



ENVIRONNEWS

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Rescheduling of ICPEP-4

During the past couple of months, the Organizing Committee of Fourth International Conference on Plants and Environmental Pollution (ICPEP-4) was facing a difficult situation due to inability of international funding agencies to co-sponsor this Conference and provide travel grants to overseas delegates due to the resource crunch faced by them because of global economic recession. One possible solution to this problem was rescheduling the Conference to a later date, several months away. As our preparations for holding the Conference were in an advanced stage, it was not easy for us to take a decision in the matter, one way, or the other. Ultimately, we decided to seek the advice of distinguished members of International Advisory Committee and National Organizing Committee on this crucial issue. I am grateful to them for promptly responding to my request and intimating their well considered views. A large majority of them advised rescheduling the meeting. After detailed discussions, though reluctantly, we decided to reschedule ICPEP-4 meeting to 8-11 December 2010.

Incidentally, a major international conference on Nitrogen is being organized during 3-7 December 2010 at IARI, New Delhi, in which a large number of overseas delegates are expected to participate. It will be an added advantage for us to hold our meeting on the above dates, i.e. soon after the Nitrogen conference, as many of the delegates may like to extend their visit to India to participate in both the conferences.

I wish to assure you that we will make all out efforts to maintain international character of ICPEP-4 as achieved in the earlier meetings. I do look forward to your continued patronage in making this Conference a grand success.

Rakesh Tuli
President ISEB & Director NBRI

- Informative news, views and popular articles/write-ups on current environmental researches/issues are invited for publication in ENVIRONNEWS.
- Environews is published quarterly on the first of January/April/July/October; and is supplied free to all members of ISEB.
- Environews is also supplied in exchange for scientific literature published by reputed organisations.
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- **E-mail : isebnbrilko@sify.com • Website : <http://isebindia.com>**



LETTERS

The global mammalian population is going down at an alarming rate. A recent report published in *Science* by Schipper *et al*¹ has presented this monumental concern regarding the possible extinction of threatened and highly endangered mammalian species. The researchers reported finding that there is possibility of extinction of one in every four global mammalian species in the coming future if appropriate measures are not adopted to protect and conserve them. A largely varying number of causal factors are responsible for these including climate change, pollution of the ecosystem, harvesting, poaching, sporadic outbreak of diseases, habitat fragmentation and habitat loss. The pattern of impact on mammalian population varies significantly between developed, developing and under developed countries cutting across the planet. The threat of extinction is certainly higher in nations representing poorer economies but richer biodiversities; however, no single country is immune against the rapid erosion of the mammalian species, whether rich or poor. It is very important for us to stand up against this loss of rare species and extend our whole-hearted support and help to those who are involved in the critical task of conserving these threatened and endangered species for preserving a better global environment. I appeal to all readers to join their hands for establishing a common platform to save these GEMS of the GREEN PLANET that we all share and love so much.

Saikat Kumar Basu

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I am young researcher at Department of Botany, University of Karachi, Pakistan. My field of research is plant Ecology and I am working on industrial pollution. I have seen *EnviroNews*, Vol. 15, No. 3 published by you. I found it very informative and inspiring. Such news magazines should be published regularly in order to create awareness among the peoples. If any of your readers have some information about Effects of industrial pollution on distribution of plants then he may send it to me. I shall be grateful for this act of kindness.

Muhammad Kabir

Research Scholar, Department of Botany
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I have gone through the article published in International Society of Environmental Botanists Newsletter July, 2009.

The article on Urban Pollution and Solution with special reference to Lucknow, so called city of gardens. The article is very informative and educative especially for those who care for saving the environment. The article will benefit the horticulturists in making the Landscape plans for the urban areas. I congratulate International Society of Environmental Botanists for publishing such article for bringing the environmental awareness among the cross section of the society.

Raju Chaurasia

Garden Superintendent,
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We know that certain trees and plants can help in reducing air pollution but don't have much information on this. Does your organization have a website or some key documentation you could share?

May I suggest for your organization to join our CAI-Asia Partnership? Then it will be easier for us to inform you about and involve you in our activities.

The registration form can be found at http://www.cleanairnet.org/caiasia/1412/propertyvalue-26883.html#h2_1

I am forwarding a copy of this letter to Dr. Parwana, who is our coordinator for CAI-Asia, India.

Sophie Punte

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Congratulations for publishing an article on "Urban Pollution & Solution" by Dr. S. C. Sharma. The article is very educative & interesting. It will be a great help to the Landscapists and Architects especially when greens are disappearing and cities are heavily polluted. ISEB is doing a great job for the environmental awareness.

Vinod Tomar

Landscapist, Lucknow

WELCOME NEW LIFE MEMBERS

Dr. T.S. Rana is working as a Senior Scientist at Plant Biodiversity and Conservation Biology Division of National Botanical Research Institute, Lucknow. He has over 17 years of research experience in Angiosperm Taxonomy and Biodiversity assessment at the species, ecosystem and genetic levels. Dr. Rana has published one book and about forty research papers in national/ international journals. Dr. Rana was deputed to Slovak Republic under exchange programme of CSIR, New Delhi and Slovak Academy of Sciences, Bratislava, Slovakia. He was awarded prestigious BOYSCAST Fellowship (2001-2002) by Department of Science and Technology (Government of India), New Delhi to visit IPK, Gatersleben, Germany for a period of six month to carry out research-cum-training in Molecular Systematics. He is currently working on Molecular systematics of the genera like *Punica*, *Murraya* and *Sapindus* at the National Botanical Research Institute, Lucknow.

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Prof. R.K. Kohli, an internationally renowned plant ecologist is the chairperson of the Department of Botany, Panjab University, Chandigarh. In his long and eventful research career he has published over 100 research papers, 7 invited reviews, 52 research articles, and 22 book chapters. He has authored and edited 3 and 10 books, respectively. He has guided 27 Ph.D. and 27 M.Phil. theses in Ecology, Environment and Forestry.

Prof. Kohli has won a large number of highly prestigious international honours, awards and recognitions. He was a member of the International Jury of the Albert Einstein Award for the outstanding scientist, World Cultural Council, Mexico (1999-2001). He is the Chair/Coordinator, International Union of Forestry Research Organizations, Austria. He is a member of the Editorial Boards of several international scientific journals, including 3 journals published from U.S.A. He was awarded UNESCO-WHO Postdoctoral Fellowship in 1978-79. Prof. Kohli was honoured with SAARC Chair (2007-08). He was made an Adjunct Professor by the Chinese Academy of Sciences (2007-2008). He won B.P. Pal National Environment Fellowships Award.

Prof. Kohli's major scientific contributions have been in the areas of biochemical inter-plant interaction, allelopathy for sustainable weed management, mode of action of allelochemicals, plantation forestry and agroforestry.

Prof. Kohli's current research interests include management of noxious weeds using environment-friendly techniques, impact of invasive plants on the Ecology, plant-environment interaction, urban forestry and weed ecology, impact of mobile phones and their towers on ecology and environment.

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Dr. Ms. Kavita Rambal is a reader in the Department of

Botany, M.D. College, Mumbai, where she is teaching post-graduate students in Environmental Botany. Her M.Phil. work was related to carbon cycling and Ph.D. on Bacterial Population Dynamics. She has published her research work in reputed international journals.

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Dr. Shekhar Mallick is a Scientist in the Ecotoxicology & Bioremediation Group of National Botanical Research Institute, Lucknow, India.

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Dr. Vinod Tomar, Director, High Tech Horts Service is a leading landscapist of India based at Lucknow. Dr. Tomar did his M.Sc. (Horticulture) from G.B. Pant Agricultural University, Pant Nagar. He was awarded Ph.D degree in Plant Propagation from the Meerut University, Meerut. He has deep interest in the environmental protection and conservation programmes.

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Mrs. Tulika Mishra is an amateur Horticulturist. She has keen interest in dairy development, environmental programmes and home science.

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Dr. R.P. Rastogi is a leading medical pathologist of Lucknow. Dr. Rastogi did his M.B.B.S. and M.D. degree from G.S.V.M. Medical College, Kanpur He has deep love for saving the nature and environment of Lucknow, City of the Gardens.

Dr. Tariq Husain is the Head of Taxonomy, Herbarium and Biodiversity Division in National Botanical Research Institute, Lucknow. He has 27 years research experience in the field of Angiosperm taxonomy, Biodiversity and Conservation. He has published several research papers in national and international journals of repute. Dr. Husain has been honoured by awards e.g. F.E.S. (Fellow of Society of Ethnobotanists), FIAAT (Fellow of Indian Association for Angiosperms Taxonomy) Robert 'O' Bass Fellowship from Field Museum of Natural History, Chicago, U.S.A.

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Dr. G. Venkateshwar Rao is working as a Lecturer in the Department of Botany at Osmania University. He has carried out extensive researches on medicinal and aromatic plants and their symbiotic association with Arbuscular Mycorrhizal Fungi at CIMAP, Hyderabad.

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Shri K.C. Sharma is an outstanding horticulturist and landscapist of India. He is former Director, Horticulture of New Delhi Municipal Corporation. Mr. Sharma has participated in many national and international garden festivals and won prizes for his contributions.



NEWS FLASH

Tree Plantation Drive at NBRI

National Botanical Research Institute, Lucknow organized a Tree Plantation Programme on the eve of Independence Day (August 14, 2009). The purpose of the Tree Ceremony was to enrich the germ-plasm collections as well as creating awareness about the significance of trees for preserving the environment. The ceremony was attended by dignitaries from different walks of life (Directors of CSIR labs, Fellows of Indian National Academy, judges, doctors, morning walkers of the Botanic Garden and scientists of NBRI).

The ceremony started with a puja held under the historical Banyan Tree of Botanic Garden of the Institute. Dr. Rakesh Tuli, Director NBRI delivered the welcome address and gave the genesis of the Tree Plantation Drive. Dr. S.C. Sharma, Vice-President, International Society of Environmental Botanists (ISEB) was the coordinator for organizing the Tree Plantation Programme.

The following plant species were planted in the New Arboretum:

Aegle marmelos (Bael), *Anthocephalus cadamba* (Kadam), *Cayra illinois* (Desert Nut), *Cocos nucifera* (Coconut), *Elaeocarpus ganitrus* (Rudraksh), *Milletia peguensis* (Iron Wood Tree), *Mimusops elengi* (Molseri), *Parkia biglandulosa* (Parkia), *Prosopis cineraria* (Shami), *Pterospermum acerifolium* (Kanakchampa), *Pterygota alata* (Buddha's Coconut), *Saraca asoka* (Sita Asok), *Swietenia macrophylla* (Brazilian Mahogany), *Terminalia arjuna* (Arjun) and *Terminalia cattapa* (Indian Almond). Out of these **Brazilian Mahogany** is a rare plant and has been

categorized as vulnerable due to the exploitation for commercial purposes.

Prof. R.S. Tripathi, FNA, Life Member and Advisor, ISEB, was invited to deliver a series of four lectures in the Division of Forestry and Ecology, Indian Institute of Remote Sensing, Dehra Dun (Department of Space, Govt. of India). He delivered lectures on the following topics during 31 August – 2 September, 2009.

- (i) Evaluation of forest ecosystem with special emphasis on forest fragmentation
- (ii) Evaluation of aquatic ecosystem
- (iii) Changes in soil properties, soil microbial population and plant diversity during eco-restoration and natural recovery of coalmine spoils
- (iv) Development of plant communities and analysis of their structure

Prof. Tripathi was invited to participate as a Resource Person in the SCAPES (Strengthening Capacity to Alleviate Poverty through Ecosystem Services) Regional Workshop on "Studying the Linkages Between Ecosystem Services and Poverty : Building Networks in South Asia". He chaired the thematic groups on "Coasts" and "Forests". The Workshop was sponsored by the Natural Environment Research Council (NERC), the Department for International Development (DFID), the Economic & Social Research Council (ESRC) and the United Nations Environment Programme (UNEP). It was organized by the Institute for Sustainable Water, Integrated Management and Ecosystem Research (SWIMMER),

University of Liverpool, U.K. and Department of Environmental Studies, North_Eastern Hill University, during 8-9 September, 2009 at Shillong, India.

Role of Senior Citizens in Environmental Awareness Programme

Bhartiya Varishth Nagrik Samiti (Indian Senior Citizens Society) invited Dr. S.C. Sharma, Vice-President of the International Society of Environmental Botanists (ISEB) to deliver a lecture on the role of "Senior Citizens for Protecting the Environment" on August 23, 2009. Dr. Sharma emphasized that the senior citizens should create awareness among children and youth for maintaining the clean and healthy environment. The children should care and love plants and animals. The healthy environment provides healthy thoughts for upbringing the children who are hope of the future for saving the Planet Earth.

Lucknow Girl Addresses United Nation Climate meets

13 years old Yugratna Shrivastava, who is Asia-Pacific representative of the Junior Board of the United Nations environment Programme, addressed the United Nations General Assembly on Global Climate Change on 22 September 2009.

The Summit was called by United Nations Secretary General Ban Ki-Moon. Yugratna is the first teenager from India who has been selected for the honour.

Yugratna is studying in Class IX of St. Fiedelis College. Father Wilson Andrade, the Principal of the College is a Life Member of ISEB.

FACTS ABOUT GLOBAL WARMING

By eating less meat you can reduce the amount of methane that is sent into the atmosphere! Methane is the second most significant greenhouse gas. Cows exhale methane with every breath because of their grassy diet multiple stomachs.

Do you know that if our earth gets any warmer, forty years from now we will only be able to grow half of the almonds and walnuts that we are growing now! Wouldn't we miss our crunchy, nutty ice creams?

At the rate our climate is changing, the work will soon be warmer than it has every been in the last 10,000 years.

ARSENIC THREAT AND ITS REMEDIATION THROUGH PLANTS: A STEP FOR ENVIRONMENTAL CLEAN UP

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Introduction

Geochemical weathering and anthropogenic activities contaminate the natural and ground water with metals and metalloids, which poses a serious environmental and health hazards for the 21st century.

Industrial revolution has been a symbol of development throughout the world and has led to the emergence of enormous number of facilities and commodities.

During operation, Industries produce potentially toxic and hazardous wastes of pesticides, dyes and pigments, organic chemicals, fertilizers, non ferrous metals. This is creating a high risk in all compartment of the environment. These waste and effluent of industries contain high amount of toxic metals and metalloids.

Arsenic (As) is considered one of the most important toxic elements. These days, it has become a global concern owing to the ever-increasing contamination of water, soil and crops in many region of the world. As is released into environment by human activities as well as naturally from the earth crust, through ground water irrigation. The international agency for research on cancer (IARC) places inorganic As under highest health hazard category i.e. a group carcinogen, and there is substantial evidence that it increases risk of cancer of the bladder, lung, skin and prostate.

The permissible limit of As- concentration in potable water is fixed at 50µg/l in India, Bangladesh and many other countries, however WHO (1993) recommends lowering this limit

provisionally to 10µg/l, which has been endorsed by Bureau of Indian standards(2003).

Groundwater contamination by As has been reported from many countries, with the more severe problems occurring in the south east Asia, mainly in Bangladesh, and West Bengal in India. Arsenic can be harmful through inhalation, absorption through skin, mucous membranes and ingestion. Accidental poisoning can occur through breathing fumes, licking, paintbrushes to paint when using pigment containing arsenic, or from wearing inadequate clothing when applying arsenic based products.

Effects of mild poisoning from inhalation include loss of appetite, nausea, and diarrhea. Effect of more severe, chronic or acute exposure includes skin lesions, skin rash, and chronic headaches. Garlic odor on breath, a metallic taste in the mouth, a bronzing pigment of the skin resembling "raindrops on a dusty road" and possible damage to the liver. Arsenic and As compounds are known cancer causing agents and have been implicated in lung and skin cancer and associated with birth defects. It has different forms, such as inorganic or organic form, inorganic arsenic being generally considered more toxic.

Source of Arsenic

A. Arsenic in Groundwater

Arsenic is found in groundwater which has flowed through arsenic-rich rocks. Recent work has demonstrated that arsenic originates from ferrous oxides in the Holocene- era aquifers tapped by the tube wells. Carbon deposits from ancient mangrove swamps provide

reducing conditions that cause the release of arsenic. Contamination of groundwater with arsenic and its impact on humans have been reported from 23 countries. The magnitude of this problem is severe in Bangladesh and West Bengal in India. In recent years, evidence of arsenic groundwater contamination has also emerged in other Asian countries including Cambodia, The Lao peoples Democratic Republic, Myanmar, Pakistan, Nepal, Vietnam, a province in Iran and Bihar state in the middle Gangetic Plain in India.

B. Arsenic in Surface water

Arsenic comes in to surface water through industrial effluents, agricultural runoff, and it is also used commercially in alloying agent and wood preservatives.

Arsenic Transportation and Metabolism

Much of the arsenic in the atmosphere comes from high-temperature processes such as coal-fired power plants, burning vegetation and volcanic activity. The arsenic is released into the atmosphere primarily as arsenic trioxide where it adheres readily onto the surface of particles. These particles are dispersed by the wind and eventually fall back to the earth due to their weight or during rain. Microbes acting on arsenic in soils and sediments generate arsine gas or other volatile arsenic compounds. Arsine reacts with oxygen in the air and is converted back to non-volatile forms of arsenic, which settle back to the ground. In well-oxygenated water and sediments, nearly all arsenic is present in the stable form of arsenate. While in flooded conditions arsenic predominates and it is interchangeable, depending

on the chemical and biological conditions.

Arsenic is absorbed from the lung, from the mucous membranes of the nose, and from the gut. It passes through the body and is partially metabolized in the liver. It is excreted in the urine, the sweat and in the keratin of skin and the nails. Its disappearance rate from the blood is very rapid with a biological half-life of one hour and from the body in to the urine with a biological half life of four days.

Because of its rapid elimination, arsenic dosages do not build up over time. The measurement of arsenic in the urine will indicate the level of exposure over the past few days, and in the hair, indicate past few months. It is known that children eliminate arsenic from their system more rapidly than adults. A study of about 400 children from the Anaconda smelter site in Montana found no evidence of an increase in urinary arsenic level correlating with the general contamination level for the area.

Effects of Arsenic on Aquatic System

Arsenic is an essential compound for many animal species, because it plays a role in protein synthesis. It is unclear whether arsenic is a dietary mineral for humans. Arsenic toxicity is another important characteristic. The boundary concentration of arsenic is 2.46 ppm for fresh water algae. This compound also blocks enzymatic processes, increasing the toxicity. Large amount of arsenic end up the environment and living organisms. It is mainly emitted by the copper producing industries, but also during lead and zinc production and in agriculture. It can not be destroyed once, entered the environment, so that the amounts that we add can spread and cause health effects to humans and animals on many locations on earth.

Plants absorb arsenic fairly easily, so that high ranking concentration may be present in food. The high concentrations of dangerous inorganic arsenic that are

currently present in surface water enhance the chances of alteration genetic materials of fish. This is mainly caused by accumulation of arsenic in the bodies of plant-eating freshwater organisms. Birds eat the fish that already contain eminent amounts of arsenic and will die as a result of arsenic poisoning as the fish is decomposed in their bodies.

Effect of Arsenic on Human Health

Arsenic is a well known carcinogen. It is also causes melanosis, leucomelanosis, hyperkeratosis, hepatomangoly, neuropathy, odema. Environmental exposure to arsenic has also been well linked to the development of a variety of cancers like skin, lung, bladder and urinary tract cancers.

The study was reported from Taiwan in the 1960s and concerned an area with a previously unknown disease-Blackfoot Disease. It was the investigation of Blackfoot disease and its associated skin cancer that led to the identification of arsenic as the probable or possible cause of both diseases.

Phytoremediation: From Green to Clean

Various efforts have been made to enhance the remediation capacity of plants through genetic engineering, for example, through over expression of arsenate reductases and phytochelatin synthases. Although, As tolerance in some transgenic was enhanced, but accumulation factors particularly in shoot tissue have remained low.

Even though As and most other heavy metals are toxic to plants, a range of plants have been described as so called metallophytes or hyperaccumulators. Hyperaccumulator ferns, which accumulate very high concentration of arsenic specifically in above ground tissues.

Fresh water macrophytes such as, *Ceratophyllum demersum*, *Alisma*

plantago, *Collitriche stagnalis*, *Eigeria densa*, *Elodea canadensis*, *Juncus* spp., *Potamogeton orchjreatus*, *Oscillataria*, *Chara* etc. are potent hyperaccumulator of arsenic.

Various methods of phytoremediation are as follows:-

- 1. Phytoextraction (phytoaccumulation):** Is the name given to the process where plant roots uptake metal contaminants from the soil and translocate them to their above ground tissues.
- 2. Rhizofiltration:** It is similar to the phytoextraction but is concerned with the remediation of the contaminated groundwater rather than the remediation of polluted soils. The contaminants are either adsorbed on to the root surface or are absorbed by the plants roots.
- 3. Phytostabilization:** Is the use of certain plants to immobilize soil and water contaminants are precipitated in the rhizosphere.
- 4. Phytodegradation (phytotransformation):** Is the degradation or breakdown of organic contaminant by internal and external metabolic processes driven by the plant.
- 5. Rhizodegradation:** Also called enhanced rhizosphere biodegradation, Phytostimulation and plant assisted bioremediation is the breakdown of organic contaminants in the soil by soil dwelling microbes which is enhanced by the rhizospher's presence.
- 6. Phytovolatilization:** Is the process where plants uptake contaminants which are water soluble and release them into the atmosphere as they transpire the water.

Extensive efforts have been made to reduce the negative effects of arsenic contamination on the environment and human health. Among these, phytoremediation has been proved as a promising new technology for environmental clean-up. The term phytoremediation consists of a Greek prefix phyto

(plant) and the Latin root *remedium* (remove an evil). Thus, phytoremediation is a technology that removes contaminants or pollutants by growing particularly selected plants. *Pteris vittata*, the first identified arsenic hyperaccumulator, has received extensive attention since its discovery in

2001. *P. vittata* belongs to the *Pteris* genus and family Pteridaceae. It meets all the required criteria to qualify for being a natural phyto-extractor. The amount of arsenic accumulated in fronds can be up to 93% of the total arsenic content in the plants and 25 times more than that in the roots.

LOOKING AFRESH AT URBAN GREENS

***Monika Koul & **A.K. Bhatnagar**

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Adequate tree cover is important for economic and ecological security. Experts recommend that at least a third of India's geographical area should be tree clad for sustainable environment and economic development. The total forest cover of our country as per 2005 assessment is 677,088 km², constituting 20.6% of the geographic area. Of this, the tree cover has been estimated as 91,663 sq. km, which is about 2.79 per cent of the country's geographical area (Forest Survey of India, 2005). Rampant felling of trees, on account of urbanization and developmental activities such as construction of roads and railway lines, is seen all over India. Data available on land use pattern clearly depicts that India has a skewed land use pattern. State of Environment India Report (2009) released by the Ministry of Environment and Forests states that over 50% of our total land is under agriculture, 17% is barren and uncultivable, 13% is culturable wasteland and barely 20% is under some form of the forests. The per capita forest area available in India is 0.06 ha, which is much below the world average of 0.64 ha per person. National Forestry Action Programme (NFAP) of Government of India states that besides protecting the existing forest resources, expansion of tree cover is important for maintaining the ecological balance. Therefore, plantations are to be carried out on the existing available pockets as well as areas which are devoid of tree cover. With no additional area available for

afforestation, the focus during the last three decades has been on social forestry/community forestry and roadside/canal side tree plantations. With our towns and cities expanding rapidly, we need to think afresh about urban tree plantations too. These should not only contribute to aesthetics, but also add their bit to overall national tree cover targets and meet some of the residents' small timber and non-timber plant product requirements.

Importance of trees in cities-aesthetics and ecology

India's cities and their suburbs have expanded at the cost of farmlands, which in turn have encroached upon forests. Population explosion, economic development, industrialization and vehicular pollution are magnifying the urban problems and contributing to further loss of green cover. Nearly half of the population now resides in the cities and towns. The urban elite are conscious of the social and aesthetic value of trees. Yet, it has never been considered desirable that the cities should meet some of their own timber and firewood requirements. Cities need enhanced tree cover for their ecological needs-conserving soil and water and providing habitat for variety of life forms such as birds, animals, insects and microorganisms. The green belts also serve as lungs for purifying air in cities, act as sink for pollutants, check the flow of dust and aid in bringing down noise

levels. Scientists all over the world are looking at trees in urban areas as entities which provide ecological services such as cleansing of the environment, recycling of the wastes, maintenance of seasonal cycles and acting as carbon sequestration units for mitigating the effects of global warming and climate change.

Most of the people responsible for urban development agree that plants contribute towards the environmental quality and there are ample social and psychological benefits of contact with plants. Recent public health research has deepened our understanding of the positive effects of plants on physical and mental well being. Social scientists have given conclusive evidence of the role of greenery in helping to cope up with stress and anxiety. Working and living near quality green spaces can satisfy people, help them relax and influence their mood and ability to concentrate for long. Urban pockets having adequate green cover harbour a lot of biodiversity too. The green patches serve as nesting ground for many birds, and act as macro and microhabitats for primates, rodents, insects, epiphytes, lichens, fungi and variety of other living organisms. Alternative habitats for a variety of living organisms in urban pockets enhance the aesthetic value of city landscapes and thus help in enhancing the scope of ecotourism. When the spaces next to residences are green, these become more attractive, comfortable and draw a

lot of people to them. Such settings serve as foundation for social ties, ideal places for people to relax and children to play.

Present urban management practices

Why cities and towns should not produce some of their own tree-based requirements is a question which should now be discussed. The cities are a huge drain on forests and tree cover of rural areas for their timber and fuel/firewood needs. Urban centres draw huge quantities of wood from the forests and countryside, the poor for firewood and the better off for construction and furniture. Massive programmes and projects have been undertaken by government and non-government agencies to enhance urban tree cover over the years. Millions of saplings are distributed and planted each year in cities such as Delhi, Mumbai, Bangalore, Kolkata and Chennai. Tree plantations in most of the Indian cities are undertaken by horticulture departments or municipal boards or councils. The city councils plant large number of trees during the monsoon period, but fail to take adequate care during the dry period that follows. Juvenile mortality rate is very high. To achieve its full growth, a tree requires a lot of care during early years of growth. Attention has to be paid for proper placement of the tree in the ground, and its protection from ruminants. Many horticulturists recommend staking the young trees irrespective of the type of species to which the tree belongs. Since, most of the trees planted in city parks, on the roadsides, in the parking lots, in recreation parks and as shelter belts are taken from nurseries, a newly planted sapling in these areas requires manuring and irrigation at regular intervals. Novel soil reclamation and replenishment techniques need to be applied for improving the health of soil. This is very important for proper establishment of the tree in the new habitat. Compaction of soil in cities is also taking huge toll of trees. Many large trees are razed to the

ground whenever there are strong winds and rain. Due to poor soil aeration, roots of such trees are shallow and weak. Concretization of roads is considered worst for the tree health. It causes choking of roots and hence injuries and death. It also results in destruction of flora and fauna below and above ground. Ministry of Urban Development and Poverty Alleviation has clearly specified in its guidelines that an area of 1.8X1.8m² foot should be left "uncemented" around each tree to ensure that it gets enough breathing space. However, such recommendations based on common sense are not followed.

Road digging for laying cables and pipes are major threats, requiring saplings to be planted in the same place again and again. However, once the tree has survived, there is a total ban on its cutting, removal or even husbandry. Public perception, compounded by the media, is that once a tree has grown, it should not be cut or trimmed for developmental purposes even if it is overgrown, old or hazardous. The only way a large tree or its branches can fall is when there is a storm or rain. Extraction of non-timber products too is often not allowed. Pruning helps a tree to attain its maximum productivity, sustainable growth and tackles the requirements of fodder and fuelwood to some extent. It facilitates the growth of new shoots and formation of a wide canopy. Dormant buds after pruning produce new branches. If twigs and tops of trees are collected, and if old and underdeveloped trees are replaced regularly, it could help generate some wood and revenue and at the same time enhance landscape and organization of trees. Studies conducted on urban trees by Singapore Forest Department suggest that the average life expectancy of most of urban trees is about 50 years. Over the first three years of growth, 20% of the trees planted in urban areas die. Most show visible symptoms of aging such as loss of leaves, falling of branches and susceptibility to pests and pathogens. Such trees showing negligible growth over a time period and fewer number of

leaves relative to the size of trees, should be allowed to cut and replaced by new saplings.

Species selection

Selection of trees for plantation is the most critical factor. What species should be planted is much less a matter of concern now than it was when many of our large cities were planned. Trees in older planned areas of Hyderabad, Pune, New Delhi, Lucknow, Kolkata, and Bangalore are far more diverse and systematically planted than in the newer townships and suburbs. A comparison of the trees planted in major cities before or just after independence with those being planted now would be very revealing. The British introduced hardwood trees in India from their other colonies through specially created arboreta and gardens in Kolkata, Bangalore, Darjeeling, Ooty, Dehradun, Saharanpur, Panchmari, Manali and elsewhere. Establishment of city national parks in Mumbai and Chennai and botanical gardens in Lucknow, Bangalore and Kolkata are some examples of well thought out and well planned urban green belts. The reforestation of Delhi Ridge (1912) and declaration of Delhi Ridge as a Reserve Forest is also a milestone in conservation of urban greenery. Considering the strategic importance of these green belts, species selection, introduction of exotics and landscape features were given considerable attention. In the concrete jungles these still serve as green lungs. The present day municipalities, despite their huge budgets and jet-set executives and councilors, neither follow the traditions nor have introduced any innovations in their tree plantation programmes. Trees that can be multiplied easily and require no post-plantation care are the favourites. Thus, we can see on most of the roads a mixture of big and small trees of eucalyptus, casuarina, ashoka, alstonia, neem, banyan, mulberry and sisoo. Beautiful palms, conifers and ornamental trees such as corals, flame of the forest, silk cotton, bauhinias, crape

myrtle, temple tree, bottle brush, Indian laburnum, gulmohur and squirtwort are rarely planted now as these are considered 'commercial', prone to pilferage and difficult to sustain. The regulation and publication of Gazette Notification defining the trees that can be planted by official agencies in a major city also leaves horticulturists with much less choice in selection of species. Dr M.S. Randhawa, in his book entitled 'Flowering Trees,' has mentioned that during the British rule evergreen tree plantations gained more attention. Trees such as tamarind, arjuna and African sausage tree were seen as good for hot summer climate. Plantation of beautiful deciduous trees which formed an important component of the vegetation was seriously neglected. By recommending a preponderance of 'ever green species' for the arid habitat in Delhi many native species were edged towards local extinction.

Incidentally, many trees with wind borne pollen, which cause allergic disorders in a substantial part of the human population, still find place on city roadsides. Such trees, including eucalyptus, wattle and mulberry are in the lists of permissible trees in many cities. It is observed that in Delhi multiple government agencies viz. Delhi Development Authority (DDA), Municipal Corporation of Delhi (MCD), Cantonment Board and Forest Department continue to plant several allergenically significant trees.

Selection of trees for plantation in urban areas revolves around convenience. The basis of selection is very narrow. Saplings raised on mass scale are distributed and planted without taking into account the importance and the role the tree is going to play in a particular habitat. The concept of landscaping is still alien to our planners with the result that the trees are haphazardly planted, and the trees planted on roadsides are no different from those in parks or schools, offices and hospitals. Some of the most beautiful trees flower during February-

March, coinciding with breeding season of several birds. The flowers provide nectar to the birds in return for pollination service essential for their reproductive cycle. To attract birds, the trees produce beautiful flowers. The bird-pollinated trees, such as silk cotton, flame of the forest, Indian coral tree and *Bauhinia* spp. make the landscape majestic. The African sausage tree is pollinated by bats. The Arjuna has fruits that are chewed up by bats that help in seed dispersal. Manila tamarind has a red aril covering a part of the seed which attracts birds. Thus, a variety of trees support different birds, bats and insects and make the human habitat lively and biodiversity rich. Rare and endangered species of trees can be reintroduced in certain pockets as is being done in the Aravalli foot hills in the NCR. Kala siris (*Albizia odoratissima*), frankincense tree (*Boswellia serrata*), kulu tree (*Sterculia urens*) and pisangian (*Grewia flavescens*) which were the characteristic of Aravallis can be reintroduced in the city forests of Delhi and Jaipur. Many cities can be safe heavens for RET trees. Multipurpose trees, especially those of medicinal importance, can be introduced in some selected pockets where adequate care can be taken. Since, natural products are already catching frenzy of city populations, such introductions can also help in revenue generation. Trees such as emblic myobalam, soapnut, marking nut, drumstick, neem and butter tree which were once important components of vegetation of many cities should be grown more frequently. A planted area as a whole with trees, shrubs and a ground cover forms a living and dynamic system with better ecological services. The selection of trees for plantations should be done in accordance with the type of land/ physico-chemical properties of the soil available for plantation.

Estimation of green cover

A flaw with the estimation of green cover is another area which eludes the urban foresters. Tree records, based on

number of saplings planted, and remote sensing data depicting everything green as a part of tree cover, often give exaggerated data. Phytosociological and quantitative vegetation analysis procedures, giving more precise details of about density, abundance, basal cover area and canopy cover area, need to be reinstated and used to supplement satellite data. The government machinery is often confused and stands divided on many aspects related to management of tree cover. Focus has always been on the number of trees planted each year. Monitoring on the basis of tree clad area can give better picture of the city's green area. Research in urban forestry and management of trees is yet another area where no public funding or interest is apparent. Lot of research is carried out on management and improvement of forest tree species. However, urban trees growing in different ecological settings are not being studied. Ministries and other funding agencies need to allocate funds for research on ecological, economic, aesthetic and psychological aspects of urban trees.

Mitigation of climate change

With the United Nations Framework Convention on Climate Change (UNFCCC) now allowing countries to earn credits for planting trees, which function as carbon sinks, the cities can earn carbon credits under the clean development mechanism (CDM). Delhi and Himachal Pradesh have already identified land for tree plantation and agreed to increase the green cover and earn these credits to boost their economy. Such plantation drives are already taking place in tropical countries. Singapore and Malaysia are front runners in their profitable endeavour because of enhanced green cover and modern scientific tree management strategies.

Recommendations

Urban forestry practices in India are anachronistic. A paradigm shift in

planning and management framework is required for tree plantations to be aesthetic, cost-effective and of multiple utility. The choice of species needs to be expanded to include a much larger diversity of the indigenous and exotics. Ornamental trees, mostly insect and bird pollinated, will add some colour to drab landscape of Indian cities. Palms and conifers at appropriate locations can help break the monotony. Trees deserve more care and hospitality, especially in the early stages.

Regulations that limit replacement of old, diseased and crooked trees, or those at unsuitable locations, need to be dropped, and urban greenery should increasingly be treated as dynamic, productive systems. The large, resourceful horticultural and forestry departments in major cities should invest in tree improvement, landscaping and resource utilization technologies. Many RET and medicinal trees can be conserved in urban plantations, to take off the pressure in the wild. The present

method of fixing targets based on number of saplings planted annually also needs to be replaced with modern methods of tree cover and biomass assessment by remote sensing. Trees that are good in carbon sequestration can help mitigate climate change, and in addition earn carbon credits. Finally, involvement of citizenry, through education and incentives and individual choice and care of trees will go a long way in fostering good people-tree relationship.

BIOSORPTION OF COPPER IN AQUATIC MACROPHYTES

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Aquatic macrophytes are unchangeable biological filters and they carry out purification of the water bodies by accumulating dissolved metals and toxins in their tissue. A phytoremediation study was carried out to ascertain the degree of copper absorption in the following aquatic macrophytes. The aquatic plants (biomonitors) *Hydrilla verticillata*, *N. nucifera*, *Eichhornia crassipes*, *Ipomoea aquatica* Forsk, *Typha angustata* Bory & Chaub, *Echinochloa colonum* (L.) Link, and *Vallisneria spiralis* L. were collected from Bellandur Lake located in east of Bangalore. Based on the absorption capacity observed in macrophytes was *E. crassipes* > *H. verticillata* > *N. nucifera* > *Vallisneria spiralis* > *Echinochloa colonum* > *Typha angustata* > *Ipomoea aquatica*.

Macrophytes are aquatic plants, growing in or near water that are either emergent, submerged or floating. Macrophytes are beneficial to lake because they provide food and shelter for fish and aquatic invertebrates. They also produce oxygen, which helps in overall lake functioning, and provide food for some fish and other wildlife. Heavy metal pollution is one of the main problems for the ecosystem due to technological development. Diverse industrial wastes have aggravated the

problem of water pollution. This problem becomes complex because of the qualitative and quantitative differences in pollution according to the industries involved, and due to the non-degradability of inorganic pollutants like heavy metals which are hazardous when discharged into a water body. Several studies have shown that constructed wetlands are very effective in removing heavy metals from polluted wastewaters. Algae and aquatic plants play a key role in aquatic ecosystems because they are at the base of food webs. Also, they are a food resource and provide oxygen and shelter for many aquatic organisms. They also contribute to the stabilisation of sediments and bio concentration of compounds and are used as bioremediatives. Direct discharge of contaminants increase the concentration of trace elements in aquatic systems, thus resulting in their accumulation in sediments. In aquatic systems, where pollutant inputs are discontinuous and pollutants are quickly diluted, analyses of plants provide time-integrated information about the quality of the system. Phytoremediation has several advantages and is the most significant one in study of sub-lethal levels of bioaccumulated contaminants within the tissues/components of organisms, which indicate the net amount of

pollutants integrated over a period of time. Biomonitoring of pollutants using some plants as accumulator species, accumulate relatively large amounts of certain pollutants, even from much diluted solutions without obvious noxious effects.

The aquatic plants (biomonitors) *Hydrilla verticillata*, *N. nucifera*, *Eichhornia crassipes*, *Ipomoea aquatica* Forsk, *Typha angustata* Bory & Chaub, *Echinochloa colonum* (L.) Link, and *Vallisneria spiralis* from the lake were selected during February 2009 as passive biomonitors for estimating the toxicity status induced by the heavy metal Copper. Aquatic plants were thoroughly washed to remove all adhered soil particles. Samples were cut into small pieces, air dried for 48 hours and finally dried at 85° C in hot air oven for two hours. In warm condition, the samples were ground and passed through 1 mm sieve. Macrophytes fine powder samples (2.5 g/50 mL distilled water) were subjected to acid digestion by adding 8 mL concentrated nitric acid on hot plate and filtrate was diluted up to 50 mL with distilled water. Heavy metals analyses were performed on an Atomic Absorption Spectrophotometer.

This study reveals that the observed level of copper in *E. crassipes* (124-340

ppm), *H. verticillata* (120-300), *N. nucifera* (109-287 ppm), *Vallisneria spiralis* (102-276 ppm), *Echinochloa colonum* (98-254 ppm), *Typha angustata* (75-205 ppm), *Ipomoea aquatica* (52-145 ppm). The order of accumulation of copper observed was *E. crassipes* > *H. verticillata* > *N. nucifera* > *Vallisneria spiralis* >

Echinochloa colonum > *Typha angustata* > *Ipomoea aquatica*.

Phytoremediation has several advantages and is the most significant one in study of sub-lethal levels of bioaccumulated contaminants within the tissues/components of plants/organisms, which indicate the net

amount of pollutants integrated over a period of time. Biomonitoring of pollutants using some plants as accumulator species, accumulate relatively large amounts of certain pollutants, even from much diluted solutions without obvious noxious effects.



NEWS AND VIEWS

SOLID WASTE MANAGEMENT

The current waste disposal system is not sustainable. Food/organic waste along with other goods thrown away from household end up on landfill sites. Apart from taking up valuable land space food waste also release toxins in the environment and when food/organic waste breaks down anaerobically, i.e. without oxygen, it mainly releases methane and carbon dioxide. Both are greenhouse gases and are responsible for global warming. In U.K. landfill sites are the biggest man-made source of methane released into the atmosphere.

Recycling waste is a practical solution for waste management. Around 6.9 m tones of food waste comes from in U.K. That could create enough power to heat and power 2 m homes. And the 100 m tones of organic waste (food, farms and agriculture) could power a city like Birmingham five times over. Methane-producing food waste can also be used to make helium energy by a process called anaerobic digestion. Other initiative include landfill tax which will encourage local authorities and businesses to recycle more.

Throwing away food scraps is possibly the worst eco-crime. Learning to use leftovers, shopping smart are part of the solution. One less item stuck in landfill equals less methane in our environment. This will be helpful in our battle against climate change.

Meera Dattani

In SIDEWAYS News for fresh perspectives

HUNTING FOR METHANE

Climate change has contributed to the melting of frozen arctic tundra which, in turn, may be hastening the release of carbon dioxide and methane buried inside tundra in the billions of tons. The scientists of the National Oceanic and Atmospheric Administration (NOAA), U.S.A. are trying to discover just how much of these greenhouse gases is being released.

Some of the greenhouse gases are from natural sources, others from activities, like oil drilling. The data collect by NOAA scientists will help to determine how quickly these emissions might increase and begin to cause irreversible changes.

It is important to locate natural sources and measure how much methane and carbon dioxide are being released now so we can watch for signs of increasing emissions. The release of methane in Alaska has been documented for some time now. Large methane "bubbles" have been from near Arctic lakes and methane "vents" releasing gas from the arctic ocean floor have also been discovered.

Brita Belli

Source: NOAA Earth System Laboratory

CLIMATE CHANGE THREATS

Climate change poses an enormous challenge to the conservation and management of plant diversity and focuses the attention on the need to ensure ex-situ collection of native

species as an insurance policy against possible future extinction. The impact of climate change on European plants is likely to result in the distribution of species, flowering times etc. and these impacts are forecasted to be most pronounced in mountainous areas and the Mediterranean. Climate change will particularly impact on species, such as those with long life cycle and/or slow dispersal. Mechanism that are unable to change their distribution that enough to keep up with changing climates. Arctic, Alpine and island species will also be extremely vulnerable

Climate change may also result in changes in plant communities and species associations as species move and adapt at different rates. Increased invasion by alien species is also likely as conditions become more suitable for exotics, and native species are unable to compete. Evidence has already emerged providing proof that climate change in the Italian Alps is forcing plants to move to higher altitudes, cooler temperatures and probable extinction.

Source: Suzanne Sharrock and Meirion Jones

In: "Conserving Europe's Threatened Plants", BGCI.

Around nine billion tonnes of Carbon dioxide is absorbed by trees every year, but nearly two billion tonnes are released through deforestation.

*Plant & Tree initiative
European Commission*



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27-30 June 2010; Beijing, P.R. China
Contact: info@twows.org
Web: <http://www.twows.org>

23rd IUFRO World Congress

23-28 August 2010; Seoul, Republic of Korea.
Contact: Elena Paoletti
E-mail: e.paoletti@ipp.cnr.it
Website: <http://www.ipp.cnr.it/paoletti>

Third World Aqua Congress

2-4 December 2009; New Delhi, India
Contact: Aqua Foundation
C-18 B, First Floor, Kalkaji, New Delhi-110019, India.
E-mail: wac@worldaquacongress.org

Sixth International Conference on Environmental, Cultural, Economic and Social Sustainability

5-7 January 2010; Cuenca, Ecuador
Website: <http://onsustainability.com/conference-2010/>

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2-4 December 2009; Lisbon, Portugal
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International Conference on Technology & Sustainability in the Built Environment

3-6 January 2010; Riyadh, Saudi Arabia
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EPA Indoor Air Quality Tools for Schools National Symposium

14-16 January 2010; Washington, DC, United States
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The New Green Economy

20-22 January 2010; Washington, DC, United States
Website: http://ncseonline.org/conference/green_economy/

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24 February 2010; Penang, Malaysia
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