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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

Although Eco News is printed on tree-free paper made of bagasse, we would like to cut down our carbon footprint even further. Those who would prefer to receive Eco News by e-mail, please let us know by sending an e-mail to **econews@gmail.com.**

We come to an end of very difficult year when the rains have failed several parts of India and water and famine stalked the land. This is because of the mismanagement of natural resources. Water is meant for drinking and agriculture, but it has been diverted for industries - all in the name of development.

We have to decide whether the goal of a 9% rate of growth which is derived from industry is essential for an agricultural country like India. Lands are infertile and water scarce. In this scenario, we should pay greater attention to conserving natural resources, rather than development. But this is not happening.

Nanditha Krishna
Editor

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

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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.

Ornamental Gardens

P. Sudhakar

Ornamental gardening is an aesthetic blend of art, nature and science. Gardens formed an important feature of landscapes in all ancient human civilisations. All religious mythologies depict gardens as important places for major events in history. The Bible mentions the Garden of Eden created by God for Adam and Eve. The *Ramayana* talks about *ashoka vana*, a place where Sita was imprisoned. The *Sabhaparva* of the *Mahabharata* describes the layout of gardens, parks and artificial lakes in the city of Indraprastha.

The terms garden and park are often used interchangeably. The meaning of garden according to the Oxford dictionary is a '*piece of ground for growing flowers, fruits or vegetables and as a place of recreation*.' Similarly, it also refers to a park as a '*large public garden in a town for recreation*'. These terms are also used for a variety of meanings.

History of Gardening

The earliest physical evidence of ornamental landscape comes from the Egyptian tomb paintings of about 3500 years ago. Gardens have existed throughout the world in most ancient civilisations.

Persian Gardens

The gardens of Persia were well known for their engineering marvels and novel designs. The Hanging Gardens of Babylon (in modern Iraq), one of the Seven Wonders of the Ancient World, were a landmark in the history of gardening. Persian gardens were designed with underground aqua ducts called '*qanats*' that helped to create lush gardens in a dry region.

Gardens of Europe

Ornamental gardens have become immensely popular in Europe right from the medieval period. Italy was known for its Renaissance gardens of the late 15th and 16th centuries. Each country in Europe such as Britain, Portugal, Greece, France and Spain has developed unique designs of gardening. From the 17th century onwards, Europe has witnessed a rapid growth of public gardens which harboured plant collections from several parts of the world. These botanical gardens have also become centres of germplasm collection, nature education and economic activity.

Gardens of Asia

There is a lot of literature available on the gardens of China, India and Japan. Chinese gardens were initially developed as medicinal gardens and expanded later with a larger scope. These gardens have also become places for solitude and contemplation, festivities, social gatherings, study, leisure, romance, painting, poetry, music and everyday activities. Bamboo, pine, lotus, chrysanthemum, banana and sweet olives were among the plants cultivated in Chinese gardens.

Japanese gardens were developed based on the designs of Chinese gardens to some extent. In Japanese gardens, the trees were sheared into mountain shapes. The technique of *Bonsai* was

introduced by the Japanese. Stone elements formed an integral part of Japanese landscape. The water source in Japanese gardens is found to appear as part of natural surroundings. Japanese gardens have also been adapted to Western settings from the 19th century onwards.

India was a forerunner in having well planned urban landscapes dating back to 3000 BCE. Features of natural landscapes were incorporated in royal gardens and urban p etublic parks of ancient India. Systematic establishment of parks and avenues was done during the rule of King Ashoka who meticulously planned both location and components of the parks which included a water pool, arbour, creepers and shaded pavements. There are numerous references in Sanskrit literature to the early gardens of India and different types of gardens such as *pramadodyan*, *udyan*, *vrikshavatika* and *nandanavana*.

The Mughals in India established a unique style of garden which reflected the Quranic idea of paradise. Mughal gardens are of three types, namely tomb gardens, pleasure gardens and courtyard gardens. These gardens were also a symbol of power and wealth of the empire.

The British colonial period was another milestone in the history of gardens in India. It is during the British period that the distinction between parks and gardens was established. Scientific gardens were established with a number of introduced species of economic and aesthetic importance as well as native species of conservation importance, whereas parks as primary recreation spaces were established in the urban landscapes. Spacious lawns became a major focal feature of British gardens. British gardens spread the passion for horticulture and were resources for seeds and other planting material for the public. The major botanic gardens established by them include the Acharya Jagadish Chandra Bose, the Indian Botanic Garden at Kolkota, Lal Bagh at Bengaluru, Sim's Park at Coonoor and the Botanical Garden at Ooty.

Gardens of Chennai

Dr. James Anderson started the first Botanical Garden at Madras in 1769. Starting his botanical researches in 1771, he established a Nopalry (*Nopalea cochenellifera)* in Saidapet, its location in today's terms along the western edge of Mount Road from approximately the Long Tank Drain to the Saidapet Bridge. By 1791, it had been developed as a botanical garden, the first in India, and flourished till 1800. Anderson, meanwhile, had developed between 1778 and 1792 his private botanical gardens in the 111 acres around his house in Nungambakkam, bound by College Road, Graeme's Road, Graeme's Lane and Haddow's Road. Anderson's Gardens survived till at least 1828, long after his death, pioneering the development of botanical gardens in India.

According to the Chennai Corporation, whenever the Open Space Reserve (OSR) lands are handed over to the Corporation they are converted into parks (*www.chennaicorporation.gov.in*).

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Conservation and Education initiative in the river basins of Northern Tamil Nadu with special emphasis on Water resources for school students

U. Thirunavukkarasu & R. Selvapandian

The Kosasthalaiyar sub-basin of Chennai Basin is very important for the water security of Chennai and surrounding areas. The river system is comparatively clean until it enters the city. On entry to the urban area it is subjected to various threats. The Kosasthalaiyar sub basin is 136 km long, originating in Kaveripakkam in Vellore district. It drains into the Bay of Bengal. The river has catchment areas near North Arcot district and a branch flowing down into Chennai as the Cooum river. The main Kosasthalaiyar enters into the Poondi reservoir.

Varahanadhi sub basin

The Varahanadhi basin is located in Tamil Nadu and Puducherry with a

total catchment area of 4498.5 sq.km. and spread over many districts viz., Villupuram, Thiruvannamalai, Kancheepuram and Cuddalore. It is one of the important river basins among the 17 major river basins in the above mentioned districts. The Varahanadhi sub basin is geographically surrounded by the Ponnaiyar basin in the south and west, Palar basin and Nallavur sub basin in the north and Bay of Bengal in the east. The total length of the Varahanadhi river is about 78.50 kms.

Sensitization programmes on Environment and Importance of Water Resources

The Environment Cell, Public Works Department / Water Resources Department (PWD/WRD-IAMWARM), in association with C.P.R. Environmental Education Centre (CPREEC), organised and conducted awareness programmes for school students in Ongur sub-basin of Varahanadhi river basins of North Tamilnadu. Secondary and senior secondary students participated in the programmes.

S.No.	River basin	Sub basin	Project area
1	Varahanadhi river basin	Ongur Sub-basin	Government Girls' Higher Secondary School, Achirupakkam Kanchipuram district
2	Varahanadhi river basin.	Nallavur sub-basin	Government Higher Secondary School, Olakkur, Villuppuram district
3	Varahanadhi river basin.	Nallavur sub-basin	Government Higher Secondary School, Marakkanam, Villuppuram district
4	Chennai river basin.	Kosasthalaiyar sub-basin	Government Girls' Higher Secondary School, Nemili, Vellore district
5	Chennai river basin.	Kosasthalaiyar sub-basin	Government Higher Secondary School, Thiruvalangadu, Thiruvallur district
6	Chennai river basin.	Kosasthalaiyar sub-basin	Government Higher Secondary School, Poondi, Thiruvallur district
7	Chennai river basin	Araniyar sub-basin	K.L.K. Government Boys' Higher Secondary School, Gummidipoondi, Thiruvallur district
8	Chennai river basin	Araniyar sub-basin	Government Higher Secondary School, Periyapalayam, Thiruvallur district

Environmental Education requirement survey and interaction

C.P.R. Environmental Education Centre (CPREEC), Chennai, constituted a team of experts to study the environmental education requirements of the project area by interacting with the teachers and students. CPREEC's project team consisted of subject experts, pedagogues, monitoring experts, field officers and headed by a supervisor.

Based on the needs identified and with input from the PWD – Environmental Cell experts, the thrust areas were identified for the region. The team, guided by the training experts from CPREEC, Chennai, formulated and designed the learning modules for the proposed programmes.

Objectives of the programme

The objectives of the environmental awareness programmes were:

- To raise awareness among the school students about the Varahanadhi river basin about the importance of environmental resources
- To motivate the students on environmental conservation issues of the region
- To orient them about the pivotal role played by the river system in ensuring the water security of the area
- To pass on the skills and to initiate environmental activities in conservation and protection of water and water resources
- To interact and to elicit their response

Resource Materials designed and developed for the Environmental Awareness programmes for the students

The materials designed and developed for the Environmental Awareness programmes for the students were:

- A documentary on conservation of water resources
- Illustrated animated film clippings on rainwater harvesting, water conservation methods and organic farming
- Carefully selected tree species saplings for demonstration and launch of environmental action
- An interactive – animated multimedia presentation on the subject of global warming, waste management and the importance of the environment
- An illustrated power point presentation on the Ongur Sub basin of the Varhanadhi river basin
- Power point on rainwater harvesting

An effective audio – visual multimedia facility including demonstration were prepared and set for the programme.

Target group

The orientation programme targeted selected secondary and higher secondary students of Government Higher Secondary Schools in Kanchipuram,

Villupuram and Vellore districts who were involved in National Green Corps and Eco Club activities of the school. The target areas covered Achirupakkam in Kanchipuram district. Marakkanam & Olakkur in Villuppuram district, Nemili in Vellore district and Thiruvalangadu, Gummidipoondi & Periyapalayam in Thiruvallur district. The target areas were selected by random sampling and giving priority to the two river basins.

Methodology

Awareness Orientation Programmes

Environmental awareness programme for the students of selected schools were conducted. The programme covered major concepts (themes) as per the learning design devised. Various experts deliberated and spoke about the issue of water conservation with relevance to the river.

- Importance of water resources
- Environmental threats to river basin: Indiscriminate disposal of solid waste, plastics , sewage, sand mining, chemical farming and other polluting factors.
- Influence of consumerism and other developmental activities
- Conservation of water
- Rainwater harvesting, sanitation. natural farming, solid waste management
- Individuals' role in conserving the river basins

The concept orientation and awareness module delivery

The focus of awareness module was on water conservation, factors responsible for destruction of the river beds-encroachment, dumping of garbage, pollution by mixing of sewage and industrial effluents, sand mining and the health and hygiene of the people living in the river basin. The frame work of module delivery is given as under;

- **Importance of Environmental resources:** Importance of the environment, biosphere and different roles played by various species. The importance of environmental resources for life, in particular – water as the fluid of the life support system

- **Conservation of water resources:** The importance of the initiative and the need to conserve water resources in particular the river systems of Tamilnadu to ensure water security. Water being the primary resource in supporting life forms continues to be the same. Unfortunately, the life supporting role of water has been long ignored and the base has been destroyed, encroached, depleted and contaminated beyond nature's capacity to recuperate the same.

- Protection of water resources is one of the duties of the citizens and healthy living depends on it.

- **Water scarcity and demand**: Water scarcity in Tamilnadu. The recent monsoon failure; the need to protect the remaining water resources.

- **Destructive human activities in the river basins:** The destruction of resources by human activities. Encroachment of lakes, river beds and river courses are additions.

- **River Pollution**: A classic example of the 'biomagnifying effect of heavy metal pollution' is the tanneries of Vellore district which are polluted the underground water resources and surface water. The effects are reaped in terms of toxicity of the drinking water and plant products.
- The Kosasthalaiyar sub basin is devastated with encroachments and mining and garbage accumulation.
- The environmental threats faced by the districts of the two river basins.
- Solid waste management at various levels and the necessity of segregating it into various categories, viz., biodegradable, recyclable and other wastes.
- The health perspective to environmental threats faced by the population. Personal health and hazards of smoking
- The food security of any region depends upon the pattern of agriculture. Due to excessive use of chemical fertilizers, the soil and water gets contaminated. Bio-magnification, resistance to chemical pesticides were happening due to intensive farming. Organic farming, promoting the use of bio-fertilizers and bio-pesticides are the need of the hour.
- **Conservation of water resources**: Role of Pollution Control Boards in protecting water resources and preventing air pollution. The legal mandate of TNPCB and environmental monitoring efforts of TNPCB in ensuring the quality of air and water.
- The resource depletion and the importance of environmental conservation. The issue of climate change and its impact on water security
- Techniques of vermicomposting
- **Role of students in conservation**: Role needed to be played by the student community. The role of NGC students in protecting the water resources of the districts.
- The students were finally taught the technique of planting by demonstrating it in the school grounds as a mark of environmental conservation initiative.

Multimedia method of environmental education: Animation and colourful pictures, filmlets were played to highlight the interaction of environmental

Mr. U. Thirunavukkarasu,
Environmental Education Officer,
CPREEC addressing the students

Mr. R. Selvapandian,
Education Officer, CPREEC addressing the students

A view of students attending the interactive sessions

Tree plantation at the school campus

resources and resource depletion. As a review, an animated picture of the 'transformation of a river based agrarian society degenerating into industry based polluting society' was shown to the students.

Summarizing the entire event and eliciting responses from the students in the form of a feedback. All the participants were provided with a copy of the pamphlet in Tamil on land and watershed management along the river basins in Tamilnadu. The questionnaire and response obtained from the students were analysed for the impact.

Discussion

The participants of the awareness interaction in the schools could achieve the majority of the objectives set for the project. Through the interactions, a profile of awareness pattern emerged.

1. Majority of the secondary and senior secondary students of suburban and town areas are generally aware about the environmental problems faced by them.

2. The conceptual knowledge bases for the environmental problems were found to be optimal.
3. The connectivity between local environmental challenges and the status of environment could not be established by the students. The environmental orientation revolved around it and tried to link the status and challenges faced by the people.

Of the total number of students who participated, around 90% were found to be aware of the impacts of garbage on the river system and its basin. The students opined that there is no proper

system of disposal existing in the towns and cities. The information about erratic seasonal rains, failing crops and rising food prices were known to 95% of the students after the orientation. Since rain water harvesting systems are compulsory in schools, the students are familiar with the terminology. 80% of the students could connect rain water harvesting and groundwater table improvement in larger community setting.

The students could visualize the entire river basin as an entity after the orientation programmes. The entire student community unanimously agreed that indiscriminate disposal of plastic as a major problem and was interested to learn about the alternatives. Recycling of plastic, avoidance, and reuse was accepted by 87% of the students. Energy efficiency was a new initiating action point for most of them and further reinforcement is needed to guide them further.

On actionable criteria on environmental matters relating to water and the individuals' role brought out many missing links between their concept learning and extending it to field based action. They agreed on planting more trees, reducing garbage, recharging the ground water, recognizing the importance of a pollution free environment, impact of garbage on the river system and health issues related to sanitation and personal habits.

Conclusion

The environmental awareness orientation for the school students on river basins of north Tamilnadu has helped them in visualizing the Varahanadhi and Chennai river basins in a holistic perspective and in relating the impact of environmental challenges to it. The student community perceived the threats posed to the river system and water resources because of human intervention and developmental activities. Most of the students were attracted towards the multimedia presentation on water and environment. The short intervention should be supported further by follow-up activities and environmental skill training to teachers to sustain and to institutionalize the efforts.

Ecosystem Services Provided by Sacred Plants

M. Amirthalingam

The Millennium Ecosystem Assessment (MEA) report, 2005, defines ecosystem services as "*benefits people obtain from ecosystems*" and distinguishes four broad categories of ecosystem services: (i) provisioning, such as the production of non timber forest products, timber and water; (2) regulating, such as the control of carbon sequestration, climate, disease and maintaining hydrological balance; (3) supporting, such as nutrient cycles, pollination and biodiversity; and (4) cultural, such as spiritual and recreational benefits. Ecosystem services of sacred forests are perhaps the greatest and the most crucial contribution to society and community. However, so far no serious studies have been conducted on the subject of sacred plants.

A plant that is equally venerated from time immemorial by devotees as holy as the presiding deity of a temple is the sacred plant or *sthala vriksha*. This practice has played a vital role in the conservation of certain native plant species. Although the medicinal and mythological importance of sacred

References

1. *www.tn.gov.in*
2. *www.tnhrce.in*

plants is recorded, their taxonomical identification and conservation value are yet to be examined.

Due to their ecological value and efficacious properties, sacred plants constitute a part of the genetic resources for the conservation of species diversity. Sacred plants are symbolic of a single genetic resource and play an important role in the conservation of biodiversity. The process of conserving economically, ecologically and medicinally important plants by declaring them as sacred also protected the genetic value of several plant species. Thus the preservation of sacred plants may also help in the conservation of local floral wealth.

Many living organisms, including man, depend upon plants for their food, shelter and medicine. That is why the plant is held on par with the prime deity in a temple.

Non-Timber Products

Sacred plants continue to be used in the religious and social ceremonies of the Hindus. The trunk of the banana is used to erect welcoming gates and its leaves to make the ceremonial pavilion in the case of all religious and cultural ceremonies. The five most sacred leaves of Pipal, Indian fig, Java fig, banyan and mango are ubiquitously employed in making prayers and offerings. On auspicious occasions, mango leaves are hung on doors as a *toran*; leaves of the flame of the forest (*palasa*) and banyan make workable plates and bowls during community feasts. Leaves of some other trees are also customarily offered to deities, such as the Bengal quince to Lord Siva, banana and arjuna to Lord Ganesha, and *amaltas* (Indian laburnum) to all the gods and goddesses. The red flowers of the Indian coral tree are used in the worship of Lord Vishnu and Lord Shiva; Indian oleander is used in the worship of Lord Shiva and the Sun-god; *ketaki* (Yucca gloriosa) in the worship of Laksmi, and jackfruit in the worship of Lord Vishnu.

The use of the flowers of the *sirisa* or parrot tree is prohibited during the worship of Lord Ganesa; in the worship of Lord Shiva the leaves of the Indian kino tree are banned from use. However, areca nut, which symbolizes Lord Ganesha, is commonly used in various rites. Banana is offered to Lord Vishnu and Lakshmi on the eleventh day of the bright half of *Pausa* (December-January) and to the Sun god on the sixth day of the bright fortnight of *Kartika* (October-November). Mango and Bengal quince fruits are also included in the worship material; the former is offered to all gods, the latter especially to Lord Shiva.

Several temples plant the Indian butter tree in and around the compound. This is because, in the past, oil from the tree was used to light lamps in the temple.

Trees provide livelihood to the people during times of scarcity. The people believed that trees sheltered or harboured village gods and goddesses. The local people never destroy or harm these trees. *Johad* (ponds) bunds in Alwar district of Rajasthan in India support several Pipal trees protected by the village community. These trees are

never felled; however, the leaves are lopped for fodder and small twigs are used as fuel wood. Trees also provide protection to bunds of the sacred ponds.

Devotees of Shiva wear the seeds of the *rudraksha* as rosaries which are used in meditation. Mesquite is the most feared and respected tree because it represents the dangerous planet Saturn and Agni (the powerful fire god).

All individuals of certain species are totally protected. For example, the Banyan, Pipal and Indian Fig afford total protection in the Southern Aravallis. *Ficus* is now considered a keystone resource playing a significant role in the conservation of many insects, birds, and mammals, flying-foxes, peafowl and spotted owlets live amidst the branches of these sacred trees (Terborgh 1986), and thus they provide food and shelter. These are an important species providing homes for beehive to honeybees. Thus sacred plants support several species of primates, birds, reptiles, insects and mammals. They are living without any disturbance in the trees and plants since these are held sacred. These are an important species providing the site for beehives to honeybees in the Aravallis. The inhabitants of the Aravallis also protect Indian frankincense (*Boswellia serrata*), Mountain persimon (*Diospyros montana),* Wood-apple (*Feronia limonia*) and the Indian gooseberry (*Emblica officinalis*).

Timbers of the Sacred Plants

The wood of sacred trees like Bengal quince, banyan, mesquite tree (*sami*), *palasa* (flame of the forest) and pipal is never used as fuel as it invites the wrath of the gods. But they are employed in other ways in sacrificial rites and ceremonies. Sandalwood is turned into paste and applied to the forehead. The wooden seat used during the sacred thread ceremony is made of mango or *palasa* (flame of the forest); the *brahmacarin* is also made to walk with a stick of *palasa*. During the sacred thread ceremony, the *brahmacarin* has to perform a sacrifice using pipal twigs called *samit*. After a person dies, the twigs of *bel* are placed near the central pillar of the house and those of neem scattered near the corpse.

Medicinal and Economical Use

Sacred plants (*sthalavrikshas*) and the beliefs associated with them contribute to conserving plant and animal biodiversity. Almost all the plants and trees are used for medicinal purposes by people in the surrounding rural areas. The *vilva* (Bengal quince) tree, for instance, is believed to cure fever, diabetes, ulcer and diarrhoea.

Religious and Cultural Use

Sacred plants support several species of primates, birds, reptiles and insects. Animals and birds can live undisturbed in these trees since the *sthalavirkshas* are considered sacred. However, these species play a key role in nutrient cycling, conservation as well as ensuring water balance in the soil. The utilization value recognized by the ecological knowledge system could be viewed as a more recent product in the social evolutionary scale

(Ramakrishnan, *et al.*, 1994). Socially, culturally or religiously important sacred species are worshipped in villages and rural areas even today.

Their regeneration, growth and bearing of fruit are regarded as_mysterious godly actions. The larger trees are worshipped as the abode of the gods and they protect the worshippers from evil spirits. The sacred trees are also considered as abodes of ancestral spirits and to appease them special offerings are made at the time of festivities.

Kapila Vatsyayan (1992) has drawn attention to the sacredness of plants seen in all parts of India. Gupta (1991), have pointed out that the *deodar* is considered the abode of the gods; the *sal* tree is venerated in Uttar Pradesh, Bihar and Madhya Pradesh and similarly *rudraksha*, *vilva* (Bengal quince), *ashoka*, Seaside Indian oak (*Anthocephalus chinensis*) and *pipal* are considered sacred in Rajasthan.

Conservation practices

Certain vulnerable stages in the life history or the phenological cycle of a plant may be offered protection. Thus, the *Kols* who live in the Vindhya hills refrain from eating the unripe fruits of *vila* (wood-apple) and the Indian gooseberry before the *Dussehra* festival in the month of October. This saves the species from getting locally extinct, for the fruits might otherwise be consumed even before the tree has produced viable seeds.

Conclusion

Sacred plants are very important as they play a key role in regulating various functions such as hydrological cycles, rainfall, temperatures, local climatic conditions and supporting bio-diversity. Of course, they also provide significant economic support to society and to local people in various ways. Socially, culturally or religiously important sacred species are worshipped in villages and rural areas even today. In many temples, sacred plants are neglected and in danger of becoming extinct. Hence, it is necessary to create awareness among the devotees to restore this ancient practice.

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International Day for Biodiversity

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Introduction

The United Nations Conference on Environment and Development (also known as Earth Summit) was held in 1992 at Rio de Janeiro, Brazil. In this summit the leaders of various countries of the world agreed on a strategy for sustainable development. Sustainable development is a way to meet the basic needs of people all over the world and ensuring that planet earth remains healthy and viable for future generations. During the Earth Summit, one of the most important agreements reached was the Convention on Biological Diversity.

Background on International Day for Biodiversity

The Convention on Biological Diversity came into force on December 29, 1993. Each anniversary of this date has been designated as the International Day for Biodiversity. From the year 2001, the date of the celebration on the International day for Biodiversity was moved to May 22. Since many holidays fall in the last week of December, this decision was taken. And also since 2003, a specific theme was also suggested to observe the International Day for Biodiversity. The International Day for Biodiversity is part of a series of activities to focus the attention on the Convention of Biological Diversity. A symbol is also attached to this convention. The symbol of this convention is a stylized image of a twig or branch with three green leaves. Depending upon the background the leaves may be outlines or green blocks. Each year a piece of artwork is commissioned to reflect the theme. Details of the artwork are used as symbols for different aspects of the International Day for Biodiversity.

The various themes of the International Day for Biodiversity since 2003 are given below:

Year	Theme
2002	Dedicated to forest biodiversity
2003	Biodiversity and Poverty Alleviation – Challenge for Sustainable Development
2004	Biodiversity : Food, Water and Health for All
2005	Biodiversity : Life Insurance for our changing world
2006	Protect Biodiversity in dry lands
2007	Biodiversity and Climate Change
2008	Biodiversity and Agriculture
2009	Invasive Alien Species
2010	Biodiversity, Development and Poverty Alleviation
2011	Forest Biodiversity
2012	Marine Biodiversity
2013	Water and Biodiversity

International Day for Biological Diversity, 2013

The theme for the year 2013 is Water and Biodiversity. This theme was selected to coincide with the United Nations designation of 2013 as the International year of Water Cooperation. The theme provides a lot of scope to raise awareness about conservation and protection of water as well as biodiversity for the future generations and also the linkage between water ad biodiversity richness. More over the period between 2005 and 2015 has also been declared as International Decade for Action 'WATER FOR LIFE'. Earlier, the United Nations declared the year 2010 as the International Year of Biodiversity. This was mainly done because the international community did not achieve the goals set by the Convention on Biological Diversity (CBD) for the reduction of the current rate of biodiversity loss. For example, last year's IUCN Red List of threatened species showed that there exists a threat of extinction for 38% of monitored species. The current rate of species extinction is about 1000 times higher than the natural rate due to the various activities of humans.

Water and Biodiversity – the theme for 2013

Water is the most important resource on the planet and it supports all life forms on Earth including human beings. Water is the most abundant resource; however, most of it is salt water and is in the oceans. Of the world's total water resources, less than 3% is fresh water. The quantity of fresh water available on earth supports a high degree of biodiversity. This includes not only the species which are living in the water but also the various other species depending on an inland water habitat.

Inland water biodiversity is very important for poverty reduction. Inland water biodiversity is directly linked with food security of the local people. Above all this system plays a vital role in climate regulation, flood mitigation, nutrient recycling, water purification and various human welfare and development measures. As per the Millennium Ecosystem Assessment, the importance of the wetlands is described as follows:

"Estimates for the global economic importance of wetlands are highly variable, with an upper value of $15 trillion (over three times the value of global forest ecosystem services, which is $4.7 trillion). Intact wetlands have a net value of 1.6 times that of sustainable forests, 5.8 times than that of mangroves and 4.5 times that of forests under traditional management".

The wetlands play a major role in climate regulation. It is unfortunate that the biodiversity of fresh water ecosystems is declining faster than any other ecosystem. This is due to the loss of inland waters, due to infrastructure development, pollution, introduction of invasive alien species, etc.

Some suggested activities for International Day for Biological Diversity, 2013

India is very rich in biodiversity; the richness is associated with various ecosystems. The wetland ecosystem of our country (58.2 million hectares) is endowed with high biological resources and is a source of livelihood for millions of people. Next to coastal water the inland wetlands support a high degree of biodiversity. Already within 50 years, we have lost about 30–40% of inland water bodies. Documentation of wetlands in our country is available. However, mapping, ecosystem services, management plan, conservation

priorities have not been made for more than 75% of our wetlands. Ramsar sites, large water bodies, which are supplying drinking water for cities are well protected but the smaller water bodies are not at all managed. Hence, some remedial are suggested:

Communicate the relationship between water and biodiversity to the stakeholders.

The stakeholders in our country are numerous. To achieve this goal, all the State Training Institutes should be asked to conduct orientation programme. Currently, the issue related to climate change, disaster management are highly discussed. Inland water body issues should be discussed with local stakeholders, the benefits received by the local people should be made publicised. For example, sand mining in the river beds and the ground water recharge mechanism, the invasive alien species in the lakes and ponds and its effect on fish productivity, water quality, effect on local agriculture, etc. may be highlighted.

Preparation of biodiversity registers for wetlands

At present, only biodiversity registers of the Ramsar sites are available in our country. The richness of other water bodies is known to the local people. This oral tradition should be documented and verified by experts. The endangered and endemic species of plants and animals should be conserved through public participation.

Water quality monitoring

The water bodies which are supplying drinking water to the people are monitored by the concerned departments. Periodical monitoring of all water bodies is essential to correlate with biodiversity richness and also for effective management.

Awareness for younger generation

School children should be made aware of the wetland ecosystems and biodiversity richness. Now, the students are only aware of flagship species such as, the Gangetic dolphin, Siberian crane, etc.

Preparation of awareness materials

Currently, a few educational materials are available and that too site or habitat specific. The local competent authorities should be asked to prepare material for awareness and education. Except for fish biodiversity of inland wetlands, no comprehensive data on biodiversity richness is available.

Law and wetland biodiversity

Most of the small wetlands of our country are used as a dumping ground for solid waste. In order to stop this activity, the legal mechanism should be strengthened.

Conclusion

The United Nations had declared the year 2010 as the International Year of Biodiversity and has also declared the years between 2011 and 2020 as United Nations Decade on Biodiversity. The period between 2005 and 2015 has been declared as International Decade for Action 'WATER FOR LIFE'. All these declarations are mainly done to sensitize the importance of water and biodiversity conservation. India is a developing country; our population has crossed 1 billion. It is imperative to protect our water resources and life on it.

Industrial Ecology- Principles and Practices

R. Sabesh

Introduction

Industrial ecology is the study of material and energy flows through industrial systems. Industrial ecology emerged out of several ideas and concepts, which date back to the 19thcentury. It aims at closing material cycles within industrial systems by developing symbiotic functions among system components. The key focus of industrial ecology relates mainly to how industrial systems are structured and how they transform, use and discard natural resources. The global industrial economy can be modeled as a network of industrial processes which extract resources from the Earth and transform those resources into commodities which can be bought and sold to meet the needs of humanity. Industrial ecology seeks to quantify the material flows and document the industrial processes that make modern society function. Industrial ecologists are often concerned with the impacts of industrial activities on the environment, natural resources and the problems associated with waste disposal.

In short, industrial ecology aims at looking at the industrial system as a whole. Industrial ecology not only addresses just issues of pollution and the environment, but also promotes important technologies, process economics, inter-relationships of businesses, financing, overall Government policy and the entire spectrum of issues involved in the management of commercial enterprises. As such, industrial ecology can provide a conceptual framework and an important tool for the process of planning the field approaches to issues of sustainability by examining problems from multiple perspectives, usually involving aspects of sociology, the environment, economy, toxicology engineering and technology.

Principles of Industrial Ecology

The concept of industrial ecology was evolved as a scientific discipline around three decades ago and the concept became popular during 1989 through a *Scientific American* article by Robert Froschand Nicholas E. Gallopoulos. Frosch and Gallopoulos' with the focus of "why not our industrial system behave like an ecosystem, where the wastes of one species may be the resource for another species? Why would not the outputs of an industry be the inputs of another? This will help in reducing the use of raw materials. Pollution results in waste minimization and ultimately reducing the costs waste treatment. The concept of industrial ecosystems function as an analogue of the biological ecosystem wherein the plants synthesize nutrients that feed herbivores, which, in turn, feed various species of carnivores, whose wastes and bodies after decomposition eventually add nutrients to the soil. Industrial ecology is concerned with the shifting of industrial processes from linear systems in which resource and capital investments move through the system to become waste, to a closed loop system where wastes can become inputs for new processes.

Industrial ecology seeks to understand the way in which industrial systems interact with the biosphere. Natural ecosystems provide a metaphor for understanding how different parts of industrial systems interact with one another, in an "ecosystem" based on resources and infrastructure rather than on natural resources. It seeks to exploit the idea that natural systems do not have waste in them to promote sustainable design and practices along with the conservation of energy, materials, and redefining commodity markets. At present, industrial ecology is being pursued with unprecedented vigour. It is gaining recognition not only in business communities, but in academic and government circles as well. Ecology is used as a metaphor due to the observation that natural systems reuse materials and have a largely closed loop cycling of nutrients and industrial ecology approaches problems with the hypothesis and similar principles as natural systems. The following table shows the general metaphor.

Biosphere	**Industrial atmosphere**
Ecology	Market
Organism	Company
Natural Product	Industrial Product
Survival of fittest	Competition
Ecosystem	Eco-Industrial Park
Ecological Niche	Market Niche
Metabolism	Waste Management
Mutation and Selection	Design for Environment
Succession	Economic Growth
Adaptation	Innovation
Food Web	Product Life Cycle

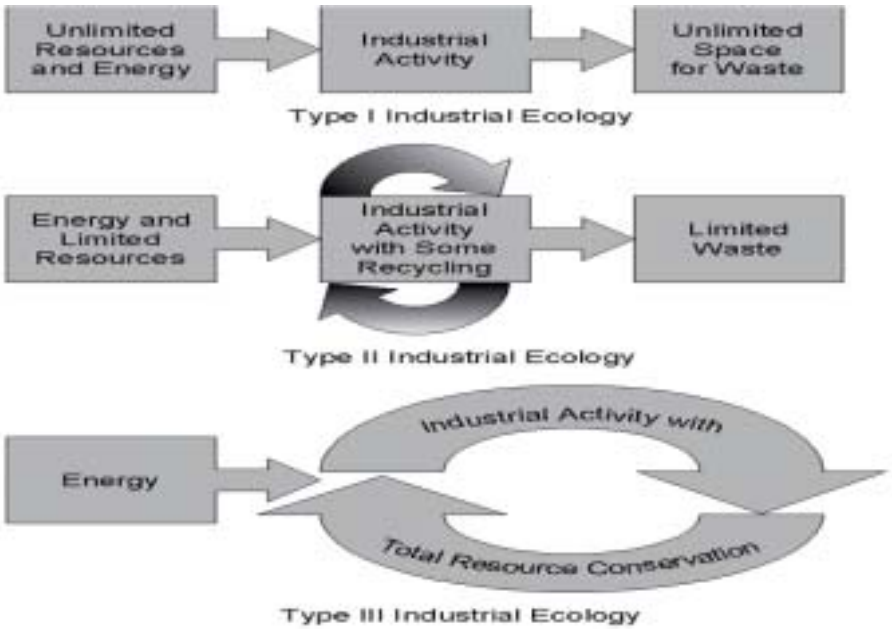

Figure 1: The three types of Industrial Ecologies. Industrial Ecologists advocate closing loops in industry to transition from a Type I ecology to a Type III ecology.

Source: *http://www.amrita.edu/sdg/pdf/intro%20to%20industrial%20ecology.pdf*

The principles and the concepts of industrial ecology can be used by service as well as manufacturing companies. Application of industrial ecology will improve the planning and performance of government operations, including local, regional, and national levels of infrastructure. While much of the initial work in industrial ecology has focused on manufacturing, a full definition of industrial systems includes service, agricultural, manufacturing, military, public operations such infrastructure as landfills, water and sewage systems, and transportation systems.

Conclusion

Industrial ecology principles are emerging in various policy realms such as the concept of the circular economy which is being promoted in China. The hope is that such strategies would create more efficient economy with less pollutants and other undesirable by products. There is no doubt that time has come to prepare for the coming era of technological advancement, mainly nanotechnology which contributes to the ultimate goal of industrial ecology i.e., to promote more sophisticated and efficient industrial systems, capable of creating more wealth and better living standards with less harmful impacts on the biosphere. A final and important principle of industrial ecology is its integrated approach to the three disciplines namely, the social sciences including economics, the technical sciences and the environmental sciences. The major challenge is to merge them into a single approach. Nature's ecosystems have more than 3.5 billion years of experience evolving efficient, complex, adaptive, resilient systems. Hence, the same nature's principles can be adopted in the industrial sector to retain its sustainability and protect the biosphere.

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