ISSN 0975 - 9379
Vol. 19, No. 2
July - September 2013

ECO NEWS




Quarterly Magazine of CPR Environmental Education Centre

Annual Subscription - Rs. 200/-

C.P.R. ENVIRONMENTAL EDUCATION CENTRE

The C.P. Ramaswami Aiyar Foundation
1, Eldams Road, Alwarpet, Chennai 600 018, Tamilnadu, India.
Phone : 91- 44 - 24337023 / 24346526 Fax 91- 44 - 24320756
Email : cpreec@vsnl.com / cpreec@cpreec.org
Websites : www.econewscpreec.com / www.cpreec.org / www.cpreecenvis.nic.in
A Centre of Excellence of the Ministry of Environment and Forests, Government of India.

C.P.R. ENVIRONMENTAL EDUCATION CENTRE

Established in 1989

- **1980** - The C.P. Ramaswami Aiyar Foundation starts nature education for teachers and students.
- **1989** - C.P.R. Environmental Education Centre (CPREEC) established jointly by the Ministry of Environment and Forests and the C.P. Ramaswami Aiyar Foundation as a Centre of Excellence of the Ministry of Environment and Forests. Government of India.

Our Mission

- To increase knowledge, awareness and interest among the public about the environment in all its aspects
- To develop resource materials for environmental education and awareness raising
- To conduct training programmes for a wide cross-section of people
- To take up environmental projects for demonstration and research

Our Activities

- Training and awareness raising
- Awareness to and through action
- Awareness programmes in ecologically fragile areas
- Conservation of the ecological heritage
- Research and surveys
- Generation of resource materials
- Exhibitions
- Courses, seminars and symposia

Facilities

- Environmental Laboratory
- Library
- Computer Division
- Publications Division

Geographical Spread

CPREEC's activities extend to

- Andaman & Nicobar Islands
- Andhra Pradesh
- Goa
- Karnataka
- Kerala
- Maharashtra
- Orissa
- Tamilnadu
- Puducherry

NGO Network

CPREEC has an extensive network of about 600 NGOs. All educational programmes are carried out in partnership with select NGOs, Universities, Colleges and Schools.

Publications

- Activity and information books and pamphlets for children
- Environmental training guides and kits for teachers
- Researched Publications
- Colourful and informative posters
- *ECONEWS* - A quarterly magazine
- *Indian Journal of Environmental Education*, a peer-reviewed journal

Exhibitions

CPREEC designs three new exhibitions every year and has a bank of mobile exhibitions that travel all over India.

Environmental Education

- Green Schools of India (GSI)
- Training programmes for Teachers
- Training programmes for School and College Students
- Environmental Law Education

Special Projects

- National Green Corps (NGC)
- Biomedical Waste
- Biodiversity Conservation

Research and Surveys

- Sustainable Technologies
- Surveys of Natural Resources
- Socio-Economic Surveys
- Lab to Field Technology Transfer

EDITORIAL

Water is one of the pre-requisites for life on earth. No living creatures or plant can exist without it. It is also essential for the preservation of the environment. The United Nations has designated the year 2013 as the International Year of Water Cooperation. Water and Biodiversity is also the theme for the International Day for Biological Diversity in 2013. This provides a platform for the parties to the convention on Biological Diversity (CBD) as also the world community in general to be seized of this matter and take pro-active steps to not only create awareness about this vital issue, but also to take positive measures to solve this problem. CPREEC, for its part, is bringing out a quarterly Newsletter entitled "Eco News" that focuses on these vital issues affecting our water security as well as the environmental challenges facing our community.

Chennai city has been facing a severe water crisis since the 1980s and there is an urgent need for an immediate urban renewal programme that will tackle the problems of urbanization and pollution. Dr. T. Sundaramoorthy has written about the importance of the restoration of the ancient temple tanks as also the cleaning up of the Chennai rivers through the Chennai River Restoration Trust (CRRT), M. Lakshmi Sree discusses the Cooum, once a fresh water river and now a stream of sewage, in Chennai, while M. Amirthalingm writes about Chennai's shrinking wetlands. P. Sudhakar makes a case for preserving the biodiversity of the parks of Chennai and the importance of protecting these green patches that act as the lungs of Chennai city. Following this, M. Kumaravelu has highlighted the Benagudi Shola sacred grove of the Nilgiris and the cultural and spiritual values that they help to preserve even today. Finally, there is an article on the toxicity of the Musi River in Hyderabad and the spread of Zoonatic diseases through the food habits of birds.

Nanditha Krishna

Editor

Contents

• •

will become an online magazine from 2014. Therefore No new subscriptions will be accepted.

Please Visit us on : www.econewscpreec.com

Conserving the Water Resources of Chennai – The Need of the Hour

T. Sundaramoorthy

Introduction

The major problem with India's water resources is that it varies greatly over both time and space. Nearly three-quarters of India's rain comes pouring down during the four months of the monsoon. For the rest of the year, the country remains relatively dry. There are 14 major, 44 medium and 55 minor river basins in our country. India has an annual exploitable groundwater of 26.5 million hectare meters. India's groundwater resources are about 10 times its annual rainfall. But this water is declining in many areas due to the developmental activities. The average rainfall in India is about 1200 mm. It is a little above the global mean precipitation of 990 mm. River basin conservation is thus very essential for drinking water, agriculture and others.

Water resources in Tamilnadu

Tamilnadu is one of the driest states in India, averaging only 925 millimeters of rainfall a year. Per capita availability of water resources in Tamilnadu is only 900 cubic meters a year, compared with 2,200 cubic meters for the whole of India. The state's dry season lasts five months (January through May) even in good years, and severe droughts occur in 3 of 10 years, severely limiting cultivation of crops between June and September. A recent series of droughts and water shortages has highlighted the importance of good water resources and irrigation management.

Tamilnadu's geographic area can be grouped into 17 river basins (127 Sub Basins) a majority of which are water-stressed. There are 61 major reservoirs, about 40,000 tanks (traditional water harvesting structures) and about 3 million wells that heavily utilize the available surface water and groundwater. Approximately 30% of the net irrigated area of 30 lakh hectares is watered by canals and 21% by tanks, while 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs.

Conservation of Chennai River Basin

The Chennai river basin comprises of Araniyar, Kosasthalaiyar, Cooum and Adyar rivers. The length of the river basin is 329 km passing through Thiruvallur, parts of Kancheepuram and Vellore districts in Tamilnadu.

The urban expansion of Chennai city is one of the fastest in the country. The present metropolitan area of Chennai city is 1189 sq. kms. and the present population is about 5 million. The population density is 26,903 per sq.km. The expansion of the city is happening in the two neighbouring districts of Kanchipuram and Thiruvallur. The Government of Tamilnadu is planning to include the entire districts of Kanchipuram and Thiruvallur and a part of Vellore district to form the proposed new Chennai Metropolitan Area with an

area of 8,878 sq. kms. As per the study carried out by Madras Institute of Development Studies (MIDS, 2013), there are about 3600 water bodies (irrigation tanks). Apart from this, there are temple tanks and ponds.

The major water bodies supplying drinking water to Chennai are as follows:

Storage of Chennai City Water Supply Reservoirs

Reservoirs	Gross Capacity (MCM)	Live Capacity (MCM)	Catchment Area (km2)	Water spread Area (ha)
Chembarambakkam	88.30	87.80	77	350
Porur	1.04	4.90	22.64	320
Poondi	77.90	77.40	2704	3230
Red Hills	80.75	80.25	59.57	2086
Sholavaram	25.63	25.43	28.33	2258

(Source: Public Works Department, Government of Tamilnadu)

Chennai is famous for its temples. Several temples have a temple tank within its premises. The temple tanks help in increasing the water table in residential areas. The list of major temple tanks in Chennai city is given below:

Major Temple Tanks in Chennai City serving as storage tanks

S. No.	Name of the temple	Place
1.	Thiagaraja Swamy	Thiruvottriyur
2.	Kalyana Venkatesa Perumal	Kaladipet
3.	Angala Parameswari	Royapuram
4.	Arunachaleswarar	Tondiyarpet
5.	Kasi Viswanatha Swamy	Peddanaikenpet
6.	Manneswarar	George Town
7.	Krishnan	Mannadi
8.	Ekambareswarar	Mint
9.	Kachaleeswarar	George Town
10.	Angala Parameswari	Choolai
11.	Kandasamy	Kosapet
12.	Gangatheeswarar	Purasawalkam
13.	Agatheeswarar	Nungambakkam
14.	Karaneeswarar	Saidapet
15.	Prasanna Venkatesar	Saidapet
16.	Agatheeswarar	Villivakkam
17.	Vadapalani Andavar	Vadapalani
18.	Masilamaneeswarar	Thirumullaivoil
19.	Adipuriswarar	Chindadripet
20.	Parasuramalingeswarar	Ayanavaram

S. No.	Name of the temple	Place
21.	Kasi Viswanatha Swamy	Ayanavaram
22.	Velleswarar	Valasaravakkam
23.	Kothandaramasamy	West Mambalam
24.	Marundeeswarar	Thiruvanmiyur
25.	Kapaleeswarar	Mylapore
26.	Virupaksheeswarar	Mylapore
27.	Adikesava Perumal	Mylapore
28.	Parthasarathy	Triplicane
29.	Kandeeswarar	Velachery
30.	Thiruvottiswarar	Triplicane
31.	Vengeswarar	Kodambakkam
32.	Raveeswarar	Vyasarpadi
33.	Karapadrasamigal Madam	Vyasarpadi
34.	Kasi Viswanathasamy	St. Thomas Mount
35.	Chengaluneer Pillaiyar	Mannady
36.	Karungaleeswarar	Koyambedu

(Source: Public Works Department, Government of Tamilnadu)

CPREEC has documented about 50 temple tanks in Chennai city (Source: Temple Tanks of Chennai city, 2004). There will be more than 250 temple tanks if the proposed Chennai Metropolitan Area is formed comprising of Chennai, Kanchipuram, Thiruvallur and parts of Vellore districts. The exact number of small lakes and ponds in the proposed Chennai Metropolitan Area is not known.

Suggested measures to be taken up for the conservation and protection of the water resources of Chennai

The expansion of Chennai city will directly have an impact on the water resources due to urbanization which leads to high population density, industrialization, etc. Already, the present city is facing acute water shortage, ground water depletion, sea water intrusion in the coastal areas, encroachment of tanks and *eris* for housing, office complexes and garbage disposal yard. Moreover, the agricultural land in the proposed Chennai Metropolitan Area will also get converted for developmental activities such as human settlement, special economic zones, etc.

The major rivers of the proposed Chennai Metropolitan Area serving as water resources to the Chennai city will be the Palar, Kosasthalaiyar and Araniyar while the Cooum and Adyar have been polluted to a greater extent. The Cheyyar – Kiliyar sub basin will also serve as an additional water resource.

The protection of catchment area, water spread area is very essential for augmenting the drinking water needs, other domestic and industrial needs. At present, the State Government is providing drinking water from the tanks supported by the various river basins apart from the desalination plant near Chennai. Moreover, Chennai city is also getting water from the Krishna river and Veeranam tank. Many of the industrial needs are fulfilled by utilizing the salt water, ground water and recycled water.

The study made by the MIDS using the GIS technique, provides the distribution

of the major tanks in the districts of Kanchipuram, Thiruvallur and part of Vellore. The baseline data needs to be strengthened by further environmental studies. This will help in the long term conservation of water resources.

The role of college students in water conservation

There are about 200 colleges comprising of engineering, arts and science, medical, para medical, teacher training institutes, polytechnics, in the districts of Chennai, Kanchipuram, Thiruvallur and Vellore. As part of the curriculum and project work, students may be involved in documenting, monitoring and studying the water quality of rivers. Presently, the water quality of selected tanks is being monitored by the Public Works Department under IAMWARM Project. The periodicity of monitoring is comparatively low. Involvement of students will be a fruitful venture. Engineering Colleges may be assigned to map the temple tanks and other irrigation tanks. The Environmental Engineering Department and the Arts & Science Colleges may be involved in preparing the biodiversity registers and monitoring the water quality. The students of other disciplines may be assigned to document the historical and social aspects of the water bodies. All the students may be involved in maintaining the rainwater harvesting structures in their colleges, other government and public buildings in their neighbourhood and also the desilting and maintenance of canals that link the temple tanks.

The role of school students in water conservation

There are about 600 schools under National Green Corps of the Ministry of Environment and Forests, Government of India and about 600 schools under Eco clubs of the Government of Tamilnadu. These students may be involved in water quality monitoring of temple tanks and other water bodies and to increase the awareness level on water conservation among the public and observe the following environmental days:

- ❖ Observing Wetland Day
- ❖ Observing Water Day
- ❖ Observing International Day for Biological Diversity
- ❖ Observing World Environment Day
- ❖ Observing Wildlife Week

The role of community in water conservation

Lake Protection and Monitoring Committees may be formed by the Public Works Department (PWD), Government of Tamilnadu involving the local community around the water body to protect it from not letting out the sewage and dumping garbage.

The Public Works Department (PWD), Government of Tamilnadu may bring out an Atlas on the available irrigation tanks. The Hindu Religious & Charitable Endowment Department (HR&CE), Government of Tamilnadu may also provide the list of tanks under their maintenance. Restoration of temple tanks may also be entrusted with Corporates as part of their Corporate Social Responsibility (CSR) initiative.

The Government of Tamilnadu has proposed to clean up the rivers and canals flowing through Chennai city through the Chennai Rivers Restoration Trust (CRRT). In order to protect the tanks, the trust may also take up conservation and restoration of lakes. All these measures will go a long way in improving the water resources management of the Chennai Metropolitan Area.

River Cooum : A Boon or Bane to Chennai

M. Lakshmi Sree

If anyone thinks of Chennai – they immediately associate it with the Marina beach, the famous Kapaleeswarar temple, the Santhome Basilica, the aroma of filter coffee, Madras Tamil (the slang), the graffiti of the heroes of Kollywood, the speeding electric trains, the frequent traffic snarls due to Metro Rail work, etc. and last, but not the least, the ever stinking Cooum river which welcomes a train passenger coming to the city from any part of the country – east, west, north or south. Even passengers flying in get an aerial glimpse of the Cooum minus the stench!!!!!

The Cooum is presently a polluted river spoiled by filth and pollution. In earlier days, the river was very clean and was called as the Triplicane river. It was used as an inland waterway to transport goods for maritime trade to the Roman Empire and Sri Lanka. The river's proximity to the ancient port city of Manarpha or Mylapore was very vital to trade. Roman merchants came to buy Indian textiles, gemstones and spices in exchange for gold, silver, copper and quality wine. Archaeologists have discovered ancient wine jars, Roman and Chinese coins on the banks of the Cooum. In ancient days, the Cooum river and the nearby Elambore river (North River) which flows into the Cooum at its mouth were running very close opposite to the present Central Station and inundated the whole area during floods. During 1700, the two rivers were linked by a cut to equalize the floods and a bridge was constructed in 1710 across the cut bridging the rivers. In the late 18th century, a renowned philanthropist – Pachaiyappa Mudaliar had bathed in the river before offering prayers at the Komaleeswaranpet Temple in Chintadripet.

The Cooum river originates at a place called Cooum – near Kesavaram anicut in Thiruvallur district and drains into the Bay of Bengal. The Cooum receives water from the Kosasthalaiyar basin by the Kesavaram anicut diversion and the old Bangaru channel in the upstream. The anicut at Korattur on the Cooum and new Bangaru channel takes off on the right bank to feed the Chembarambakkam Lake in the Adyar basin which supplies drinking water to the people of Chennai apart from the Poondi, Red Hills and Cholavaram reservoirs of the Kosasthaliyar basin and Porur reservoirs of the Adyar basin. There is very little flow in the Cooum river as it approaches Chennai city.

Total length of the River	-	65.00 Km
City limit of the River	-	17.98 Km
Catchment Area	-	139.8 Sq. Km
Maximum Flood Discharge	-	19000 Cusecs

(Source: Public Works Department, Government of Tamilnadu)

Flowing through Poonamalle, the river enters Chennai district at Arumbakkam. The river flows through the three corporation zones of Kilpauk, Nungambakkam and Triplicane. The major residential areas covered by the river are Choolaimedu, Chetpet, Egmore and Chintadripet. The river splits into two near Chintadripet and again joins at Napier bridge forming the Island Grounds which is a major islet. The mouth of the Cooum river is not too wide. The river mouth has groynes running to a total length of nearly 250 m. The opening between the groynes is about 170 m to facilitate tidal action and the impact of high tide bringing in sea water is felt for nearly 3 km in the river. The river is periodically cleaned to prevent sand deposits near the river mouth very close to the Napier Bridge and the sand is removed at frequent intervals to facilitate tidal action and to avoid flooding. About 80,000 cubic metres of sand were removed in 2010 – 2011.

Once a fishing river, it has borne the brunt of the city's unplanned expansion. In 1950, the river housed 49 species of fish which came down to 21 by the late 1970s. Today, there are no fish due to high toxic pollutants in the river. The water quality is highly toxic and completely non-potable. The water has almost no dissolved oxygen and has sewage and sludge in plenty.

The river Cooum was once a fresh water source but today it has become a drainage course inside Chennai city, collecting surpluses of 75 small tanks of a minor basin. The river is narrow, placid and meandering. There are more than 9000 families living along the river in addition to 450 shops and business establishment or commercial buildings, invariably polluting the river. There are about 700 odd points in the river bank letting sewage directly into the river. Out of the identified 127 sewage outfalls into the river, 85 are still in use. The majority of the outfalls are located between Aminjikarai and Nungambakkam in Chennai city. It is also stated that nearly 30% of the estimated 55 million litres of untreated sewage is let into the Cooum river. In Maduravoyal, it is estimated that more than 7 tonnes of municipal solid waste is dumped into the river every day.

Industries let out effluents directly into the nearby drains reaching the river or supply channels of tanks, thus leading to water pollution. Even though major industries on the sub-basin have set up treatment plants, the field in and around the sub-basin has been polluted by the treated effluents disposed by these industries.

The classification of industries on the river basin is given below:

Classification / Category	Large	Medium	Small
Red	32	24	223
Orange	87	124	331
Green	7	22	37

(Source: Public Works Department, Government of Tamilnadu)

The Corporation of Chennai maintains 13 bridges on the river. The major bridges on the river excluding small bridges are:

- ❏ Napier Bridge
- ❏ Wallajah Bridge
- ❏ Periamet Bridge
- ❏ Chintradripet Bridge or St.Andrew's Bridge
- ❏ Harris Bridge
- ❏ Commander-in-Chief Road Bridge
- ❏ College Road Bridge
- ❏ Spur Tank Bridge and
- ❏ Aminjikarai Bridge

A new bridge across the Cooum connecting Golden George Nagar in Mogappair with Nerkundram is being constructed by the State Highways Department. It is a 10 span bridge measuring about 110 m long and nearly 24 m wide, accommodating six-lane traffic, with space provisions for bicycles and pedestrians.

Aquatic weeds Kadal palai (*Ipomoea)* are found in 80% of the tanks in the sub-basin restricting the water storage and loss in capacity of the tanks.

Another major threat to the river basin is illegal sand mining which has increased alarmingly of late. Excess quarrying of sand from the Cooum river near A.N. Kuppam anicut had resulted in washing away of the anicut portion. The causeway near Thiruvallur Railway station across the Cooum, the Karanodai Bridge across Kosathalaiyar on the Chennai – Kolkata highway and the Tamaraipakkam anicut were affected due to excess sand quarrying.

Sea water has intruded at many places which have resulted in the loss of soil fertility for cropping. The areas in the Minjur belt and over 10000 ha. land in Gummidipoondi, Cholavaram and Ponneri blocks are affected by salt water intrusion. The intense use of surface water for agricultural purposes upstream and the pumping of ground water have led to the reduction in base flow of the Cooum river. The other reasons for the polluted Cooum

are formation of sand bars at the mouth, discharge of untreated sewage, industrial effluents and encroachments along the banks of the river downstream which has been severely polluted.

Due to contamination of drinking water people suffer. People living along the river basin suffer from acute diarrhoea. The other major diseases are dysentery and jaundice. This is especially so during the rainy season.

The Government of Tamilnadu has constituted the Chennai Rivers Restoration Trust (CRRT) which has taken up a detailed study to clean the Cooum causeway. It will submit its findings by November 2013 to the State government. The government has proposed to clean the river between Paruthipattu anicut near Avadi and the river mouth later this year. The State government has sought a coordinated approach with various departments to reduce pollution in the river and to prevent dumping of solid waste and closing the sewer lines that flow into the river. Mangrove plantations will be carried out in the Cooum estuary near the Island grounds to minimize pollution and to restore biodiversity. In the long run, the state government has also planned to establish parks and waterways in the urbanized stretches. It was also reported recently that it is proposed to increase the tree cover of Chennai city to 33.3% by planting palmyra trees along the banks of the Cooum.

Chennai's Wetlands: A Shrinking Natural Heritage

M. Amirthalingam

The history of the region where the modern city of Chennai now stands goes back to the ancient period. However, the origin of the present city goes back to only about 372 years. Chennai city is today the fourth largest metropolitan city in the country. It comprises of the revenue district of Chennai along with the adjoining portions of Kanchipuram and Tiruvallur district. It occupies an area of about 1,189 square kilometres. In 1639 AD, the English East India Company was on the lookout for a suitable strip of land on which to construct a fort and a factory. They made a reconnaissance of the coast and finally decided upon a piece of land between the Coovam and the Elumur River which enter the sea. The area was then ruled by Peda Venkata Raya, Raja of Chandragiri – Vellore who was the descendant of the famous Rajas of Vijayanagar. They accordingly entered into a lease agreement with the Raja and established a settlement there which was subsequently named as Madrasapatanam.

The area of the settlement was approximately 14 kms long and 4-6 km broad. It was mainly agricultural in nature and irrigated by large tanks. In fact, the old British maps show the area almost entirely occupied by tanks and ponds which have disappeared today due to developmental activities even during the colonial period.

Wetlands can be defined as pieces of land that are inundated or saturated by ground water to a sufficient level so as to support vegetation that can grow in such a type of soil. It includes marshes, swamps, jheels, lakes, peat lands, wet meadows and estuaries (World Wide Fund-India, 1987). Wetlands are the home of varied and endangered living organisms. They also act as a natural drain and a major source of groundwater recharge. They are helpful in charging the aquifers of the region and are home to diverse and fragile living organisms. They are instrumental in checking floods, preventing coastal erosion and minimising the effect of cyclones. They can serve as reservoirs of water and are the natural habitat for various species of birds and animals.

These tanks were mainly irrigated by the monsoons and dried up in summer. The local people use these tanks as their main source of water supply. However, over the years the upkeep of these tanks has been neglected and they were soon filled with garbage and waste material. Cattle were being washed in them and the surroundings of the tanks were being used as an open toilet. Hence, they soon became a health hazard. In addition, the unplanned and rapid urbanization led to the further degradation of these tanks and, in some cases, led to their disappearance.

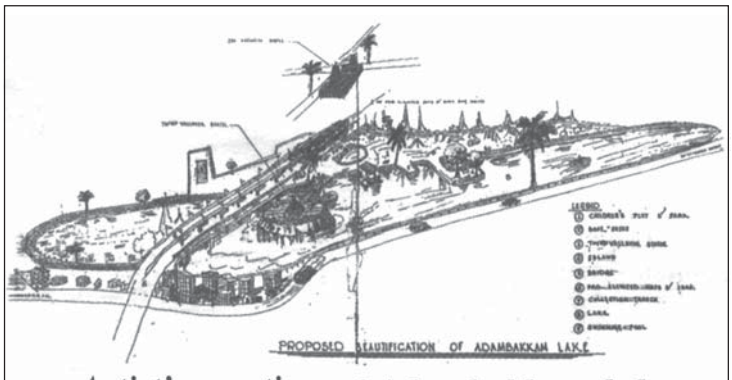
There are about 3000 tanks and ponds big and small in the Chennai area. Some of the important tanks are Madipakkam, Velachery, Thoraipakkam, Pallavaram,

Madambakkam, Maraimalainagar, Kilkattalai, Pallikaranai, Adhambakkam, Puzhudhivakkam, Thalakanancheri, Kovilambakkam, Chitlapakkam and so on. These tanks can be classified as endangered.

The problem has been further compounded by the nexus between the political parties and the land developers. These two interest groups have connived to grab vast tracts of valuable land and have begun constructing flats, complexes, colleges, concrete roads, over-bridges, railway tracks, etc. Another factor that has led to the degradation of these tanks has been the illegal occupation by squatters and the homeless poor. Due to these factors the natural drainage systems by inlet and outlet of the tanks or lakes have been completely destroyed, thus resulting in water logging during the monsoon.

These developmental activities which have been undertaken without taking into consideration the natural drainage factors have resulted in the blocking up of the natural outlet of the water bodies. The net result is that the natural runoff water gets blocked thus resulting in floods in the area. A good example is that of the Velacherry – Madipakkam - Nanganallur belt which the scene of floods every year.

It is estimated that about two decades ago that there were 650 water bodies existing in the Chennai region. About half-of them were located south of the Adyar River. Out of the total of 1,130 hectares of water bodies only about 645



Artist's creation of Adambakkam lake as drafted by a retired superintending engineer, Highways Department.

Puzhudhivakkam Lake gives way for buildings

Children make it as play ground. Many children are playing cricket, footballs,'
The lake has become a dumping ground for people. It is unthinkable how the place would be during rainy season, says Ramkumar of Ullagaram.

— Talk Team
Photo: A R JAYAKUMAR

A scene at Madipakkam Lake

hectares now exist. This has adversely affected the water storage capacity of the Chennai region. The situation has reached such a pass that it is officially estimated that only 19 out of the 29 existing water bodies can be restored. Other water bodies such as Ullagaram, Adambakkam, Thalakanacheri, Mogappair and Senneerkuppam are considered beyond restoration. In the case of water channels like inlet and outlet they have completely disappeared (Srivathsan and Lakshmi, 2013).

Several examples can be cited to substantiate the destruction of water bodies. For example, the Adambakkam Lake is being closed due to the Metro Rail work and a concretised road leading from Velachery to GST Road is being built. Similarly, Madipakkam Lake has become a dumping yard for garbage and the water is not fit for any use. And on the other side construction of buildings is going on apace. Another instance that can be cited is that of the Puzhudhivakkam Lake which was once an important reservoir and used to host a number of rare birds. This valuable natural resource has now been gradually converted into a housing colony. Inundation in Puzhudhivakkam and Madipakkam is caused by the disappearance of the Veerangal Odai which connects the Adambakkam and the Pallikaranai marsh.

According to Water Resource Department (WRD), only 19 of the 29 important water bodies in Chennai region can be revived. Other water bodies such as Ullagaram, Adambakkam, Thalakanacheri are beyond redemption. The situation in the case of lost water channels is even worse since they have entirely disappeared.

Chitlapakkam Lake was once the water source for the Sembakkam and Hastinapuram villages. The total area of this lake is 86.86 acres which has subsequently shrunk to 47 acres due to encroachments such as the development of the district court, bus terminal and the Tambaram taluk office. This lake is getting water through 3 channels from the foothills. However, in this region the water table level is higher than in other areas. This lake is further contaminated by household sewage and waste from commercial establishments.

Conclusion

It is clear that the major challenge to the survival of these wetlands comes from factors such as the pressure of human population, unplanned urbanisation, industrialization, developmental activities such as dumping of solid waste, discharging sewage and encroachments. It is extremely essential that the government should draw up an immediate urban renewal programme incorporating such factors such as encroachment, development of illegal housing colonies and dumping of solid waste and pollution from domestic cum industrial sources. Besides this, a vital role can be played by NGOs, naturalists and concerned public in increasing awareness of the importance of preserving the existing wetlands of greater Chennai.

Reference

1. "Wetlands status and Management in India - An Overview", *World Wide Fund-India*, p. 4, 1987.

2. Anonymous, Directory of Wetlands in India, Ministry of Environment and Forests, New Delhi, 1988.

3. "Indian wetlands in conservation list", *The Hindu*, December 25, 2002.

4. Srivathsan, A. and K. Lakshmi, "Chennai's vanishing water bodies", *The Hindu*, June 6, 2013.

Life Forms of Park Flora

P. Sudhakar

A park is usually characterised by the presence of trees useful for various purposes such as avenues, specimen trees or for aesthetic purposes and for providing shade. The park flora is dominated by trees. Flora of Chennai parks comprises of 40% of trees.

Some of the most common trees include *Azadirachta indica*, *Delonix regia*, *Guazuma ulmifolia, Millingtonia hortensis, Peltophorum pterocarpum, Polyalthia longifolia, Pongamia pinnata, Samanea saman, Tabebuia rosea* and *Terminalia catappa.*

Herbs represent 28% of the flora of Chennai parks which include both plants of ornamental value as well as weeds. Some of the common herbs are *Acalypha indica, Acalypha wilkesiana, Achyranthes aspera, Aerva lanata, Alternanthera betzickiana, Catharanthus roseus, Cleome viscosa, Evolvulus alsinoides, Gomphrena serrata, Sphagneticola trilobata and Tridax procumbens.*

Shrubs have a unique place in parks as hedges or as ornamental bushes or topiary plants. 20% of the total plants of the Chennai parks are shrubs. The predominant shrub that is used as a hedge is *Clerodendrum inerme.* This shrub is preferred for its hardiness, for its amenability for pruning and for its unpalatability for cattle.

Trees of Rare Occurrence

A number of plants are restricted to one or two parks in their occurrence. Many of these trees are also of rare occurrence in the entire flora of Chennai and its neighbourhood (Livingstone & Henry, 1994). They include *Ailanthus excelsa*, *Barringtonia acutangula, Berrya cordifolia, Caesalpinia ferrea, Citrus limon, Clusia rosea, Corypha macropoda, Crateva adansonii* ssp. *odora*, *Eucalyptus torelliana, Guaicum officinale, Hura crepitans, Putranjiva roxburghii, Saraca asoca and Strychnos nux-vomica.* These trees arouse interest due to their form, flowers, rarity and uses.

Caesalpinia ferrea is a species of rare occurrence and its auto-grafting phenomenon along with aesthetic patterns of bark calls for attention.

Some of the rare trees of park seem to have been a part of the natural landscape and can be called remnants of past vegetation. *Barringtonia acutangula*, a semi-aquatic tree is located in three parks, all of which are adjacent to water bodies, though at present these parks are distanced from the water bodies. Both Natesan Park and Nageswara Rao Park

were originally lakes which were eventually filled and converted into parks. Both these parks harbour *Barringtonia acutangula* as well as *Borassus flabellifer* as a remnant species.

Trees of Common Occurrence

A number of trees are common to two thirds of the parks. They include both ornamental and other species. Many of these trees are also the commonest trees of Chennai (Sudhakar, 1991; Narasimhan & Pauline, 2010). They include *Azadirachta indica*, *Cassia fistula, Delonix regia, Ficus benjamina, Guazuma ulmifolia, Millingtonia hortensis*, *Peltophorum pterocarpum*, *Polyalthia longifolia, Pisonia alba, Pongamia pinnata, Samanea saman, Tabebuia rosea and Terminalia catappa.*

The majority of these trees are well stocked in the nurseries of the forest department and other commercial horticultural establishments. Hence distribution and planting of these trees is cheaper and convenient for landscapers as well as other promoters of parks and gardens. This explains the abundance of these trees in many of the parks.

The entire Chennai flora is dominated by four or five trees, namely, *Delonix regia*, *Polyalthia longifolia*, *Peltophorum pterocarpum, Samanea saman* and *Terminalia catappa.* Apart from the easy availability of planting material, the high survival rate of these trees is another reason for their preference and spread. Many of these species are quite hardy, salty and drought tolerant as well as they are able to withstand cyclones.

Weed Flora of the Parks

Any human interfered ecosystem promotes the growth of herbaceous weeds that are mostly heliophyllous. Weeds of agro-ecosystem have been well studied (Mani *et. al.* 1968; Ranjit, Rajbhandari, 1998). Similarly, weeds of lawns have also been extensively documented. These include both native and naturalised species. The majority of the weed flora colonise in open places. Some of the native species of weeds include *Acalypha indica, Achyranthes aspera, Aerva lanata, Aristida setacea, Blepharis repens, Cleome viscosa, Crotalaria medicaginea, Evolvulus alsinoides, Hybanthes enneaspermus, Indigofera linnaei and Leucas indica.* Notable naturalised alien weeds include *Ageratum conyzoides, Amaranthus spinosus, Argemone mexicana, Euphorbia cyathophora, Hyptis suaveolens, Mimosa pudica, Parthenium hysterophorus, Passiflora foetida and Tridax procumbens.*

A few cultivars of *Lantana* are grown in a few parks for ornamental purposes. However, a wild form of *Lantana camara* also occurs as a naturalised weed in many parks. Many of the naturalised weeds have already either turned invasive or have the potential to turn invasive (Narasimhan *et. al.* 2009). Many of the plants that occur as weeds have medicinal properties and are referred to in medical texts of both Ayurveda and Siddha systems (*http://tnenvis.nic.in*). In fact, the local people in some areas do harvest these weeds for medicinal purposes.

Two weeds that are commonly harvested by the local people are *Acalypha indica* and *Phyllanthus amarus*. Some of the plants that were introduced as ornamentals have turned invasive in several parts of India. *Sphagneticola trilobata* is a recent example of such species that is spreading quite fast in shady and moist places.

The parks of Chennai do not have large sprawling lawns due to space constraints. Hence, lawns always occur as small patches that result in a less number of

weeds. The lawns of Chennai parks are dominated by *Cynodon dactylon* as a lawn grass which is a dense mat forming grass. The weeds of these lawns have other grass species that include *Brachiaria mutica*, *Dactyloctenium egyptium* and *Eragrostis tenella*.

Reference

- Livingstone, C. and A.N. Henry, 1994. Revised Edition: *The Flowering Plants of Madras City and its Immediate Neighbourhood*. Government Press. Madras.

- Mani,V.S., K.C. Gautham, and T.K. Chakraberty, 1968. *Losses in crop yield due to weed growth, PANS*, 42: 142 – 158.

- Narasimhan, D., W. Arisdason, Sheeba J Irwin and G. Gnanasekaran, 2009. Invasive Alien Plant Species of Tamil Nadu. *Proc. Natl. Sem. Invasive Alien Species*. ENVIS Centre, Dept. of Environment, Govt. of Tamil Nadu, Chennai. pp. 29 – 38.

- Narasimhan, D. and R. Pauline, 2010. *Common Trees of Chennai a Photo Identification Guide.* Forest Department Government of Tamilnadu.

- Ranjith, J.D. 1998. Weeds and weed management in the Rice-wheat system. In: *Proc. of the Rice-Wheat Research Workshop*. (Eds.) Hobbs, P.R. and N.P Rajbhandari. Nepal Agricultural Research Council (NARC), pp.13 – 22, International Maize and Wheat Improvement Centre (CIMMYT) and Rice-Wheat System Research Consortium, Kathmandu.

- Sudhakar, P. 1991. *Trees of Madras*. C.P.R. Environmental Education Centre. Chennai.

Banagudi Shola

M. Kumaravelu

It is the well known fact that the hilly Nilgiris, especially the central and western parts of the Nilgiris, received perfect south-west monsoon rains after nearly five years. That of course made the people, particularly the new and young generations, take lessons on the climatology of the Nilgiris, a biosphere hotspot of the globe.

This phenomenon triggered an interest among the public as to the importance of the interlinked triple ecosystem of the Nilgiris, namely the sholas, grasslands and swamps in the higher altitude of the Western Ghats. As these three types of vegetation have a capacity for water holding, checking soil erosion and watershed regulations these aspects need to be studied in detail.

It is needless to mention that this unique triple-tier ecosystem is well protected within the reserve forests. Both the government and NGOs are doing their utmost to reclaim the grasslands and swamps where they been lost or eroded. This is done by taking steps to remove the exotic plants like wattle, eucalyptus and pine forests. The forest department

is planning strategies to reintroduce the Shola species and native grass species.

Apart from the well protected areas, a few shola grass land and wetland ecosystem are found elsewhere in the Nilgiris. These particular areas are being protected as sacred by the by the local people. These are called sacred groves. A sacred grove or sacred woods are any grove of trees of special religious importance to a particular culture. These sacred groves stand as an important reserve of biodiversity. In sacred groves, one or more plant species or animal species are being protected and worshipped. The people living nearby these groves do believe that these groves are the abode of the spirits of their ancestors.

Banagudi Shola

Banagudi shola, a sacred grove, is located on the eastern slope of the Nilgiris in Kotagiri Taluk between an altitude of 1200m and 1800m. This Banagudi shola is denoted as a sub-montane type of forest. A committee has been formed comprising of the locals, to assist the Forest Department in conserving this shola forest as also a Longwood shola near Kotagiri town. The major functions of this committee are to organize eco-camps for tourists, students and the local people and to educate them on the importance of the shola. In addition, this committee assists the Forest Department in removing the exotic plant species such as lantana, wattle and eucalyptus and Scotch broom.

Ecology of Banagudi Shola

Banagudi Shola is spread over 22.5 hectares with evergreen plant species and encompasses 2 wet lands. The perennial water resource from this area supplies water to more than 500 families. Floral wealth is very high; around 27 dominated tree species have been identified. Around 95 species of birds, 14 species of reptiles, 19 species of mammals have been recorded by the Banagudi watch dog committee.

Cultural and spiritual values

In general, the mountains, rivers, grasslands and water bodies are being worshiped by the indigenous people. The Toda tribes in particular view the grasslands as a holy place. They depend on it for grazing their buffaloes and they also believe that it is the place where the spirits of their ancestors live.

The Banagudi Shola was identified by the Department of Archaeology as a Pre-historic site. The Hero stone with 5 tier depictions on the orthostatic dolman slabs are located in the middle of this Shola. There are seven dolmans of which two dolmans stone slabs were utilized for erecting Hero stones. The Kurumba village named Banagudi is located adjacent to this shola path. The Kurumba tribes worship these Hero stones as well as the sholas as sacred. They worship the Hero stones as Pandava Gudi (Pandavar temple) and Maa linga along with the surrounding grove. Besides, the Kurumba tribes believe that Thoddadeva (Head deity) lives in the Shola. During December/ January of every year a festival of sowing and during July of every year

festival of harvesting is being celebrated here. The cereals collected from the forest and agriculture lands are offered to the deity. These festivals are being performed near the stone circle (Pre-historic site) which is located in the western part of the shola. It is pertinent to note that the Badaga community (Harigiri clan) from Sakatha village is involved in performing rituals in which the Kurumba tribes also joins.

Despite tremendous pressure on the forest resources, the sacred groves are being protected in many places defying the challenges and other biotic pressures. Changing land use patterns have contributed to a degradation of these precious forests. In many sacred groves gathering of minor forest produce, hunting and cultivation are strictly prohibited. A few plant species are being used for medicinal purposes. Due to taboos, codes and customs and the involvement of the local people, it is not an exaggeration to say that the Banagudi is being protected well today.

In the Nilgiris, during the 1960s, the introduction of cash crops, particularly tea, resulted in many sacred groves being degraded and thus becoming restricted to a very small patch. The local communities and nature lovers are determined to retain the sacred groves because the groves are often as vulnerable to outside political and economic forces as other forest areas. In most cases the groves are being protected by the local communities because of their religious beliefs rather than for their resources.

Reference

1. Hockigns Paul, 1989. Blue Mountains, Oxford University Press, Delhi.

2. *A Complementary contribution to Global Biodiversity Assessment, United Nations Environment Programme*, 1999.

3. Kumaravelu M. 2010. Hero Stones in the sacred groves of the Nilgiris, *Eco News,* vol.16, No.3.

Acknowledgement

I express my sincere thanks to Mr. Boopathy of Sakatha village for his valuable support in studying Banagudi Shola.

Geo-engineering

U. Thirunavukkarasu

Geo-engineering is the study, design and application of human interventions in altering geological surface resources in mining, excavations, underground transportations, ground water flow, energy and other infrastructural alterations involving surface resources.

Recently zgeo-engineering was highly associated with the climate engineering aspect. It includes wide range of technologies which aims to modify the earth's energy balance and to reduce atmospheric temperature in response to growing climate change concerns.

Conception about Nature

People in different cultures conceive nature in different perspectives. The alteration in the natural setting by human being starts from the very first experiment on 'growing food' upto 'altering global climate'. There was a time, where the maximum control over the resources was in agriculture; later it turns out in to digging out water, minerals, metals and altering the course of water bodies. The way that people have imagined about nature has changed dramatically over the years of human existence (Williams 1972). In the same way, the human community has also responded to the impacts of human-nature interactions over many millennia. In the recent past, there are many responses to such events created by human beings.

The Political divide

The climate engineering technologies under the border perspective of geo - engineering technologies proposed are mostly scientifically unproven and the effects of it on the global climate are not proved beyond doubt. Many technologies proposed are available in the tracts of research or scientific validation.

The proposed Carbon Dioxide Removal and Solar Radiation Management are cross boundary in nature both politically and socially. In the context of IPCC projections and climate negotiations going on around the world, there is already a wide gap in agreement and opinions between developing and developed countries. Thus, it is unlikely that climate engineering efforts will reach a consensus amongst the various countries.

The climate-engineering technologies are principally divided into two categories, viz., the Carbon Dioxide Removal (CDR) and Solar Radiation Management (SRM). It may range from planting trees to sequestrating carbon or deflecting solar radiation by pumping aerosols in the upper atmosphere. The technological complexity, social implication, economic resources needed and socio-political approval are deciding factors in the development of geo-engineering in reducing the impact of climate change.

Carbon Dioxide Removal (CDR)

The carbon dioxide removal method operates in the principle of removing atmospheric green house gas -carbon dioxide and storing it. This uptake and storage may happen by biological, chemical or physical means. The CDR methods are many, ranging from afforestration, ocean fertilization to weathering of certain sedimentary rocks.

Carbon Capture and Sequestration (CCS)

The carbon capture and sequestration technologies remove carbon directly from the anthropogenic sources rather removing it from the atmosphere. The sources followed up are biomass, bio-energy and fossil fuels in power generation. There are divided opinions to exclude fossil fuels from geo-engineering- CCS since they are carbon positive and bio-energy and biomass are considered as carbon neutral.

Ocean Fertilization

The ocean fertilization technique uses the biological power of phyto-planktons to take in and use atmospheric carbon dioxide in the process of photosynthesis, thus retaining it in the bio system and to be deposited on the ocean floors when the phyto-plankton dies. To promote this, ocean fertilization involves addition of nutrients such as iron to the ocean surface to promote plaktonic growth. The effects of ocean fertilization on the marine ecosystem, long term effect of it and the acidification of ocean waters are some of the concerns raised by scientists. However, developed countries are also eyeing the possibility of using this technique as way for gaining 'carbon credits'.

Afforestation

Afforestation is the well known and accepted way of carbon sequestration under clean development mechanism. This method involves planting and growing of tree saplings on the land which is without tree cover for several years/ a decade or more. Afforestation has advantages, the carbon storing capacity is more in forest communities and carbon is stored for a longer period and it has other ecological benefits too. On the negative side, afforestation too has hurdles and concerns; the willingness of private land holders, conversion of land use pattern, requirement of food verses afforestation and accidental release of captured carbon are some of them.

Enhance Weathering

The natural process of weathering of silicate and carbonate rocks is expedited and carbon removal from the atmosphere is achieved. The weathered rocks are stored in the soil and the deep ocean as captured carbon storage. Mining for carbonate and silicate rocks, spreading out in the landscape, transportation, involvement of other environmental resources like energy and water are specific concerns which require scientific validation in proving this method as a probable technique to be used in climate engineering.

Solar Radiation Management

The solar radiation management method involves reduction or diversion of incoming solar radiation by making earth surface or atmosphere more reflective. Unfortunately, this method is not to have any altering effect on green house gas emission or sequestration of it. Some of the Solar Radiation Management methods are land

based desert reflectors, cloud-based cloud whitening, stratosphere based aerosol injection and space based shields.

Enhanced Albedo

Reflecting the incoming solar radiation is thought to reduce the increasing temperature. Making the earth surface more reflective by making urban landscapes and structural roofs whitened, and enhancing the reflective surfaces are some methods by which the albedo effect is enhanced.

Cloud whitening is a process by which the cloud-condensation nuclei such as small particles of sea salt are dispersed to a desired level on the clouds by airborne machines or craft.

The incoming solar radiation is reflected back at the stratosphere level by injecting aerosols such as hydrogen sulfide or sulfur dioxide.

Space based reflectors were also thought of as a measure to reflect back incoming solar radiation. But the location, material and maintenance are questions to be answered by further research and innovation.

However, the solar radiation management technologies in theoretical form appear novel but it has many complications. Changes in regional climate or season may happen due to intervention in solar radiation. It may also have wider ramifications on the ecology of many regions- affecting food and the livelihood security of people. The dispersed aerosols may interfere/destroy protective ozone layer in the longer run.

In short, the interventional effect on solar radiation may have multiple effects on the biosphere and the snowballing effect of the entire technology is highly discouraging. Solar Radiation Management may appear attractive since we still continue to release carbon through many consumerist human activities. But nature has its own unique way of answering.

Leading a sustainable life style and going along with nature which was handed down by the earlier generations is the sensible way to mitigate and reduce the impact of climate change.

Reference

1. *http://en.wikipedia.org/wiki/Geoengineering*

2. Corner, A., et al., Corner, A., K. Parkhill, N. Pidgeon and Naomi E. Vaughan, 2013, "Messing with nature? Exploring public perceptions of geoengineering in the UK", *Global Environ. Change*. http://dx.doi.org/10.1016/j.gloenvcha.2013.06.002

3. "Geoengineering: Governance and Technology Policy Kelsi Bracmort Specialist in Agricultural Conservation and Natural Resources Policy" Richard K. Lattanzio Analyst in *Environmental Policy*, January 2, 2013.

4. William, R. 1972, J. Benthall (Ed.) *Ecology : the shaping enquiry*, Longman, London.

Significance of Bioindicators

R. Sabesh

Introduction

Bio indicators are living organisms which are sensitive to environmental changes and respond clearly to such changes. The ever increasing human population, industrialisation, urbanisation and several other human activities have resulted in tremendous pressure on the natural ecosystems. This in turn has resulted in poor environmental quality of the region, disappearance of several native species which played a vital role in the purification of the atmosphere and local water bodies. In order to assess the state of environment quality in a location, we need to develop an "*early warning system*" has to the environmental condition of the particular location. Some species of plants or animals are used by ecologists, for this purpose, for example, some insects exhibit typical response to the habitat destruction (Shahabuddin, 2003). Such species are called Bio indicator species. Indicator species are sensitive to environmental conditions and therefore can give early warning signals about ecosystem health. Drastic decline in the indicator species reflects the state of the environment, mainly the signs of air and water pollution, soil contamination and climate change or habitat fragmentation.

Importance of Bioindicators for the Environmental quality assessment

Bioindicators are organisms, such as lichens, butterflies, crustaceans, birds etc. which are used to monitor the state of the environment. The organisms are monitored for changes that may indicate a problem within their ecosystem. These changes can be chemical, physiological or behavioural. Bioindicators are the relevant tool to assess the ecological health. Ecological health can be viewed in terms of ecosystems, where the structural and functional characteristics are maintained. Ecological health can be expanded to include many aspects of human health and well-being. Each organism within an ecosystem has the ability to report on the health of its environment. Bioindicators are used to detect changes in the natural environment, monitor for the presence of pollution and its effect on the ecosystem in which the organism lives, monitor the progress of environmental clean-up and verify substances like drinking water for the presence of contaminants.

The presence or absence of certain types of plant or other vegetation in an ecosystem can provide important information about the health of the environment. There are several types of plant biomonitors, including mosses, lichens, tree bark, tree rings, leaves, bacteria, fungi etc. Masses of piscivorous marine birds serve as bioindicators of the location of school of fishes. The probability of successful fishing and some other fishes dwelling in deep water can be judged from the plankton composition. Bioindicators are widely used to appraise water purity. The suitability of water for drinking purposes and the efficiency with which treatment facilities are operating can be judged from the composition of the aquatic flora and fauna. Various methods exist for analysing

the degree of pollution of water from the indicator organisms. Animals, plants and microorganisms are used in space research as bioindicators to determine the effect of spaceflight factors on living organisms.

Table-1
Common Bioindicators

S.No.	Bioindicator species	Indication
1	Presence of lLichens	Indicates Nil or Low Air pollution
2	Presence of E. Coli bacteria in water bodies	Indicates that the water is polluted with human waste.
3	Aquatic plant - Water hyacinth	Presence of heavy metals in the water body
4	Presence of stoneflies	Indicates the abundant dissolved oxygen in water.
5	Presence of agal bloom	Presence of nitrates and phosphates in the water body
6	Presence of mayfly larva	Indicates clean water
7	Presence of mosses	Indicates acidic soil
8	Presence of fishes in water body	Indicates that the water has sufficient dissolved oxygen

The hardy lichens are useful bioindicators for air pollution, mainly oxides of nitrogen and sulphur dioxide pollutants since they derive their water and essential nutrients mainly from the atmosphere rather than from the soil. Comparing with the physical/chemical monitoring, biomonitoring is less expensive in evaluating air pollution. Lichens can also be used to measure toxic elemental pollutants and radioactive metals because they bind these substances in their fungal threads where they concentrate them over time. Environmental scientists can then evaluate this accumulation to determine the quality of the ambient air. The composition and total biomass of algal species in aquatic systems serves as an important metric for organic pollution and nutrient loading such as nitrogen and phosphorus.

An increase or decrease in animal population indicates the damage to the ecosystem caused by pollution. For example, if pollution causes the depletion of important food sources, animal species dependent upon such food sources will also subsequently get reduced. In addition to monitoring the size and number of certain species, other mechanisms of animal indication include monitoring the concentration of toxins in animal tissues or monitoring the rate at which deformities arise in animal populations. Microorganisms can also be used as indicators of aquatic and terrestrial ecosystem health. As the microbes are found in large quantities, it is easier to collect samples than other organisms. Some microorganisms will produce new proteins called stress proteins when exposed to contaminants like cadmium and benzene. These stress proteins can be used as an early warning system to detect high levels of pollution. Scientists during the past traditionally conducted surveys and directly measured physical/chemical

parameters of the environment like water pollution. However, the bioindicators use the biological organisms to assess the cumulative impacts of both chemical pollutants and habitat alterations over a period of time. Consequently, the use of bioindicators is basically different from classical measures of environmental quality and offers numerous advantages. Bioindicators add a temporal component corresponding to the life span or residence time of an organism in a particular system, thus allowing the integration of current, past or future environmental conditions. In contrast, many chemical and physical measurements only characterize conditions at the time of sampling, increasing the probability of missing sporadic pulses of pollutants.

Another benefit of the use of bioindicators is their ability to indicate indirect biotic effects of pollutants. This is not possible in physical or chemical assessments. Dumping phosphorus-rich sewage into a lake will adversely impact the ecosystem. Phosphorous commonly limits primary production in freshwater ecosystems, therefore we may predict that elevated phosphorus concentrations will increase the growth and reproduction of some species. Chemical measurements, however, may not accurately reflect a reduction in species diversity or how the growth and reproduction of other species may decline due to competitive exclusion Thus, contaminant levels at higher trophic levels may be under represented by physical or chemical measurements.

Conclusion

Bioindicators can be a measure and index of measures or a model that characterizes an ecosystem or one of its critical components. The Bioindicator information helps us to develop strategies that will prevent or lower such environmental effects and make various human activities more sustainable. The role of bioindicators in sustainable development will help us to ensure that industry leaves the least carbon footprint on the environment. Bioindicators also provide a range of techniques to assess the impacts of air pollution due to sulphur and nitrogen compounds. Bioindicators are also useful in a situation where the environmental parameters cannot be measured by physical or chemical methodologies. They simply complement physical monitoring of atmospheric concentrations and deposition and risk assessment.

References

1. Hasselbach, L., Ver hoef, J.M., For, J., Neitlich, P., Crecelius, E., Berryman, S., Wolk, B. and T. Bohle, 2005. Spatial patterns of cadmium and lead deposition on and adjacent to National Park Service lands in the vicinity of Red Dog Mine, Alaska, *Science of the Total* Environment, 348, 211–230.

2. Carignan, V. & M.C. Villard, 2002. Selecting indicator species to monitor ecological integrity: A review. *Environmental Monitoring and* Assessment, 78, 45–61.

3. Iwama, G. K., Philip, T. Thomas, Robert B. Forsyth and M.M. Vijayan, 1998. Heat shock protein expression in fish, *Reviews in Fish Biology and Fisheries,* 8, 35–56.

4. Miller, S. W. *et al.* Resistance and resilience of macro invertebrates to irrigation water withdrawals. *Freshwater Biology,* 52, 2494–2510 (2007).

5. Rainio, J. &Niemelä, J. Ground beetles (Coleoptera: Carabidae) as bio indicators. *Biodiversity and Conservation*12, 487–506 (2003).\

6. Shahabuddin. 2003. *The Use of Insect as Forest health Bioindicator.http://www.iptek.net.id/ind/?ch=jsti&id=128.Bioindicator2_files*

Plastics threats to Musi birds – Disease spreads for Hyderabad's

Kakarla Venkataratnam

Next time when you walk under the trees in Hyderabad, a piece of rubber or plastic or bone pieces or some other non-degradable item may fall along with a bird dropping. And, you may wonder how such a non-degradable piece had got mixedup with the bird dropping in the air.

Cool it-don't be bothered to find out where and how the mixing had taken place. The piece you find is a part of bird excreta.

Yes, bird dropping has plastic items, rubber pieces and other non-biodegradable items as its integral part. I found this particular feature among the birds in the vicinity of the river Musi. The birds are consuming things that are not of any food value and are letting them out as it is, as they cannot digest them.

60-65 % of bird food is plastic, rubber and junk food: my study was confined to the birds in the vicinity of the river Musi in Hyderabad, Andhra Pradesh, India.

It is found that the birds consume whatever they find and thus, 60-65% of what they are eat contains polythene, rubber bands, bone pieces, pieces of birds' feathers, wood, rice and other grass particles which is contaminated junk and of no food value also. Over a large part of Hyderabad city, the atmosphere is highly polluted and the birds cannot discriminate between polluted and good food. As a result, they consume heavy

metals like arsenic, lead, mercury and other organic materials. This results in their death. A recent study has found that the green vegetables and rice produced by irrigation water from the river Musi is not fit for human consumption. The water is contaminated with garbage, sewage, municipal solids and other wastes. The birds living in these circumstances unknowingly spread a wide range of diseases to the people of the twin cities of Hyderabad and Secunderabad. This has caused tremendous concern among the scientists, ornithologists, researchers as well as bird lovers also. In this paper, I have presented my observations and my research done on the subject.

During my morning walks, I found the bird droppings containing some add (odd) materials. I grew curious and started collecting several samples of such droppings. I collected nearly 200 birds droppings from different parts of the city around the river Musi nesting centers in the areas starting from Vanasthali Harini National Park, Nagole, Marutinagar, Satyanagar, Dilsukhnagar, Salivahana-nagar, Ramanthapur, Uppal and industrial areas such as Amberpet, Malakpet, Chaderghat and Afzulgunj. Among the above samples, only 42 were deemed to fit for analysis. The same were taken for water analysis at the Ornithology Department at the Dr Achrya N.G. Ranga Agricultural University (ANGRAU), Hyderabad and another private laboratory along with my own study by using beaker and apparatus. The survey began early January 2013 and lasted till July 2013. As chemical analysis is a costly affair, I took only water analysis.

It is estimated that there are nearly 35-40 birds nesting centers. Of the 30-40 of birds verities crisscrossing in and around the Musi river, 15 are egrets. We can see cattle egrets and white browed wagtil. Spot billed duck, Shikra, little cormorants ,common pea foul, Blue rock pigeon, white cormorant, white throated munia, black ibis, Indian common peafowl, small green bee eater, Indian roller, Indian pond heron, white throated Kingfisher, Red wattled lapwing, spotted owlet, Tickells, Starlings, blue rock pigeon, common crow, house sparrow, Pariakite, common swallow etc birds in and around Hyderabad and near the river Musi.

Instead of Rodents .....

Generally, food consumed by birds contains 80 percent rodents, insects, amphibians, reptiles, beetles, etc. The remaining will be locally available. Being the capital of Andhra Pradesh, Hyderabad has a population of nearly one core. As a result, there is large scale air, water and land pollution and contaminated water spreads diseases in the city. The river Musi flows through the heart of the city and carries fully contaminated drainage systems containing viruses and so many wastes like municipal solids, hospital wastes which are illegally thrown in the river. Other bio-waste like animal & birds carcasses is also thrown in the river. Hence, it is impossible for these Musi birds to get staple and good food. In the absence of proper food, they are forced to eat whatever is available in the vicinity. Moreover, the city life involves a lot of bus, train, air, other vehicular traffic. Industries and other noise pollution also add to the general degradation of the environment. Some birds are also colour

blind, thus making them unaware of the food they are consuming.

Toxins taking their lives

Due to the toxicological effects of the river water and the food consumed by the birds, their enzyme system gets disrupted and they became prone to various digestive diseases. Also, because of the presence of pollutants in the air such as sulphur-dioxide and sulphur-monoxide the birds are losing their reproductive capacity. Their lifespan has also drastically been reduced. Thus, the population of birds in the Hyderabad area is coming down. One can also find the dead bodies of birds and other animals floating in the river Musi.

The water analysis of 42 samples has shown that there are an estimated 60% to 65% of undigested particles in the bird droppings. These include undigested plastic, rubber bands, small wooden pieces, plant cuts, bird feathers, small pieces of bone and parts of beetle mandibles. Thus, we can conclude that the majority of the items consumed by the birds consist of non-edible items. Chemical investigations may reveal even more stunning realities.

Zoonotic diseases & Threats

Due to the life threatening conditions faced by the birds, the citizens of the twin cities also face various health challenges as these birds carry so many ornithosis / zoonotic diseases.

Ornithological experts have concluded that the birds are spreading / carrying 60 varieties of zoonotic diseases such as bird flu/avianflu, Chicken gunia (Japanese encephalasis-brain fever), respiratory diseases like Histo plasmosis, canid diasis. Yeast, the fatal krip-toe-coc-o-sis called as fungal diseases from dried bird's droppings, will affect the upper track respiratory system. Alleric Alveolius like allergy, parakeet dander, avian influenza (H5N1), pneumonia, rabies, ring worm and tuberculosis may spread due to these birds. Scientists have also stated that the dried dropping of pigeons is causing fungal pneumonia, candi diasis, allergies and respiratory diseases. The common crows and starlings and egrets are also causing various communicable diseases which need to be further investigated.

Food habits of birds

We can divide the birds based on their food habits. These are carnivores, omnivores, frigivores, birds of prey, gramnivores, early time carnivores later frigivores, etc .Vegetarians eat food grains and fruits only. The non-vegetarian birds can be divided into fully dedicated non vegetarians, and those that are partially non-vegetarians. The generally spotted owlet, Emu, eagle, shikra (*Accipiter badius*) like a lot of non-vegetarian food. They are called birds of prey and they also like a little bit of decayed cattle flesh. If the cattle flesh is not available only then will they go for hunting of chickens, common (house) crow, little cormorant and the crow pheasant. The Emu bird even has a chemical digestive system that can consume rocks and get digested. House sparrows in their infant stage, which is up to early 15 days, will take rodents /insects as food. Birds which will eat only grains are called gramnivores. Birds that eat only fruit are called frigiviores. Birds that eat both vegetarian and non-vegetarian food are called omnivores.

Suggested remedies & actions to be taken

- Immediate action to control the spread of these diseases
- Full scientific investigations are needed
- Municipal solid wastes should be cleaned, especially polythene covers, rubber bands should not be mixed with municipal solid waste.
- The river Musi should be cleaned up and the previous climatic /environment conditions should be restored.
- Bird nest centres should be established where the birds will be provided clean and wholesome food. This will help to restore the bird population.

- Bird's medicines should be mixed with food and kept in all the nest centers.
- Ban & strictly implement the cultivation of cattle grass/vegetables /leafy vegetables within the city limits.
- Washing of clothes in the river Musi should also be banned.
- Public and other stakeholders should be involved in all the above processes.

C.P.R. Environmental Education Centre is a Centre of Excellence of the Ministry of Environment & Forests, Government of India, established jointly by the Ministry and the C.P. Ramaswami Aiyar Foundation.

The Centre has been set up to increase consciousness and knowledge about the environment and the major environmental problems facing the country today. It has been conducting a variety of programmes to spread awareness and interest among the public, including, teachers, students, voluntary workers, educators, farmers, women and youth, on all aspects of the environment and ecology, with the purpose of promoting conservation of nature and natural resources.

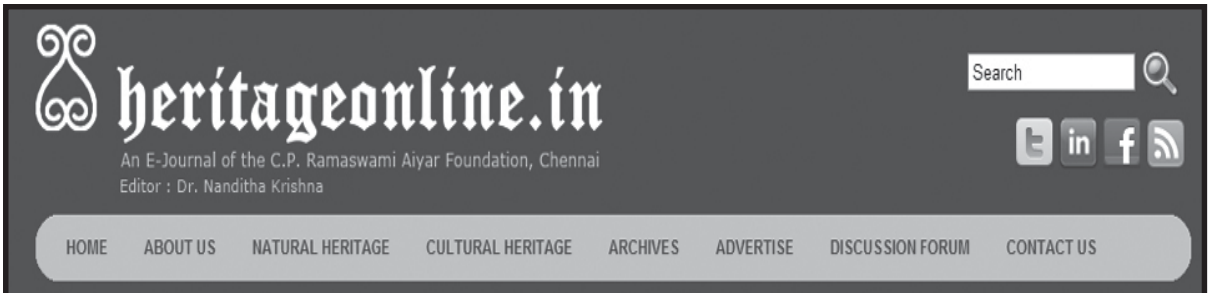
Visit our website :

www.econewscpreec.com / www.cpreec.org / www.cpreecenvis.nic.in

Our Websites ...

www.cpreec.org

www.cpreecenvis.nic.in



www.heritageonline.in

CPR Convention Centre

(Fully Air-conditioned)

C.P ART CENTRE – 2nd Floor

1 Eldams Road, Chennai 600 018.
Phone : 24346526 / 2433 7023 Fax: 91-44-2432 0756
E-mail : cpreec@vsnl.com / cpreec@cpreec.org / cpreec@gmail.com

CPR Convention Centre is a new addition to Chennai. Situated amidst the lush green gardens of the C.P. Ramaswami Aiyar Foundation's vast campus in the heart of Chennai, it has already become one of Chennai's leading venues for conventions and celebrations. Several conferences, business meetings, etc. have been conducted here in serene surroundings.

CPR Convention Centre is an excellent multipurpose center, the perfect place to host seminars, meetings and conferences. It has a fully air-conditioned hall with modern interiors and comprehensive meeting and banquet facilities designed to accommodate up to 200 guests (theatre style).

Situated on the second floor, above C.P. Art Centre, Chennai's happening place, there are levitator (lift) facilities, state of the art sound and presentation systems, excellent acoustics, projection facilities and – wonder of wonders - ample car parking.

CPR Convention Centre provides the best facilities and services par excellence for all your convention needs. For more details contact Public Relations Officer, Mr.N.Srinivasan - 9444580641


Reception


Meeting Hall
(air-conditioned)


Dining Room
(air-conditioned)


Meeting Hall
(air-conditioned)