Bio-diversity, Flora and Fauna, Geographic Information Systems, Remote Sensing, Water Quality, Wetlands

Introduction
It is a known fact that the earth was upon a time all covered by water and most of the areas remained un-drained well into the modern times (Pursglove 1988). In the age of rampant growth, the wetlands have been often associated with disease and hostile waters. However the natives have along understood and cherished the importance of these very wetlands and have a lifestyle that is closely interwoven with that of the wetlands. Integrated studies using modern science techniques on wetlands, as ecosystems are primarily a phenomenon of the past 25 years, although the development of the basic ecological concepts related to wetlands can be traced back much further (some textual facts date back to the sixteenth century). This paper is an attempt to understand that link and its need for the present age.

Since the signing of the international convention on wetlands at Ramsar (1971), wetlands across the globe have been conserved. They are defined as areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide
does not exceed six meters. The wetlands around the world are being threatened with polluting agencies of diverse kinds. Among these, the Pollution from the Sewage and the Garbage disposal is a major factor of concern. With rapid urbanization, development roles dictate the livelihoods of the endangered wetlands the world over.

Methodology

Scientific approaches are needed for the upkeep of the existing wetlands, which are havens of biodiversity. These techniques would support plant, animal, and aquatic life through a combination of regulatory and voluntary programs designed to reduce the amount of pollutants entering their environment. The contributions of Wetlands are many: they retain water during dry periods, maintain water table, control floods, remove silt and have astounding recharge potential. Wetlands are important feeding and breeding area for wildlife and a stopover for waterfowl. Wetlands are important in supporting species diversity and have a complex and important food web.

The paper has employed a strategy of past values and present techniques to bring out the paradoxical nature in which the wetlands in developing nations are cared for. Past studies for the region and its surrounding were studied in detail prior to actual field data collections, verifications and subsequent validations. The South Chennai (Pallikaranai Marsh) is the apt case where change is bought without scientific temper.

The study has used Geographical Information Systems (GIS) and Remote Sensing (RS) tools to bring out the change in the wetlands over the years, identification of Land use, Turbidity of the water bodies, and habitat zoning. The area was surveyed with GPS and Vector maps (17 village maps-1: 5000) created using ArcGIS 8.2 Software. Remote Sensing Analysis (rectification, classification) was carried using the IRS 1C (LISS-III) image with a resolution of 25.5m. Data Analysis of the wetlands was done both visual and digital interpretation. Species (Floral and Faunal) were identified. Questionnaire survey were carried for the Socio-economic data collection while water Quality tests were done for selected sample locations. Management plans were discussed and formalised with the help of expert avian ecologist, landfill specialist, botanist and wetland scientists.

Study area - Present state of the Wetlands:

Location: - The study area is located in the two districts of Chengalpattu and Kancheepuram. The approximate position of the study area is between 80.09’N to 80.15’N and 12.55’E to 12.59’E. The wetland is for most parts, is covered by the Pallikaranai Marsh located approximately 15 kms south of the heart of the Chennai city. The study area runs south from Velacheri till Medavakkam in south, Okkiyam thoraipakkam on the southeast and thereafter runs parallel to the coast along the New Mahabalipuram Road till Taramani, through Perungudi and , Sheevaram.

Geology: -The region is primarily a marsh type of wetland and demonstrates an overall flat topography with a gentle gradient to the south. The Velachery part of the wetland is the origin of the runoff in the north, a number of channels regulate the flow of water in the region. The slope is towards the south and it drains the water from the northern side in Velachery and the hills on the west and south west of Nanmangalam, Pallavaram and St. Thomas Mount towards the southern extremes as which finally find their way towards the Kovalam Creek. If the sandbar that forms at the mouth of the Kovalam Estuary is not breached regularly, the region faces imminent flooding. (NEERI 1999).
**Recharge:** Rainfall recharge is the main source of aquifer replenishment. The water level rises during the Northeast monsoon period in the months of October to December. The recharge potential of the region is immense as the region is proximate to the South Chennai Aquifer. The entire region is made up of the weathered bedrock (Charnokite) basement.

**Climate:** The climate is clearly divided into pre and post monsoon. The southwest monsoon prevails from July to September and the northeast monsoon is active during November, December and January. The average rainfall during the monsoon is 340 mm, which is about 25 percent of the annual average. Temperature varies seasonally with summer values ranging from 35 to 42 degree Celsius and winter maximum ranging from 25 to 34 degree Celsius.

**Solid waste Disposal:** There are two major Solid waste disposal dumps in the region. The first is the large Perungudi Sewage Treatment Plant (STP) of the Chennai Metro water and Sewage Supply Board (CMWSSB), handling 45 Million Litres a day (MLD) of Raw Sewage. The other is the Alandur Municipality dump yard cum STP on the Velacheri-Medavakkam Road, handling a garbage load of 80-100 tons a day and 25 MLD of sewage. These dump yards are a major menace for the region as they profusely pollute the area by producing foul odour and attract stray dogs, birds and the burning of this causes respiratory problems to the local community and affects the water quality and biota of the region.

**Developmental works:** Slums evicted within the city have been relocated in a blatant flouting of norms laid down by the Chennai Master Plan. Similarly, the Mass Rapid Transit System whose massive Railway Station is coming up at the Northern extremity of the wetland in Velachery is another huge encroacher. Large Scale landfilling activities are under way in Taramani and Perungudi regions.

**Results**

**Bio-Diversity - Flora**
A unique range of adaptations to survive and exploit the wetland environment are visible by the Wetland plants (Hydrophytes) as they are very well adapted to changing water conditions, high salt and low oxygen environment. Most aquatic plants such as water lilies (ponderiaceae family) are extremely porus and contain special tissue, called aerenchyma, which has large, air filled inter circular spaces. Oxygen diffuses thousand of times faster in air compared to water, and so the aerenchyma are thought to facilitate the movement of
oxygen from the leaves to the root like rhizomes. Roots are partly or wholly submerged in water and are poorly or not at all branched. In some cases, they are altogether absent (ceratophyllum). The floating leaves bear stomata on the upper surface only, which has a waxy coating that prevents wetting and clogging of stomata.

Table 1 Selected Flora of South Chennai Wetlands

<table>
<thead>
<tr>
<th>S.N</th>
<th>Plant Name</th>
<th>Family</th>
<th>Colloquial Name</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Typha Angustifolia</td>
<td>Thypaceae</td>
<td>Elephant grass, Sambu Foddér</td>
<td>Foddér</td>
</tr>
<tr>
<td>2</td>
<td>Eichhornia Crassipes</td>
<td>Potederiaceae</td>
<td>Water Hyacinth, Agaya thamarai</td>
<td>Foddér</td>
</tr>
<tr>
<td>3</td>
<td>Ceratophyllum Linn.</td>
<td>Ceratophyllaceae</td>
<td>Nasu.</td>
<td>Cooling, usefull in biliousness, hairs contain microphyllin</td>
</tr>
<tr>
<td>4</td>
<td>Parthenium Linn.</td>
<td>Atraceae</td>
<td>Mukuthi poo</td>
<td>Medicinal, ionic, dysentery</td>
</tr>
<tr>
<td>5</td>
<td>Acacia nilotica Linn.</td>
<td>Mimosaceae</td>
<td>Mimo, Karuvelam.</td>
<td>Tannin, furniture works</td>
</tr>
</tbody>
</table>

**Fauna** – Compared to flora, the bio-diversity of fauna is very low. This is due to its extinction from high pollution levels. Low Faunal presence indicates that advanced stages of wetland degradation. Some species are exterminated, some others mutate while others just migrate.

Table 2 Selected Fauna of South Chennai Wetlands (March and April)

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Italian Name</th>
<th>Common Name</th>
<th>Italian Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilapia (Fish)</td>
<td>Tilapia mossas</td>
<td>Three stripped ground squirrel</td>
<td>Funambulus Palmarum</td>
</tr>
<tr>
<td>Cat fish</td>
<td>Mystus guilo</td>
<td>Bandicoot rat</td>
<td>Bandicota indica</td>
</tr>
<tr>
<td>Gardern Lizard</td>
<td>Calotes versicolor</td>
<td>Checked Keelback Snake</td>
<td>Xenochrophis piscator</td>
</tr>
<tr>
<td>Monitor Lizard</td>
<td>Varanus spp.</td>
<td>Vine snake</td>
<td>Ahaetulla nasutus</td>
</tr>
<tr>
<td>Narrow mouthed frog</td>
<td>Microhyla rubra</td>
<td>Bronze back tree snake</td>
<td>Dendrolaphis tristis</td>
</tr>
</tbody>
</table>

**Avian Fauna:** In all 63 species of birds were found in and around the wetland area. The number of the birds is expected to rise following the monsoons. The most dominant species is the Indian Moorhen (Gallinula Chloropus). These wetlands serves as an ideal habitat for this species because of the Typha, a type of tall grass which provides it with the food required and material to build its nest.

Table 3 –Selected Birds identified in South Chennai wetlands

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Common name</th>
<th>Latin name</th>
<th>Tamil name</th>
<th>R/rm/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Little Grebe</td>
<td>Tachybaptus ruficolis</td>
<td>Tanni Pullu</td>
<td>R</td>
</tr>
<tr>
<td>2</td>
<td>Little Cormorant</td>
<td>Phalacrocorax</td>
<td>Pambuttara</td>
<td>RM</td>
</tr>
<tr>
<td>3</td>
<td>Darter (snake bird)</td>
<td>Anhinga rufa</td>
<td>Neela Kagan</td>
<td>RM</td>
</tr>
<tr>
<td>4</td>
<td>Purple Heron</td>
<td>Ardea purpurea</td>
<td>Perin Vellai Kokku</td>
<td>RM</td>
</tr>
<tr>
<td>5</td>
<td>Grey Heron</td>
<td>Ardea cinerea</td>
<td>Sambal Nari</td>
<td>RM</td>
</tr>
</tbody>
</table>

NA- Not available • R – Residential • M – Migratory • RM – Residential and migratory

**Socio-Economic Layer and Urban Sprawl**

The study area shows a distinct composite environment of the rural and urban confluence. The Velachery, which was a village in 1964, is today a bustling urban suburb, while the others are still in the same mould. That we are losing the wetland would be an understatement. Over the years, as the data shows the region has seen widespread changes with the development of Industries and Educational Institutions, as is evident from the satellite imagery and the latest maps. The field visits proved that the people have shifted from traditional mode of life to the newer forms of urban life. The study attained a startling information after field visits that due to the sustained encroachments of these wetlands almost a total of 273.560ha had been taken up for various pseudo Developmental work till May 2002.
Table-5 Ownership of Land

<table>
<thead>
<tr>
<th>Ownerships</th>
<th>Area</th>
<th>Ownerships</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perungudi STP (Total Area)</td>
<td>957</td>
<td>Alandur Mun. STP</td>
<td>20</td>
</tr>
<tr>
<td>Highways Dept. Radial Roadways</td>
<td>25.60</td>
<td>STP-CCRCP</td>
<td>100</td>
</tr>
<tr>
<td>Corp. of Chennai for Garbage Dumping</td>
<td>74</td>
<td>STP</td>
<td>31</td>
</tr>
<tr>
<td>Remaining land (Swamp Area)</td>
<td>706.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solid Waste Management / Sewage Outfall
The STP is totally defunct (there is no Power Supply), save for the Pipeline system that brings the Sewage to the treatment plant and is allowed to discharge itself of its load directly into the wetland without even the basic filtration process. Ironically, this is hailed as a ‘Natural Treatment’ by the authorities. The Physico-Chemical components of the Solid Waste Sample when interpreted with the water quality, give tangible results that prove that the wetlands of South Chennai are being affected by the harmful practices of humans. The depth of the dump yard used to be almost 15 feet and has now been filled to a depth of 7 feet.

Remote Sensing and GIS Integration
The region is a wetland of diverse character with only the region around the pallikaranai village being saturated with water throughout the year. The rest of the region towards the south of this patch is Non-Perennial in nature and thus in spite of the Ground truth knowledge the supervised classification gave the regions as a new class which we had to name dry beds. In all, Nine Land use classes were identified and plotted as a map. A turbidity classification was carried on over the image, to analyse the turbid character of water, which pictured the encroachments and disturbances caused to the wetlands.

Water Quality
Potable water supply is through the Public distribution system. Open wells and bore wells are used during the period of Non-supply and in the summer. The groundwater table is found at a depth of 1m in the Rainy season and at a depth of 10 m in the summer. The turbidity is high in most parts of the wetland 60-80NTU. The Total Dissolved Content too is very high at a range of 2800-3000mg/l at the selected Stations. High TDS content leads to Eutrophication. Similarly high values of Electrical Conductivity (EC) were noted denoting high pollution levels with increasing salinity. The study area gave a pH value ranging from 6.99-7.96. Most of the aquatic flora is supposed to flourish within the pH value on either side of 7. Thus the study area is a good wetland with rich biodiversity.

Discussion
The results have clearly elucidated the need for change in the developmental practices. The study suggests a series of measures that would help act as a salve to this fragile ecosystem. As a first step the Perungudi STP should be made functional and shifted within five years. Sanitary landfill should constructed and periodic water quality checks made. The Construction of the MRTS should confirm to the International Standards of Construction in Wetlands and Bio-diversity regions, as set by the Ramsar convention. Illegal encroachers should be evicted and fined. A cell for ecological monitoring be created with noted scientists as panel members and the possibility of a reservoir should be made a reality as this will help in the preservation of the wetlands. The ultimate goal is to get a wetland status for these endangered marshes and bring awareness to the people of how important it is for a vast growing city like Chennai. But certain developments here cannot be relocated or just...
demolished. So there has to be an alternative assessment that suggests a acceptable sustainable change.

**Conclusion**

From the study, it is evident that these ecological havens of Bio-diversity are being destroyed due to the negligent development initiatives with rampant human encroachment and unscientific solid waste disposal. The environs are today in the vicious circle of False Development where the concern for the mute faunal and floral players in the food web has been relegated to oblivion. It is foolish to underestimate the wrath of Mother Nature as man has learnt time and again. The study has incorporated a detailed management plan that is global in thought but local in acts. It is the fervent prayer of the authors that the authorities wake up to the need to save the wetlands and understand that nature and development have to go hand in hand. The study with its methodology can be an effective premise for anyone whose is interested to know and work for the South Chennai Wetlands. In the age of E-Governance and Globalisation, wetlands too need their share of print to enlighten the masses about the importance of the wetlands. What is needed now is not studies that explain these aspects, but constructive frameworks that work in the real world.

**Acknowledgements**

Our sincere thanks to Prof. N.Sivagnanam, Head,Dept. of Geography, Univ. of Madras, Dr. S.N. Prasad, SACON Filed Station, Dehradun, Dr.V.Krishnamoorthy- National Institute of Ocean Technology, Dr.Raghunathan, Dr.Thirumailai –Zoological Survey of India , Er.Jayaseelan- Tamil Nadu Pollution Control Board ,Mr.M.B.Nirmal & Mr.T.K.Ramkumar- Exnora International for providing help at all junctures. We cannot forget the moral support lent to us by our families. Finally, this study is dedicated this work to the Almighty God and to all the people who dare to do something different.

**References**


Fig 2. Habitat Zoning for South Chennai Wetlands

Fig 3- Land use Map of South Chennai Wetlands
1.2 FACTORS CONTROLLING THE STRUCTURE AND SPECIES COMPOSITION

Natural wetlands

- Increased disturbance
- Increased water flow
- Decreased pollution
- Decreased nutrients
- Increased pollution
- Increased disturbance
- Sewage outflow
- Solid waste
- Siltation
- Nutrient flow
- Fire, off-road vehicles
- Drainage infilling
- Fire, flood and water level control
- Flooding impeding natural drainage

- Control of pollution
- Exposed soils
- Increased evapotranspiration

Extensive Study Area from IRS-LISS-III Image of 3rd May 2000

Dramatic intrusion into the wetlands by the encroachers

Garbage lying out in the open before the entry of the dump yard proximate to the Velachery- Tambaram Main Road

Advancement of Urban Sprawl

Extent of the Wetland on 3rd May 2000