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ECO NEWS

Quarterly Magazine of CPR Environmental Education Centre

C.P.R. ENVIRONMENTAL EDUCATION CENTRE

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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

On the inner page of this edition of Eco News, you will see five websites listed:

www.econewscpreec.com is the new name for this publication which will cease to be printed from April 2014. It will be an online magazine and there is no charge for subscription. The reason for this change is because it has become difficult to get tree-free paper and we do not believe in cutting trees to say "Don't Cut A Tree". However, those who have paid for the subscription of Eco News will continue to receive it till their subscription period is over.

We have also started a website **www.heritageonline.in.** It is an online magazine of little known areas of Indian heritage, both manmade and natural. This too is a free website to which I hope you will subscribe. We already have a large list of interested scholars and public who have subscribed to this website.

www.environmentallawsofindia.com lists, in question-answer format, the various laws to protect the environment, wildlife and animals.

www.cpreecenvis.nic.in is a website about the "Ecological Traditions of India and Sacred Sites". It is a cornucopia of information.

And **www.cpreec.org** tells you about C.P.R. Environmental Education Centre. Our educational publications are also freely available online.

This issue starts with the importance about the ambient air quality which is a major concern, particularly during the Diwali season, when bronchitis and asthma cases increase. The habit of bursting crackers was introduced by the British and did not exist before. The word "deepavali" – shortened to "divali" - means a row of lights.

And the rest of ECONEWS is about various aspects of biodiversity, a diminishing resource today.

Nanditha Krishna
Editor

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

Please Visit us on : www.econewscpreec.com

Particulate matters in ambient air: a matter of concern

U. Thirunavukkarasu

Clean air is a fundamental natural resource required for living beings. Legal provisions available in the country also ensure that every citizen of India is breathing in clean respirable air. How far we are inhaling healthy air in India? We have many scientific evidences to support that our ambient air quality is getting worse day by day.

The World Health Organisation's (WHO) constituent research body, the International Agency for Research on Cancer (IARC), announced to the world on 17 October 2013 that it has classified outdoor air pollution as carcinogenic to humans (Group 1).

> "After thoroughly reviewing the latest available scientific literature, the world's leading experts convened by the IARC Monographs Programme concluded that there is *sufficient evidence* that exposure to outdoor air pollution causes lung cancer (Group 1). They also noted a positive association with an increased risk of bladder cancer"
>
> - International Agency for Research on Cancer (IARC)

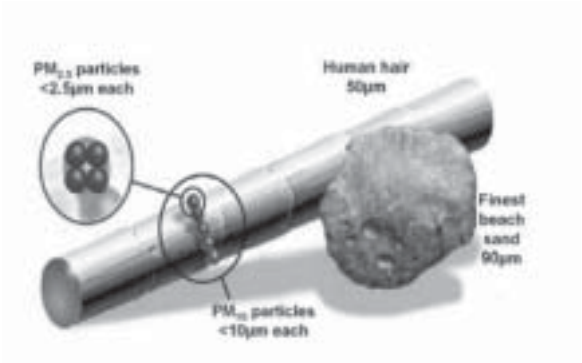
Air pollution

Air pollution is a mixture of gases and tiny particles which lowers the quality of the air we breathe. The tiny particles are suspended in the air as aerosols. Particulate matter is the term which describes very small solid, liquid or gaseous particles in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. Particulate matter less than 10 micro meters in size is of greater concern. These particles are known as PM10.

Particulate Matter

Polluting particulate matter originate from a variety of sources. Diesel trucks, traditional woodstoves, power plants and industrial activity are a few to mention. Particulate matter can be directly emitted or formed in the atmosphere.

Comparitive size of PM10



-Source: www.mfe.govt.nz

Anthropogenic sources of particulate matter

We may trace out the source to many domestic, transport and industrial activities. However, the major contribution is through the urban life style that people are leading now-a-days. Anthropogenic sources such as burning of fossil fuels in automobiles, coal combustion in power plants and industries have multifold effects on the atmosphere when compared with natural sources such as volcanic eruptions, dust storms and forest fires.

The vehicles we drive, the power that we use and the waste that we create and burn are deleterious to the environment. In India, a good example is the festival like "Diwali" which contributes in a negative way to the ambient air quality.

Ill-conceived festivities and urban life style: the prime contributor to air pollution

The festival of lights no more brings brightness to our life; instead it brings gloom and darkness to the health of human beings and animals. The happiness and joy we derive out of bursting crackers brings pain and suffering to young children and senior citizens. The hospitals around the county report a spurt in the cases of bronchitis, allergy, asthma and wheezing during the time of this festival. If we consider ourselves as responsible law abiding citizens, we have no right to spoil the health of others and endanger their life. Consider the Central Pollution Control Board's real time ambient air quality found in Chennai before and after Diwali.

Real time ambient air quality in Chennai

Source: Real time Air Quality Data, Central Pollution Control Board, Ministry of Environment and Forests, Government of India.

Station: Manali(Tamil Nadu-Chennai), Alandur (Tamil Nadu-Chennai)

Parameter:
Manali(SO2,CO,NOx,RPM),Alandur (SO2,CO,NOx,RSPM)

AvgPeriod: 24 Hours

Date - From : 31/10/2013 **To:** 05/11/2013

Date	Manali(Tamil Nadu-Chennai)				Alandur (Tamil Nadu-Chennai)			
	SO_2	CO	NOx	RPM	SO_2	CO	NOx	RSPM
31/10/2013	22.92	0.00	12.80	-	17.32	1.04	18.13	94.19
01/11/2013	6.29	0.00	0.00	-	2.71	0.96	15.49	73.88
02/11/2013	23.19	0.00	395.16	-	18.33	0.00	37.18	114.02
03/11/2013	34.13	0.00	57.83	-	24.45	0.00	37.56	51.84
04/11/2013	2.75	0.00	46.63	-	20.35	0.00	25.56	54.49
05/11/2013	1.76	0.00	35.07	-	16.31	0.00	28.11	77.72

The Central Pollution Control Board in India has a real time ambient air quality monitoring system established in important cities of India. The Government of India has also notified the National Ambient Air Quality Standards through a Gazatte Notification on 18th November 2009.

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutants	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)	
1	Sulphur Dioxide (SO_2), µg/m³	Annual*	50	20	1. Improved West and Gaeke 2. Ultraviolet Fluorescence
		24 Hours**	80	80	
2	Nitrogen Dioxide (NO_2), µg/m³	Annual*	40	30	1. Modified Jacob & Hochheiser (Na-Arsenite) 2. Chemiluminescence
		24 Hours**	80	80	
3	Particulate Matter (Size <10µm) or PM_{10} µg/m³	Annual*	60	60	1. Gravimetric 2. TEOM 3. Beta attenuation
		24 Hours**	100	100	
4	Particulate Matter (Size <2.5 µm) or $PM_{2.5}$ µg/m³	Annual*	40	40	1. Gravimetric 2. TEOM 3. Beta attenuation
		24 Hours **	60	60	
5	Ozone (O_3), µg/m³	8 hours**	100	100	1. UV photometric 2. Chemiluminescence 3. Chemical Method
		1 hours **	180	180	
6	Lead (Pb), µg/m³	Annual *	0.50	0.50	1. AAS/ICP Method after sampling using EPM 2000 or equivalent filter paper 2. ED-XRF using Teflon filter
		24 Hour**	1.0	1.0	
7	Carbon Monoxide (CO), mg/m³	8 Hours **	02	02	Non dispersive Infra Red (NDIR) Spectroscopy
		1 Hour**	04	04	
8	Ammonia (NH_3), µg/m³	Annual*	100	100	1. Chemiluminescence 2. Indophernol blue method
		24 Hour**	400	400	
9	Benzene (C_6H_6), µg/m³	Annual *	05	05	1. Gas chromatography based continuous analyzer 2. Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP)-particulate phase only, ng/m³	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m³	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m³	Annual*	20	20	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

** Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval.*

*** 24 hourly 08 hourly or 01 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

Source: National Ambient Air Quality Standards, Central Pollution Control Board, New Delhi, published in Gazette of India, 19 Nov, 2009.

Urban air quality and life style

In most of the urban areas, the ambient air quality standards are always worse when compared with the standards prescribed for the residential areas and the situation gets worse during festivities. The twelve major festivals of India drew a common ecological and cultural ground few decades earlier; unfortunately all those ecological values have now been forgotten and the festivals of India are now a great source of garbage and pollution.

Growth of Automobiles in India

If we examine the growth of automobile industry in India, it can be quantified in terms of quantum jumps over the years. We are now adding millions of fossil fuel powered vehicles to the Indian roads every year. However, the road infrastructure is not able to cope up with the tremendous leap in the growth of vehicles in India. Individually owned vehicles occupy more road space and leave the pedestrians and cyclists to suffer the most. Un-authorized road side parking by private vehicles, apathy towards pedestrians, and disregard for cyclists add to the problem. It is very hard to find cycle tracks, pedestrian pathways and crossings in the urban roads of India.

Growing Garbage

A World Watch study in 1999 predicted that by 2025, the amount of solid waste generated in the world would double, i.e., from 1.3 billion tones to 2.6 billion tones. As the city grows and the urban consumerist life style prevails, more amount of solid waste is generated. The most saddening part of that is the increase of non-recyclables in the total municipal solid waste generated.

India with its large population and high density is on the top ten 'high contributing countries' of solid waste in the world. Unscientific management including the burning and transportation of solid waste contribute to the pollution of air.

It is time to realize that a healthy and happy life is more important than our smoke guzzling vehicles and sophisticated modern gadgets. The vulgar display of wealth should give way to more eco-friendly and sustainable way of life that will nurture our planet.

Automobile Domestic Sales Trends (Number of Vehicles)

Category	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Passenger Vehicles	1,549,882	1,552,703	1,951,333	2,501,542	2,618,072	2,686,429
Commercial Vehicles	490,494	384,194	532,721	684,905	809,532	793,150
Three Wheelers	364,781	349,727	440,392	526,024	513,251	538,291
Two Wheelers	7,249,278	7,437,619	9,370,951	11,768,910	13,435,769	13,797,748
Grand Total	**9,654,435**	**9,724,243**	**12,295,397**	**15,481,381**	**17,376,624**	**17,815,618**

Source: Society of Indian Automobile Manufacturers, www.siamindia.com

Asthmatic student seeks law banning crackers

She and her friends plan to petition Centre in this regard

The ride has only got rougher

Road network growth out of proportion with rise in vehicle numbers

On Bellary Road

Reference

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2. *http://en.wikipedia.org/wiki/Particulates*
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5. *http://cpcb.nic.in/National_Ambient_Air_Quality_Standards.php*
6. *http://www.worldwatch.org/global-municipal-solid-waste-continues-grow*

ECONEWS welcomes articles and news items from its readers. Please send them to

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Kaliveli Wetland

T. Sundaramoorthy

Wetlands are almost seven times more productive than tropical forest ecosystems. The ecological importance of wetlands was understood only in the 19th century. Directly or indirectly, the wetlands support lakhs of people by providing goods and services. They are water storage, recharging of ground water, nesting and feeding grounds for birds, food and shelter for mammals; wetlands contribute a lot in environmental management like flood control, prevention of natural disasters like cyclones and act as carbon sink. Wetland plants remove a wide range of pollutants from contaminated water.

Out of 94 nationally important wetlands identified in India by the Ministry of Environment and Forests, Government of India, three are in Tamilnadu viz., Point Calimere, Pallikkaranai and Kaliveli (*Kazhuveli*) wetlands.

Kaliveli wetland is in Tindivanam taluk, Villuppuram district of Tamilnadu. The wetland is situated between 79°45' to 39°55' longitude and 12° to 12°10' latitude and Kaliveli lies adjacent to Bay of Bengal along the East Coast. The wetland lies west of Puducherry to Chennai along the East Coast Road (ECR). It starts in Keelpudupattu village, which is 6 km from Puducherry and extends to Marakkanam village. The storage capacity of the wetland is 34 million cubic metre. The maximum depth of the wetland is 6 ft. while the average depth is 3 ft. The total area of the wetland is 13,200 ha. and is divided into three areas – (i) Kaliveli flood plains, (ii) Uppukalli creek and (iii) Yedayanthittu estuary. The Uppukalli creek connects the Kaliveli flood plains to Yedayanthittu estuary.

(i) Kaliveli flood plains

This petal shaped water body is completely dry during the summer months. The catchment area for this wetland is about 740.89 sq.kms. The Auroville plateau is to the south, Marakkanam to the north and Tindivanam and beyond to the north west. There are many tanks in the catchment area and during the monsoon season, all tanks gets filled up and the excess water through many stream beds reaches the Kaliveli wetland.

ii) Uppukalli creek

This is a small channel and it connects the Kaliveli flood plains to the estuary. The water quality of this creek gets altered in accordance to the inflow of water from the sea.

(iii) Yedayanthittu estuary

This estuary area is from the north of Marakkanam road bridge to Alamparai. At Alamparai, it drains into the Bay of Bengal. According to Scot (1989), this estuary was connected to Pulicat lake through Buckingham canal.

Climate

The climate of this area is not constant. According to Bangnouls and Gaussan, the climatic condition belongs to the 37th medium tropical transitional bioclimatic.....". The dry season prevails from January to June; the rainfall is received from south west and north east monsoon from July to November; however, heavy rainfall is received during the north east monsoon due to depressions occurring in the Bay of Bengal. The average rainfall is 1300 mm, the bulk rainfall is received during October and November. The wetland is to its full capacity for about six months in a year. The entire boundary of the wetland is subject to human influences. Many villages are located around the wetland.

Biodiversity richness of Kaliveli Wetland

The soil of the wetland is sandy and having a small percentage of clay and humus. Kaliveli wetland was an old mangrove forest which has been degraded over a period of time. Aquatic weeds, sedges and grasses are found in the non-estuarine portion of the wetland. The major plants in the plain area are *Prosopis juliflora*, *Barringtonia*, *Acacia nilotica* and in the estuarine area, *Avicennia marina* is found. The common plants (Table – 1) of this wetland are as follows:

TABLE – 1

SOME COMMON PLANTS OF KALIVELI

S. No.	Common name	Botanical name
1.	Floating lace plant	*Aponogeton natans*
2.	Water hyacinth	*Eichhornia crassipes*
3.	Hydrilla / Water thyme	*Hydrilla verticillata*
4.	Arrow Head	*Limnophyton obtusifolium*
5.	Pickerel Weed	*Monochoria vaginalis*
6.	Eelgrass	*Vallisneria spiralis*
7.	Prairie Three-Awn	*Aristida adscensionis*
8.	Swollen finger grass	*Chloris barbata*
9.	Donkey's grass	*Chloris Montana*
10.	Small-flowered milkwort	*Polygala arvensis*
11.	Malaysian false pimpernel	*Lindernia crustacea*
12.	Goat weed	*Scoparia dulcis*
13.	Sleepy Morning / Basora Prieta	*Waltheria indica*
14.	Gum Arabic Tree	*Acacia nilotica*
15.	Sessile joy weed	*Alternanthera sessilis*
16.	Brahmi	*Bacopa monnieri*
17.	Creeping Coldenia	*Coldenia procumbens*
18.	Slender Cyperus	*Cyperus distans*
19.	False daisy	*Eclipta prostrata*
20.	Indian heliotrope	*Heliotropium indicum*
21.	Giant hygrophila	*Hygrophila angustifolia*
22.	Ludwigia	*Ludwigia perennis*
23.	Frog fruit	*Phyla nodiflora*
24.	Knotgrass	*Polygonum barbatum*
25.	Love Reed	*Typhya angustata*
26.	Vilayati babul	*Prosopis juliflora*
27.	Cut nut /Small Indian oak	*Barringtonia*
28.	Gum Arabic Tree	*Acacia nilotica*
29.	Gray Mangrove	*Avicennia marina*

Source: Ramanujam (2005)

Fish diversity of the wetland

Information available on the faunal diversity of the wetland is very little, except for fishes and birds. Ramanujam documented 42 species of fish representing 25 families and nine orders (Table – 2). Of the 42 species, six were confined to flood plain, 19 were estuarine and 17 occurred in both flood plain and creek. Out of the eleven species recorded by Sharma during 1997, Shark catfish (*Wallago attu*) and Giant Snake head channa (*Ophicephalus marulius*) were not found during the survey conducted by Ramanujam in 2003-04.

Ramanujam has given conservation status for 21 species as per the IUCN category out of the 42 species recorded. Of the 21 species, 1 is endangered, 5 vulnerable, 14 are threatened and 1 least concerned (Table - 2). The only exotic fish was Tilapia (*Oreochromis mossambica*)

TABLE – 2
FISHES OF KALIVELI

S. No.	Family	Common name	*Scientific name*	Status
1.	Angullidae	Indian long finned Eel	*Angullia bengalensis*	EN
2.	Clupeidae	Hilsa, Indian Shad	*Hilsa illisha*	VU
3.		Bloch's Gizzard Shad	*Nematalosa nasus*	LR-nt
4.		Gizzard Shad	*Nematalosa galatheae*	x
5.		Sardine	*Clupea sp.*	x
6.		Anchovy	*Thryssa sp.*	x
7.		Anchovy	*Coilia sp.*	x
8.	Chanidae	Milk fish	*Chanos chanos*	LR-nt
9.	Cyprinidae	Spotfin Barb	*Puntius sophore*	LR-nt
10.	Bagridae	Giant River Catfish	*Aorichthys seenghala*	x
11.		Long-whiskered Catfish	*Mystus gulio*	x
12.		Striped Dwarf Catfish	*Mystus vittatus*	VU.
Marine Catfish		*Tachysurus subrostratus*	x	
14.		Marine Catfish	*Tachysurus thassinus*	x
15.		Marine Catfish	*Tachysurus arius*	x
16.		Magur /Black Walking	*Clarius batrachus*	VU
17.	Mugilidae	Common mullet	*Mugil cephalus*	LR-nt
18.		Mullet	*Liza dussumeri*	LR-nt
19.		Mullet	*Liza macrolepis*	LR-nt
20.		Mullet	*Liza parsia*	LR-nt
21.	Hemiram-phidae	Indian / Congaturi Halfbeak	*Hyporhamphus limbatus*	x
22.	Belonidae	Fullbeak Gar	*Strongylura strongylura*	x
23.	Adrianthydae	Estuarine rice fish	*Oryzias melastigma*	x
24.	Chandidae	Glassy perchlet	*Ambassis commersoni*	LR-nt
25.	Sillaginidae	Silver Sillago	*Sillago sihama*	LR-nt
26.	Carangidae	Horse Mackerel	*Alepes kalla*	x
27.		—	*Leiognathus splendens*	VU
28.	Gerridae	_	*Gerres abbreviatus*	x

S. No.	Family	Common name	*Scientific name*	Status
29.	Theraponidae	Target Perch	*Therapon jarbua*	LR-nt
30.		Target Perch	*Therapon theraps*	x
31.	Lutjanidae	Snapper	*Lutjanus fulviflammus*	LR-nt
32.	Scatophagidae	Scat	*Scatophagus argus*	x
33.	Siganidae	_	*Siganus javus*	LR-nt
34.	Cichlidae	Pearl spot	*Etroplus suratensis*	x
35.		Egyptian Mouthbreeder	*Oreochromis mossambica*	Invasive
36.	Gobiidae	Tank Goby	*Glossogobius giurus*	LR-nt
37.	Anabantidae	Climbing perch	*Anabas testudineus*	VU
38.	Channidae	Spotted snakehead	*Channa punctatus*	LR-nt
39.		Striped / Banded Snakehead Veral	*Channa striatus*	LR-lc A
40.	Pleuronectidae	Tongue Sole / Flounder	*Pseudorhombus arsius*	x
41.	Scleroderma	Tripod fish / File fish	*Triacanthus brevirostris*	x
42.	Gymnodontes	Puffer fish / Globe fish	*Tetrodon fluviatilis*	x

IUCN Red List Categories: EN- Endangered (1); VU- Vulnerable (5); LR-nt – Lower Risk, near threatened (14); LR-lc – Lower Risk, least concern (1); x – not evaluated, hence status unknown (20)

Source: Ramanujam (2005

Birds of Kaliveli wetland

The avifauna richness of the wetland is well understood by the studies made by Balachandran (1994), Perennou and Santharam (1990). So far about one hundred and seventy nine species of birds are recorded from this wetland. Of the 179 species, 30 are shore birds and waders and 13 species are ducks (Table – 3). During March- April, the wetland attracts pelicans, herons, egrets, storks and ibises. Above all this wetland serves as an important corridor for the migratory birds which visits Point Calimere Bird Sanctuary during winter. From October to March, large congregation of wetland birds can be seen in thousands. The ecological condition of the wetland during winter season is highly suitable for the migratory birds.

TABLE – 3

BIRDS OF KALIVELI

S. No.	Family	Common name	Scientific name
1.	ACCIPITRIDAE	Pariah Kite	*Mivus migrans*
2.		Brahminy Kite	*Haliastur Indus*
3.		Shikra	*Accipiter badius*
4.		Whitebellied Sea Eagle	*Haliaeetus leucogaster*
5.		White Scavenger Vulture	*Neophron percnopterus*
6.		Pale harrier	*Circus macrourus*
7.		Montagu's Harrier	*Circus pygargus*
8.		Pied Harrier	*Circus melanoleucos*

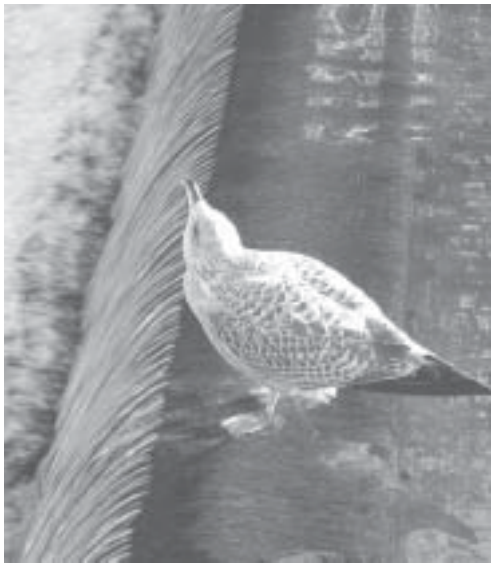
S. No.	Family	Common name	Scientific name
9.		Marsh Harrier	*Circus aeruginosus*
10.		Osprey	*Pandion haliaetus*
11.		Black winged kite	*Elanus caeruleus*
12.		Black eared kite	*Milvus lineatus*
13.		Lessar Grey-headed fishing Eagle	*Ichthyophaga ichthyaetus*
14.		Hen Harrier	*Circus cyaneus*
15.		Short-toed Eagle	*Circaetus gallicus*
16.	ALAUDIDAE	Bush Lark	*Mirafra assamica*
17.		Sky Lark	*Alauda arvensis*
18.		Redwinged Bush Lark	*Mirafra erythroptera*
19.		Ashycrowned Finch Lark	*Eremopterix grisea*
20.		Rufous Tailed Finch Lark	*Ammomanes phoenicurus*
21.		Oriental Skylark / Indian Small Sky Lark	*Alauda gulgula*
22.	ALCEDINIDAE	Lesser Pied Kingfisher	*Ceryle rudis*
23.		Common Kingfisher	*Alcedo athis*
24.		White breasted Kingfisher	*Halcyon smyrnensis*
25.	ANATIDAE	Ruddy Shelduck	*Tadorna ferruginea*
26.		Pintail	*Anus acuta*
27.		Wigeon	*Anas penelope*
28.		Garganey	*Anas querquedula*
29.		Shoveller	*Anas clypeata*
30.		Common Teal	*Anas acuta*
31.		Spot billed Duck	*Anas poecilorhyncha*
32.		Redcrested Pochard	*Netta rufina*
33.		Common Pochard	*Aythya ferina*
34.	APOBIDAE	Palm Swift	*Cypsiurus parvus*
35.		House Swift	*Apus affinis*
36.	ARDEIDAE	Grey Heron	*Ardea cinerea*
37.		Large Egret	*Ardea alba*
38.		Paddybird /Pond Heron	*Ardeola grayii*
39.		Median / Smaller Egret	*Egretta intermedia*
40.		Little Egret	*Egrette garzetta*
41.		Indian Reef Heron	*Egretta gularis*
42.		Purple Heron	*Ardea Purpurea*
43.		Cattle Egret	*Burbulcus ibis*
44.	ARTAMIDAE	Ashy Swallow Shrike	*Artamus fuscus*
45.	BURHINIDAE	Stone Curlew	*Burhnus oedicnernus*
46.	CAMPEPHAGIDAE	Common Wood Shrike	*Tephrodornis pondicerianus*
47.	CAPITONIDAE	Small Green Barbet	*Megalaima viridis*
48.		Coppersmith or Crimson-breasted barbet	*Megalaima haemacephala*
49.	CHARADRIIDAE	Yellow-wattled lapwing	*Vanellus malabaricus*

S. No.	Family	Common name	Scientific name
50.		Grey-headed lapwing	*Vanellus leucurus*
51.		Ringed plover	*Charadrius dubices*
52.		Kentish plover	*Charadrius abxandrinus*
53.		Red Wattled Lapwing	*Vanellus indicus*
54.		Grey Plover	*Pulvialis squatarola*
55.		Eastern Golden Plover	*Pulvialis dominica*
56.		Large Sand Plover	*Charadrius leschenaultil*
57.		Little Ringed Plover	*Charadrius dubius*
58.		Kentish plover	*Charadrius alexandrinus*
59.		Lesser Sand Plover	*Charadrius mongolus*
60.		Whimbrel	*Numenius phaeopus*
61.		Curlew	*Numenius arquata*
62.		Black Tailed Godwit	*Limosa limosa*
63.		Turnstone	*Arenaria interpres*
64.		Pintail Snipe	*Gallinago stenura*
65.		Fantail Snipe	*Gallinago gallinago*
66.		Long-toed Stint	*Calidris subminuta*
67.		Dunlin	*Calidris alpina*
68.		Ruff	*Philomachus pugnax*
69.	CICONIDAE	Painted Stork	*Mycteria leucocephala*
70.		Openbill Stork	*Anastomus oscitans*
71.		White Stork	*Ciconia ciconia*
72.	COLOMBIDAE	Blue Rock Pigeon	*Columba livia*
73.		Spotted Dove	*Streptopelia chinensis*
74.		Turtle Dove	*Streptopelia turtur*
75.		Indian Ringed Dove	*Streptopelia decaocto*
76.		Little Brown Dove	*Streptopelia senegalensis*
77.	CORACIIDAE	Indian Roller	*Coracias benghalensis*
78.	CORVIDAE	Indian Treepie	*Dendrocitta vagabunda*
79.		House Crow	*Corvus splendens*
80.		Jungle Crow	*Corvus macrorhynchos*
81.	CUCULIDAE	Common Hawk-cuckoo	*Cuculus varius*
82.		Pied Crested Cuckoo	*Clamator jacobinus*
83.		Koel	*Eudynamya scolopacea*
84.		Coucal (or) Crow-pheasant	*Centropus sinensis*
85.	DICRURIDAE	Black Drongo	*Dicrurus adsimilis*
86.	FALCONIDAE	Peregrine Falcon	*Falco peregrinus*
87.		Kestrel	*Falco tinnunculus*
88.	GLAREOLIDAE	Indian Courser	*Cursorius coromandelicus*
89.		Large Indian Pratincole	*Glareola pratincola*
90.		Small Indian Pratincole	*Glareola lactea*
91.	HIRUDINIDAE	Striated or Red-rumped Swallow	*Hirundo daurica*
92.		Collared Sandmartin	*Riparia riparia*
93.		Swallow	*Hirundo rustica*
94.	IRENIDAE	Common lora	*Aegithina tiphia*
95.	LARIDAE	Great Blackheaded Gull	*Larus ichthyaetus*

S. No.	Family	Common name	Scientific name
96.		Browhheaded Gull	*Larus brunnicephalus*
97.		Blackheaded Gull	*Larus ridibundus*
98.		Whiskered Tern	*Chidonias hybrid*
99.		White-winged Black Tern	*Chidonias leucopterus*
100.		Gullbilled Tern	*Gelochelidon nilotica*
101.		Caspian Tern	*Hydroprogne caspia*
102.		Common Tern	*Sterna hirundo*
103.		Little Tern	*Sterna albifrons*
104.		Large Crested Tern	*Sterna begil*
105.		Herring Gull	*Larus argentatus*
106.		Lesser Black-backed Gull	*Larus fuscus*
107.		Slender-billed Gull	*Larus genei*
108.		Little Gull	*Larus minutes*
109.		Indian River Tern	*Sterna aurantia*
110.		Black-caped Tern	*Chidonias niger*
111.		Black bellied Tern	*Sterna acuticuda*
112.	MEROPIDAE	Bluetailed Bee-eater	*Merops philippinus*
113.		Green Bee-eater	*Merops orientalis*
114.	MOTACILLIDAE	Paddyfield Pipit	*Anthus novaeseelandiae*
115.		Richards Pipit	*Anthus richardi*
116.		Yellow Wagtail	*Motacilla flava*
117.		Large Pied Wagtail	*Motacilla maderaspalensis*
118.		Forest Wagtail	*Motacilla indica*
119.		Thick-billed flower-Pecker	*Dicaeum agile*
120.		Tickell's Flower-Pecker	*Dicaeum erythrorhynchos*
121.	MUSCICAPIDAE	Streaked Fantail Warbler	*Cisticola juncidis*
122.		Franklin's wren-warbler	*Prinia hodgsonii*
123.		Plain wren-warbler	*Prinia subflava*
124.		Ashy wren-warbler	*Prinia socialis*
125.		Indian Great Reed warbler	*Acrocephalus stentoreus*
126.		Blyth's Reed warbler	*Acrocephalus dumetorum*
127.	Sub family SYLVINAE	Tailor Bird	*Orthotomus sutorius*
128.		Green warbler	*Phylloscopus nitidus*
129.	Sub family TIMALINAE	White head babbler	*Turdoides affinis*
130.	Sub family TURDINAE	Magpie Robin	*Copsychus saularis*
131.		Indian Robin	*Saxicoloides fulicata*
132.	NECTARINIDAE	Purple rumed Sunbird	*Nectarinia zeylonica*
133.		Loten's Sunbird	*Nectarinia lotenia*
134.		Purple's Sunbird	*Nectarinia asiatica*
135.	ORIOLIDAE	Golden Oriole	*Oriolus oriolus*
136.	PELICANIDAE	Spottedbilled or Grey Pelican	*Pelecanus philippensis*

S. No.	Family	Common name	Scientific name
137.	PHALACROCIDAE	Cormorant	*Phalacrocorax carbo*
138.		Little Cormorant	*Phalacrocorax niger*
139.	PHASSIANNIDAE	Grey Partridge	*Francolinus pondicerianus*
140.	PHOENICOP -TERIDAE	Greater Flamingo	*Phoenicopterus roseus*
141.		Lesser Flamingo	*Phoenicopterus minor*
142.	PICIDAE	Lesser Goldenbacked Woodpecker	*Dinopium benghalense*
143.	PLOCEIDAE	Baya (Baza)	*Aviceda leuphotes*
144.		Common Silverbill	*Lonchuria malabarica*
145.	Sub family PASSERINAE	House Sparrow	*Passer domesticus*
146.		Yellow throated Sparrow	*Petronia xanthocollis*
147.	PODICIPEDIDAE	Little Grebe	*Tachybaptus ruficollis*
148.	PSITTACIDAE	Rose ringed Parakeet	*Psittacula krameri*
149.		Alexandrine Parakeet	*Psittacula eupatria*
150.	PYCNONOTIDAE	Redvented Bulbul	*Pycnonotus cafer*
151.		White-breasted Bulbul	*Pycnonotus luteolus*
152.	RALLIDAE	White-breasted waterhen	*Amaurornis phoenicurus*
153.		Moorhen	*Gallinula chloropus*
154.		Purple Moorhen	*Porphyrio porphyrio*
155.		Coot	*Fulica atra*
156.	RECURVI -ROSTRIDAE	Blackwinged Stilt	*Himantopus himantopus*
157.		Avocet	*Recurvirostra avosetta*
158.	SCOLOPACIDAE	Spotted red shank	*Tringa erythropus*
159.		Red shank	*Tringa totanus*
160.		Marsh sandpiper	*Tringa stagnatilis*
161.		Greenshank	*Tringa nebularia*
162.		Green Sandpiper	*Tringa ochropus*
163.		Wood Sandpiper	*Tringa glareola*
164.		Terek Sandpiper	*Tringa terek*
165.		Common Sandpiper	*Tringa hypoleucos*
166.		Little Stint	*Calidris minuta*
167.		Temminck's Stint	*Calidris temminckii*
168.		Curlew Sandpiper	*Calidris testacea*
169.		Black tailed Godwit	*Limosa limosa*
170.		Bartailed Godwit	*Limosa lapponica*
171.		Eurasian curlew	*Numenius arquata*
172.		Common snipe	*Gallinago gallinago*
173.	STRIGIDAE	Spotted Owlet	*Athene brama*
174.	STURNIDAE	Common Myna	*Acridotheres tristis*
175.	THRESKIOR -NITHIDAE	White Ibis	*Threskiornis aethiopica*
176.		Glossy Ibis	*Pseudibis papillosa*
177.		Spoonbill	*Platalea leucorodia*
178.	UPUPIDAE	Hoopoe	*Upupa epops*
179.	ZOTEROPIDAE	White – eye	*Zosterops palpebrosa*

Source: Perennou, C., and V. Santharam (1990)



Values of Kaliveli wetland

The wetland helps in recharging the ground water aquifers in the surrounding villages and helps in preventing salt water intrusion. Many villagers engage themselves in fishing as a source of income. They also utilize the reeds and grasses for firewood, fodder and building. Salt panes and shrimp farming is on the rise on the brackish part of the lake. The northeast part of the lake support India's third largest salt marshes (Chari 1997).

Threats to the wetland

The water storage capacity of the wetland is shrinking due to encroachments by paddy fields and salt panes. About 6 sq. km of the Kaliveli wetland has been encroached by agricultural fields. Unfortunately, some portion of the wetland near Aruvadi has been leased by the Government of Tamilnadu to farmers. Use of fertilizers and pesticides will also affect the biodiversity richness of the wetland. Shrimp farming is mushrooming along the Kaliveli mainly at Erappanai, Mudaliarpet and Vadagaram, which will spoil the hydrology and ecology of the wetland. The wetland is already eutropic and the effluents from shrimp farming will add further nutrients such as nitrogen and phosphorus encouraging the growth of algae and weeds. Dumping of industrial waste in and around the lake is also affecting the ecology of the lake. Poaching of birds is another threat to the faunal diversity of the lake.

Conclusion

The United Nations declared the year 2014 as the Year of Family Farming. Wetlands and agriculture is the theme of the Ramsar Convention for the year 2014. The wetlands are closely linked with agriculture. The slogan issued by Ramsar Convention for 2014 is "Wetlands and Agriculture: Partners for Growth". The main aim is to create awareness about the linkage between the wetland and agricultural production.

The Government of Tamilnadu notified the Kaliveli wetland as reserve land to create a bird sanctuary under Tamilnadu Forest Act 1882 of Section 26 dated 16.4.2001. After this notification, not much progress is made except the declaration as on among the important wetlands of India. The United Nations and Ramsar Convention very clearly linked the importance of wetland for the agriculture production and livelihood. Tamilnadu is one among the water starved states of India, all stakeholders of Kaliveli wetland should try for the conservation and protection of Kaliveli wetland. The research and academic bodies of this area should also make efforts for continuous monitoring of this wetland.

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Ethno-botanical Importance of Park Flora

P. Sudhakar

Parks are valuable not only for their flora but also for the medicinal properties contained in them. Nearly 45% of the plants, both cultivated and weeds that are seen in most of the parks are reported to be of medicinal value. Plants such as *Acalypha indica* and *Phyllanthus amarus* are harvested by the local people from the parks for medicinal uses. *Tridax procumbens* is used by the gardeners and other workers of the parks as an antiseptic and blood coagulant for cuts and wounds.

A number of edible greens such as *Amaranthus spinosus, Amaranthus viridis, Cardiospermum helicacabum, Murraya koenigii, Pisonia alba* and *Solanum americanum* are also found in the parks. Some of the greens collected from the parks which are used for its medicinal values. For example, *Cardiospermum helicacabum* and *Pisaonia alba* are used for treating joint pains. Similarly, leaves of *Solanum americanum* are cooked and eaten to cure mouth ulcers. The juice of *Cynodon dactylon* has become a popular health product in Chennai which is sold fresh. Leaves of *Lawsonia inermis* are harvested for cosmetic purposes. Fallen flowers of *Hisbiscus rosa-sinensis* are collected from the parks for cosmetic purposes as well as well as for use as a health drink.

The list of herbs along with their medicinal properties and parts used that are found in the parks of Chennai city is given in the following table.

Plants with Medicinal Properties

S.No	Name of the Plant	Uses	Parts Used
1	*Andrographis echioides*	Hair care	Leaves
2	*Andrographis paniculata*	Fever, liver and stomach disorders	Stem, leaves
3	*Asystasia gangetica*	Asthma	Leaves
4	*Barleria prionitis*	Dental problems	Leaves and tender branches
5	*Blepharis repens*	Heals wounds and set bones	Leaves
6	*Justicia adhatoda*	Cough	Leaves
7	*Justicia gendarussa*	Sinusitis	Leaves
8	*Achyranthes aspera*	Heals cuts and wounds	Leaves

S.No	Name of the Plant	Uses	Parts Used
9	*Aerva lanata*	Diuretic, antidote for snake bite	Whole Plant
10	*Amaranthus spinosus*	Diuretic, appetiser	Leaves
11	*Crinum asiaticum*	Laxative, urinary infections	Bulb
12	*Lannea coromandelica*	Wounds	Bark
13	*Mangifera indica*	Stomach-ache	Kernel
14	*Annona squamosa*	Diarrhoea , cold	Bark, leaves, root
15	*Calotropis gigantea*	Snake bite	Latex
16	*Cascabela thevetia*	Fever	Bark
17	*Catharanthus roseus*	Cancer	Root and leaf
18	*Ervatamia divaricata*	Eye	Flowers
19	*Hemidesmus indicus*	Indigestion, cooling	Root
20	*Plumeria rubra*	Rheumatism, toothache	Latex
21	*Wrightia tinctoria*	Skin, dandruff	Leaves
22	*Centella asiatica*	Memory	Leaves
23	*Agave angustifolia*	Diuretic, constipation, joint pains	Leaves, root
24	*Sansevieria roxburghiana*	Ear ache	Leaves
25	*Glossogyne bidens*	Deworming, Snake bites and scorpion sting	Whole plant, roots
26	*Tridax procumbens*	Wounds	Leaves
27	*Kigelia africana*	Rheumatism	Fruits
28	*Tecomaria capensis*	Pain, insomnia	Bark
29	*Cordia obliqua*	Cough, cold	Fruit
30	*Caesalpinia pulcherrima*	Deworming , fever	Flowers, leaves
31	*Cassia alata*	Ringworm, skin diseases	Leaves
32	*Cassia auriculata*	Diabetes	petals
33	*Cassia fistula*	Ringworm, stomach disorders	Leaves, flowers
34	*Cassia siamea*	Stomach disorders	Flowers
35	*Saraca asoca*	Dysentery	Flowers

S.No	Name of the Plant	Uses	Parts Used
36	*Carica papaya*	Digestive problems, blood pressure, intestinal worms	Fruits
37	*Cleome viscosa*	Ear ache, wounds and ulcers	Leaves
38	*Calophyllum inophyllum*	Epilepsy, paralysis, body temperature	Flowers
39	*Gloriosa superba*	Pain	Tubers
40	*Commelina benghalensis*	Hair care	Leaves
41	*Evolvulus alsinoides*	Asthma	Leaves
42	*Ipomoea quamoclit*	Haemorrhoids	Leaves
43	*Kalanchoe pinnata*	Boils	Leaves
44	*Mukia maderaspatana*	Cough	Leaves
45	*Acalypha indica*	Cough	Leaves
46	*Euphorbia hirta*	Skin diseases	Latex
47	*Ricinus communis*	Cooling	Oil
48	*Abrus precatorius*	Joint pain	Seeds
49	*Crotalaria medicaginea*	Cooling	Leaves and seeds
50	*Desmodium gangeticum*	Arthritis	Leaves
51	*Erythrina variegata*	Asthma	Leaves
52	*Indigofera linnaei*	Wounds	Plant extract
53	*Pongamia pinnata*	Diabetes	Whole plant
54	*Hyptis suaveolens*	Antimicrobial properties	Leaves
55	*Leonotis nepetifolia*	Fever	Leaves
56	*Leucas indica*	Nasal drops, cough Leaf juice,	flowers
57	*Ocimum tenuiflorum*	Cough	Leaves
58	*Barringtonia acutangula*	Diarrhoea, fever, cough	Bark, fruit
59	*Couroupita guianensis*	Stomach disorders	Flowers
60	*Strychnos nux-vomica*	Cholera	Root bark
61	*Ammannia baccifera*	Ringworm	Leaves
62	*Lagerstroemia reginae*	Constipation	Bark and Leaves
63	*Lawsonia inermis*	Hair care	Leaves

S.No	Name of the Plant	Uses	Parts Used
64	*Abutilon indicum*	Mouth ulcers, laxative	Leaves, seeds
65	*Ceiba pentandra*	Skin diseases	Leaves
66	*Gossypium barbadense*	Menstruation problems	Leaves
67	*Hibiscus rosa-sinensis*	Hair care	Flowers, leaves
68	*Sida cordifolia*	Asthma, cold and fever	Leaves
69	*Sterculia foetida*	Skin diseases	Oil from seeds
70	*Thespesia populnea*	Skin diseases	Fruits, leaves, root
71	*Azadirachta indica*	Dental care	Bark
72	*Melia azedarach*	Cracked feet	Leaves
73	*Tinospora cordifolia*	Fever, appetiser	Twigs
74	*Acacia nilotica*	Dental care	Bark
75	*Adenanthera pavonina*	Boils, inflammations	Seeds
76	*Albizia lebbeck*	Snake and scorpion bites	Stem, leaves, flowers
77	*Mimosa pudica*	Tooth ache	Root
78	*Glinus oppositifolius*	Joint Pain, Fever	Leaves
79	*Artocarpus heterophyllus*	Skin Diseases	Root
80	*Ficus benghalensis*	Ulcers, Diarrhoea	Bark
81	*Ficus religiosa*	Mouthwash	Gum
82	*Eucalyptus tereticornis*	Cold, Pain	Oil
83	*Psidium guajava*	Tooth ache, gastric problems	Leaves
84	*Syzygium cumini*	Diabetes	Seeds
85	*Mirabilis jalapa*	Boils	Leaves
86	*Pisonia alba*	Arthritis	Leaves
87	*Jasminum angustifolium*	Skin diseases	Root
88	*Nyctanthes arbor-tristis*	Eye ailments	Flowers
89	*Argemone mexicana*	Purgative	Seeds
90	*Passiflora foetida*	Digestive problems	Fruits
91	*Phyllanthus amarus*	Jaundice	Whole plant
92	*Phyllanthus emblica*	Digestive problems, hair care	Roots, fruits

S.No	Name of the Plant	Uses	Parts Used
93	*Cynodon dactylon*	Urinary tract infection	Leaves
94	*Putranjiva roxburghii*	Rheumatism	Leaves and fruits
95	*Ziziphus mauritiana*	Blood purifier, rheumatism	Fruits, Bark
96	*Rosa alba*	Eye ailments	Petals
97	*Canthium parviflorum*	Fever	Roots
98	*Asparagus racemosus*	Liver disorders, fever	Tuber
99	*Aegle marmelos*	Cooling, hair care	Fruit
100	*Limonia acidissima*	Liver and spleen disorders	Fruit
101	*Murraya koenigii*	Hair care	Leaves
102	*Cardiospermum*	Rheumatism *halicacabum*	Leaves
103	*Madhuca longifolia*	Cough, skin diseases	Flowers, bark
104	*Mimusops elengi*	Dental care	Bark
105	*Ailanthus excelsa*	Fever	Bark
106	*Datura metel*	Swellings	Leaves
107	*Solanum americanum*	Mouth ulcers	Leaves
108	*Cissus quadrangularis*	Gastric problems	Stem
109	*Aloe vera*	Digestion, moisturiser	Plant, leaves

In fact, parks are the major habitats for these plants and small animals, and giving shade to the people. The parks act as the lungs of the city and provide valuable breathing space amidst the hustle and bustle of the city.

Veneration of Plants in Tamil Tradition

M. Amirthalingam

The veneration of trees was equally prevalent among the Tamils as it was among the people of other civilizations. There are numerous references in Sangam literature to the belief that trees were the abodes of deities (*Natrinai*, 83-2 and 303:3; *Agananuru* 270:12; *Agananuru*, 7; *Sirupanatruppadai*, 17; Kalithogai, 83:14; *Manimekalai*, 3:144; *Purananuru*, 191:1 and 198:1; *Natrinai*, 343-4; *Tirumurugatruppadai*, 256 and *Kurunthogai*, 87:1). Hindus tend to anthropomorphize their gods. Hence, often the temple developed after the initial worship of the *sthalavriksha* or the sacred plant. Traditionally in Tamil Nadu, the sacred plants have been considered as an aspect of the god itself. Hence, the tremendous importance given to the worship of the sacred plants, especially in connection with the rites of fertility, childbirth, wealth and prosperity.

For example, the banyan tree, which was associated with both Shiva and Tirumal subsequently developed into the *sthalavriksha* or the sacred plants of the temple with which it was associated. Further, trees like the neem, Bengal quince (*bilva*) and Indian laburnum (*kontrai*) were sacred to a particular deity whose idol was installed beneath the tree (*Purananuru*, 199-1; *Agananuru*, 287-7; *Paripadal*, 4-67). Later, when temples were erected for the deities who had originally occupied places under the trees, devotees took special care not to remove or disturb those trees. In fact, these trees formed the centre of the temple near the *garbagriha*, and they were provided enough space for future growth (Subramaniya Pillai, 1961). The tamarind tree of the Vishnu temple at Alvar Tirunagari (between Tirunelvelli and Tiruchendur) is illustrative of this practice.

In Tamil Nadu, there are a number of tree shrines and the prominent ones include the mango tree (*ekamra*) at Kanchi, a black plum (*jambu*) at Jumbukeswaram near Tiruchirappalli, the palmyra palm (*panai*) at Tirupanaiyur and the "blinding' tree (*tillai*) at Chidambaram. The sacred trees are not only associated with widely-revered gods such as Shakti, Shiva, Vishnu and Muruga, but also with the local village guardian deities such as *Arkamma*, named after the plant *erukku* in Tamil (*Calotropis procera*) and *Panaieriyamman* who is the Goddess named after the palmyra palm or *panai* and also called *Taalavaasini*, a name that extends by association to all palms.

The presence of a particularly bountiful tree may have given rise to the belief that a deity is present in the tree who offers her blessings in the form of fruits. This is so in the case of the tamarind tree where Puliyidaivalaiy-amman is worshipped and a kadamba tree that is linked to a Goddess called Kadambariyamman. The sacred trees are symbolic of a single genetic resource and play a pivotal role in the conservation of local floral wealth and biodiversity.

Every famous temple in Tamil Nadu has a holy tree of its own and is associated

with either a local or a Puranic legend. Sometimes places are even named after the tree, such as the town of Kanchipuram which has acquired its name from the kanchi tree; Thiruverkadu, Tillai, etc. are other examples to further substantiate this fact. Every tree has a legend of its own. For example, the mango tree at the Ekambareswarar temple in Kanchi is said to yield mangoes of different variety, taste and size and is believed to be possessed of an element of divinity and hence worshipped (Jayasendhilnadhan, 1988).

Many places are named after the plant (*vriksha*). For example, *aal* (Thiruvalangadu) and *tillai* (Chidambaram) are derived from the banyan and *tillai* tree (blinding tree, the mangrove/ *Excoecaria agallocha*). Although the name *tillai* is still in vogue, the *tillai* tree itself is now extinct in Chidambaram except for a small patch in Pichavaram situated at a distance of about five kilometres from Thillai. To restore and respect the traditional heritage, a small *tillai* tree is now grown on the right side of the eastern gateway of the Nataraja temple at Chidambaram. Similarly, the *kadamba* (*Anthocephalus cadamba*) of Madurai, *jambu* (*Syzigium cumini*) of Tiruvannaikka, *venu* (bamboo) of Tiruvetkalam and Tirunelveli, *mullai* (*Jasminum auriculatum*) of Mullaivayil, and *nelli* (Indian gooseberry) of Thirunellikka are the plants (*vriksha*) after which the *sthala* have been named.

If the sacred tree happened to fade away or perish, it did not cease to be sacred and worship still continued. The withered tree would wear away, leaving the lower part of the trunk. The surviving part in the form of a stump, was called *kandhu* and was worshipped. The people believed that to nurture the spirit dwelling in the stump of the decayed tree, the usual offerings and worship should be carried on uninterruptedly as evidenced by the *Pattinappalai* 246-249; *Agananuru* 287:4; 307:22: *Tirumurugatruppadai*, 226; *Pattinappalai*-249; *Tiruvilaiyadar-puranam*, 18.

A *kadamba* tree (common bur-flower **SEASIDE INDIAN OAK**) once flourished in the Meenakshi Sundareswarar Temple at Madurai. Today, only the stump remains and is covered by a silver plate. In Tirupadhiripuliyur, the remains of the *padhiri* tree (Trumpet flower), under which Goddess Sivagami performed penance to get rid of her sins, are covered by copper plate. In Tiruvothur, the base of the ancient *panai* (palmyra palm) is covered by copper plate, which is circumambulated and worshipped by the devotees (Sundara Sobhidharaj, 1991). In Kutralam, the remnant base of the perished *kurumpala* tree (jackfruit), has been protected in a separate room. Later, the Tamils sculpted the image of the former sacred tree and

worshipped it and a pertinent example of this is in the Ekambareswarar Temple, where there is a sculpture depicting a woman hugging the mango tree and in Tiruvanaikka where the goddess is worshipping the Linga under a *naval* (Java plum) tree.

There are several examples of trees found in sculpture: in Kutralam people worship the Linga under the *kurumpala*; in Kurukkai, the tree is worshipped by the goddess and rishis; in Tirukuvalai, the Linga under a tree is worshipped by the king and others; in Anbilalandhurai, the Linga under the tree is worshipped by a king; in Tirukottai, a rishi sits under the *kottai chedi* (*Ricinus communis*) and in the five metal sculptures of the Tirumangalam temple, one of the Nayanars is seen under the *kontrai* tree.

It is likely that this is an extension of the earlier veneration of the spirit or yaksha of the tree. As the yaksha was gradually identified with evil spirits, the tree became the abode of the Gods.

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Biodiversity Index-Issues and Challenges

R. Sabesh

Introduction

The loss of plants, animals and their habitats is one of the world's most serious environmental crises. It is estimated that biodiversity has declined by more than 25% during the last three decades. Biodiversity provides ecosystem services such as clean air, water, pollination, climate regulation and so on. Biodiversity is often used to measure the health of biological systems. The biodiversity index is basically a quantitative measure which reflects different types of species of plants and animals and other related information recorded in a dataset and simultaneously takes into account how evenly the basic entities (individual species) are distributed in the given locality. For a given number of types, the value of a Biodiversity index is maximized when all types of plants and animals species are equally abundant.

Significance of Biodiversity Index

According to the United Nations estimate 50% of the world's population was residing in cities in 2008 and the percentage is expected to rise to 70%

by 2050. The Biodiversity Index aims to serve as a self-assessment monitoring mechanism to promote better management of resources and the conservation of biodiversity. The index also serves as a platform through which cities can share solutions for conserving biodiversity and overcoming the problems of increased urbanization, climate change and city planning and management.. The major impacts on biodiversity will inevitably lie in the urban settlements and the huge population in urban settlements could be one of the most potential threats to biodiversity conservation. The City Biodiversity Index, also known as the Singapore Index on Cities Biodiversity, measures biodiversity in cities and highlights how biodiversity conservation efforts can be improved. The idea was proposed at the Conference of Parties (COP) to the Convention of Biological Diversity (CBD) in 2008. Nowadays, companies are increasingly being asked by their larger clients to show their biodiversity conservation initiatives as part of their environmental plans as the Conservation of biodiversity is one of the key principles of sustainable development.

Biodiversity index assessment

The Biodiversity Index allows rapid assessment of the habitats in urban areas using a simple survey technique to quantify the diversity of vegetation also insect, bird and other animal diversity using various methods wherein the Percentage of area for each type of habitat, the average patch size of each type of habitat, species diversity index can be measured and such information is required for the Environmental Management system, Environmental reviews Site Biodiversity Management and improvement Plans.

Biodiversity Calculator

Several Institutions developed software for the Biodiversity assessment and the Biodiversity calculator is available online and it is free to use in http://www.alyoung.com/labs/biodiversity_calculator.html and the software is designed for biologists, ecologists, teachers, and students to enable them to quickly calculate the biodiversity indexes of an ecosystem.

Hyderabad became the first city in India to have a City Biodiversity Index released by the Andhra Pradesh Chief Minister N. Kiran Kumar Reddy at 'Cities for Life', a city and sub-national biodiversity summit, organized parallel to the 11th meeting of the Conference of Parties (COP 11) to the Convention on Biodiversity (CBD) on the 15th October 2012. The historic city has scored 36 of a possible 92 points in the City Biodiversity Index (CBI), also known as the Singapore Index on Cities' Biodiversity. Hyderabad has joined a group of 14 international cities to come out with the City Biodiversity Index and is ranked somewhere in the middle of the list of cities that already have such an index.

Conclusion

Assessment of Biological resources are essential for the better management of such resources and there are several challenging issues that need to be addressed including differences in species richness due to their geographical locations, differences in the reliability of data sets used, identification of species at the field level, number of components, indicators and variables and so on. Biologists believe that more diverse population consisting of many species has a better chance to adapt to changes

in the environment. The need of the hour is to formulate a standard methodology for developing and benchmarking a biodiversity index suitable for India. Developing a biodiversity index for cities would help the city planners to draft the future Biodiversity action plan.

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Rudraksha – Sacred Tree

M. Kumaravelu

The recent announcement by the Union Ministry of Environment and Forests about the creation of the Ecologically Sensitive Area (ESA) in around 37 percent area of the Western Ghats spread over six states has come as a shot in the arm to tighten up conservation activities in the Western Ghats, renowned for their vast and varying vegetative cover. The creation of an ESA will also bring into focus the need for the conservation of these places under ESA so that they can be passed on to future generations in all pristine purity and natural splendor.

According to Nair, around 13,000 species of flowering plants and 2500 species of trees are found in the Western Ghats.

Also 340 species of mammals, 1200 species of birds, 420 species of reptiles, 40 species of amphibians, 2000 species of fishes, 4000 species of molluses, 50,000 species of insects and about 6500 species of invertebrates are found in Western Ghats.

This rich diversity of flora and fauna is due to the varied topography and micro climate of the region. The pressure over this ecologically fragile area has increased irreparably during recent times, and that has resulted in damage to the hills and habitat destruction for many species. While the pressure on the environment is growing due to population explosion, the conservation of this rich biological diversity, especially in hill tracts such as the Nilgiris, which is also country's first biosphere reserve, has become a challenging task.

Only protected areas like sanctuaries, national parks, tiger and elephant reserves are intact to some extent. The other places have become vulnerable to degradation. In many places, the people's initiative in protecting small patch of

forests and trees also demonstrate their spirituality linked efforts for conservation as they believe that some of the trees such as *Rudhraksh* are sacred and need human support for their conservation.

Sacred Trees

Like the sacred groves, the sacred trees are also worshiped and protected by the people from time immemorial. Even when constructing a new temple, we can find that one or more trees are planted at the temple complex. It is interesting to note that in some places a single tree is planted and protected outside the temple premises without any deities. Native shola tree species such as *Mappia foetida*, *Elaeocarpus oblangus*, *Michelia nilagirica*, *Ficus carica*, *Syzygium cumini* are primarily found in the pathways in temple complexes as they are regarded as sacred. *Mappia foetida* commonly known as Kakundi found at the 'Hirodiah' (lit. Easwaran) temple. *Elaeocarpus oblangus*, also known as 'vikki' is a shola tree species which belongs to the Rudraksha tree family and is mostly associated with Shiva temples in the Nilgiris. *Michelia nilagirica*, or champak, is associated with the Mother goddess. *Ficus carica* called *seemai atti*, is a shola species associated with the Mother Goddess. *Syzygium cumini*, called *naaval* is commonly found within the temple premises of native tribal communities.

Rudhraksha

Among the sacred trees, the rudraksha tree attains special significance. The *Elaeocarpus* spp. is commonly found in most of the temple complexes. A two faced *Elaeocarpus ganitrus* – rudraksha tree is planted and protected only at the *Moo Ulaga Arasi Amman Temple*, Mettucheri, Ooty. Normally, the rudraksha tree gives five face beads, but this particular tree gives only two- face beads (called thowmugi).

People visit this temple to worship the deity and the managers of this temple say that this tree is more sacred than the other rudhraksha trees. The tree found in this temple is has two faced beads, which are known as 'Rudra's eyes' *.

Ecological value: *Elaeocarpus ganitrus*, being an ever-green tree, grows tall with large branches and broad leaves, and attracts many bird species. The roots of this tree have a very good holding capacity for water and soil. This helps to control the sound and air pollution. In addition to this, the owners of this tree are able to garner good revenue by selling the beads. Hindus are fond of buying these beads for making chains (*maalai*).

This single tree is a rare example of a sacred plant protected in a tribal area. How it got there is a mystery.

*Note: Rudhraksha lit. called in Sanskrit 'Rudra's Eyes/ Siva's eyes.

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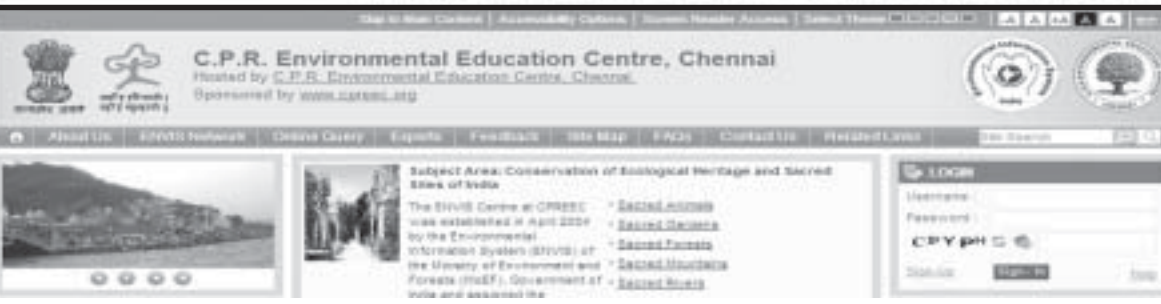

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