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DR. TULI AWARDED J.C. BOSE FELLOWSHIP



Dr. Rakesh Tuli, President International Society of Environmental Botanists and Director, National Botanical Research Institute, Lucknow has been awarded "J.C. Bose Fellowship".

This prestigious fellowship has been instituted by the Government of India, Department of Science & Technology to give a boost to scientific research in the country. The fellowship is meant to recognize active, performing scientists and engineers in the country. It is scientist specific, very selective and will have close academic monitoring.

J.C. Bose Fellow will be provided a Fellowship of Rs. 20,000 per month in addition to his own income. A contingency of Rs. 5 lakh per annum will also be provided towards conference participation and other expenses. The Fellowship will be for a term of five years initially.

Dr. Tuli, who took over as Director NBRI and President ISEB in February 2006, is an internationally renowned molecular geneticist and plant biotechnologist.

IMPORTANT

- While readers of *Environews*, members of ISEB, conference organizers and publishers of books and periodicals are welcome to submit letters, news and views, news flash for publication in *Environews*, prior consent is necessary for submission of scientific articles/papers. Unsolicited articles will not be considered for publication due to paucity of space.
- Members of ISEB are advised to immediately notify any change in their mailing address and/or e-mail IDs to Secretary ISEB.

- 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.
- All correspondence should be addressed to : **The Secretary, International Society of Environmental Botanists**, National Botanical Research Institute, Lucknow - 226 001 (India).
- E-mail : isebnrilko@satyam.net.in • Website : <http://isebindia.com>



LETTERS

I participated in the Third International Conference on Plants and Environmental pollution (ICPEP-3) held at the National Botanical Research Institute, Lucknow on November 28-December 2, 2005. Several participants were interested in the Canadian Forest Service's publication "*Methods Manual for Forest Soil and Plant Analysis*" (Y.P. Kalra and D.G. Maynard). I sent the Methods Manual to those who requested. Now this publication is available at the following website: <http://warehouse.pfc.forestry.ca/nofc/11845.pdf>.

Yash Pal Kalra
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I am very happy to have the electronic version of April 2007 (Golden Jubilee Number) of ENVIRONNEWS. All the articles therein, especially the abstract "*Plant Ten Trees In Your Life Time*" from the talk of Prof. Wangari Muta Maathai, delivered at the Eighth Rajiv Gandhi Memorial Lecture on 21st March 2007 in New Delhi, are quite informative.

"Humans need forests while forests can do without humans; world conflicts are about control of limited natural resources including water and grazing ground; correlation between human survival and amount of carbon dioxide absorbed by ten trees and hence planting, at least, ten trees in one's life time, is like planting of idea".

R.N. Mishra, I.F.S.
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I very much enjoyed reading April 2007 issue of *Environews*.

Dr. Prabhat Sitholey
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Thanks for the online ENVIRONNEWS Letter. I want the hard copy of the same. I also want to know the requirements for receiving regularly hard copy of every issue of ENVIRONNEWS in future.

Dr. Geetika Sirhindi
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My apologies for not writing to you in the recent past, but I have been on sick leave for 4 months, including 4 weeks in hospital, partly in intensive care. I am now fully recovered. The 50th issue of *Environews* looks great, but unfortunately, I was unable to write anything for it due to my indisposition. I would be happy to write in future.

JNB Bell
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We are an NGO and would like to work on Jatropha plantation in Bihar & Jharkhand. Kindly let us know the terms and conditions of working in this area from procurement of seeds to extraction of oil.

Please educate us on this matter.

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We are happy to inform you that the Dharma Vana Arboretum (DVA), a not-for-profit registered society, is planning to develop an international tree park at Bhongir, Andhra Pradesh. In this park, a wide variety of trees, both native to India as well as foreign species, would be cultivated for scientific, educational and ornamental purposes. Spread over an area of 450+ acres, DVA will be among the largest arboreta in the world and the largest located in a semi-arid tropical climate.

DVA's primary scientific mission is to collect and preserve threatened and endangered indigenous species with an emphasis on the Deccan Plateau. Our objective is to conserve over 12,000 unique species of trees through innovative horticultural and silvicultural practices that meet or exceed international standards.

Above all, we are developing Dharma Vana Arboretum library. We would be grateful if you could kindly provide us complimentary printed copies of 'EnviroNews' to be preserved for the benefit of researchers and students. Also, do include us in your mailing list to know about the activities of International Society of Environmental Botanists.

Raja Bhushan. S
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The analysis of the degree of popularity and acceptance of ISEB in the scientific world with reference to the composition of its membership is heartening and impressive. You, along with your team, deserve a pat on your back. **EnviroNews has put in a fantastic service in introducing the ISEB to the relevant people all over the globe.** Your consistent efforts have made it an attractive and interesting reading material. In this context, I also appreciate the selfless contribution of Prof. Mohammad Yunus, School of Environmental Sciences, BBA university, Lucknow, India, who was your most dependable lieutenant in early days of ISEB activities and edited EnviroNews for several years with great enthusiasm.

Prof. Muhammad Iqbal
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The comment by Prof. Nigel Bell is indeed very encouraging and speaks volumes about the level the Environews has attained. I have come across nice comments about the rich content of the Environews from several well-known environmental scientists and ecologists. I wish the Society (ISEB) all the very best.

Prof. R.S.Tripathi FNA, FNASc,
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The Asia-Pacific Forum for Environment and Development (APFED) is a regional forum supported by the Ministry of Environment, Japan. The APFED Showcase Facility Secretariat, which is established under the *United Nations Environment Programme, Regional Office for Asia and Pacific* (UNEP ROAP) and the APFED Secretariat that is established under the *Institute of Global Environment Strategies* (IGES), jointly conduct the call for proposals for innovative projects on environmental sustainable development in Asia and the Pacific region

For more information please see:
<http://www.roap.unep.org/APFED/Call%20for%20proposals.doc>

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WELCOME NEW LIFE MEMBERS OF ISEB

Dr. S.K. Grover, the Deputy Director General, Doordarshan Kendra, Lucknow, holds a doctorate degree in Botany from the University of Gorakhpur, and has got a number of publications to his credit. He has been associated with the All India Radio and Doordarshan for the past twenty seven years and has got vast experience in Broadcasting.

He has produced many programmes on popular science, which have been appreciated and widely acclaimed. He was associated with an AIR serial 'Radio Date', which dealt with the social behavior towards environment, drugs, alcohol and tobacco. The serial "Radio Date" bagged the 'National Media Award' for 1991 sponsored by the *Anti Narcotic Council of India, Thiruvanthapuram*. He was associated with the production and broadcast of other serials namely 'NISARGA SAMPADA' on National Environment and Manav ka Vikash.

Dr. Grover was actively associated with the *Leprosy Elimination Project*, the largest ever Anti Leprosy mass media campaign. This Campaign, a joint project of AIR Lucknow and BBC (WST) started in 1999. The Leprosy project involved a unique tie-up with the Broadcasters and wide range of community media workers. The programmes of this project created a far-reaching impact and more than 2,00,000 new leprosy patients came forward for treatment. This campaign project was awarded "2001 Commonwealth Broadcasting Association Award for Social action Programming". He was also associated with HIV/AIDS mass media project in partnership with BBC (WST) and National Aids Control Organization.

Dr. Grover was awarded the "Vigyan Bharati Award" by the Hindi Pracharini Samiti, Kanpur in 2001 for his meritorious contribution in the field of Science and Communication. He was given "Honorary Fellowship" in appreciation and recognition of his contribution in the field of Science Writing and Communication by Indian Science Writers Association, New Delhi on 28th November 2001.

Dr. Grover has got a vast experience and understanding of Science Communication. He has used Radio

and TV to the fullest extent as a means of Science Communication. He has been visiting various Universities and Institutions for giving lectures on popular scientific topics.

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Dr. M.A. Ali Khan is the Reader and Head, Department of Botany at the Kisan P.G. College, Simbhaoli in Ghaziabad Distt, U.P. He has published six papers and more than 100 popular articles and abstracts. He has guided 6 Ph.D. and 3 M.Sc. theses. He is also working as a Consultant to Jubilant Organosys Ltd., Gajraula, J.P. Nagar for Ferti-irrigation and Biocompost.

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Dr. Mohd. Latif Khan is an Associate Professor in the Department of Forestry, North Eastern Regional Institute of Science & Technology, Nirjuli, Itanagar, Arunachal Pradesh. He has specialized in Forest Ecology and Tree Regeneration and has also carried out extensive researches in the fields of Biodiversity Conservation and Ecorestoration. His recent investigations include mapping of some threatened and highly exploited tree species of the tropical humid forest of northeast India. His current research focuses on the survey and cultivation of medicinal plants of northeast India. He has published over 50 research papers. Three students have been awarded Ph.D. degree under his supervision.

Dr. Khan was a recipient of DST-BOYSCAST fellowship in "Biodiversity Conservation" (1995-96) to work at the University of Massachusetts, Boston, U.S.A. He was also awarded DBT-Overseas Associateship (2004), under which he worked at Genomic Laboratory in Concordia University, Montreal, Canada.

Dr. Khan was also a recipient of Nanda Memorial Young Scientist Medal (1995) of the Indian Society for Tree Scientists, and Bharat Excellence Award (2002) for his outstanding research in the field of Forestry.

Dr. Khan is the Editor (Eastern Zone) of Indian Journal of Agroforestry. In recognition of his significant research

contribution to the understanding of forest ecology and biodiversity, he was elected the 'Fellow of National Institute of Ecology'.

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Dr. Jayanthi Nagakumar holds a Ph.D. degree in Botany, a P.G. Diploma in Environmental Planning from the University of Mysore. She also holds an M.A. Degree in Sociology. She has more than 19 years of experience in the field of Environmental Science as a lecturer, researcher and an Environmental Expert/consultant. Currently, she is working as Chief Executive Director/Environmental Consultant for Amogh Enviro Vision, Bangalore.

Her involvement in various Design and Construction Supervision Projects undertaken by the Government of India has provided her deep insight into various provisions with respect to environmental standards, notifications and specifications with reference to environmental impact assessment and preparation of environmental management plans. She has over 19 years experience in coordinating projects related to various environmental issues and Social Impact Assessment for all types of Infrastructure Development Projects. She is proficient in Environmental Impact Assessment, Social Impact Assessment, Solid and Liquid Waste Treatment, Environmental Monitoring,

and Rain Water Harvesting and Environmental Auditing. She is well versed in national and international environmental policies, laws and regulations.

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Prof. S.C. Srivastava is a Professor at the Department of Botany, Lucknow University. Till recently, he was Head of this prestigious Department. He has made extensive contributions in the fields of biodiversity, taxonomy and tissue culture of Bryophytes.

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NEWS FLASH

Mr. Yash P. Kalra, Soil Chemist, Canadian Forest Service, Edmonton, has been elected a Fellow of the Indian Society of Agricultural Biochemists. The award was presented to him during the inaugural session of the International Conference on Post-Harvest Technology and Value Addition in Cereals, Pulses and Oilseeds held at the Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India. The presentation was made by His Excellency T.V. Rajeswar, the Governor of Uttar Pradesh and Chancellor of the University. Mr. Kalra is a great friend and well-wisher of ISEB and had made valuable contribution during ICPEP-3 held in 2005.

Tsetsegee Munkhbayar, a self-educated yak herdsman in Mongolia has won an international environmental award for forcing the closure of destructive mining operations along a river in the landlocked country. He is one of the six winners of this year's Goldman Environmental Prize, the largest award of its kind in the world.

Hindustan Times
(Associated Press)

Prof. K.P. Singh, an internationally reputed Plant Ecologist and a former Head of the Department of Botany, Banaras Hindu University, Varanasi, has been appointed as a Professor Emeritus in the

same Department. Professor Singh is a Life member of International Society of Environmental Botanists.

Ms Meena Gupta has taken over as Secretary Ministry of Environment & Forests Government of India. She replaces Dr. Prodipta Ghosh, who was Secretary of the ministry for the past three years. Dr. Ghosh joins The Energy and Research Institute, New Delhi. Ms. Gupta, who was Secretary of the Ministry of Tribal Affairs, Government of India had served the Ministry of Environment as a special Secretary in the past.

Earth is the third planet from the Sun and the fifth largest.

Orbit: 149,600,000 km from the Sun

Diameter: 12,756.3 km

Mass: 5,972024 kg

USEPA Stratospheric Ozone Protection Award for UNEP

The United Nations Environment Programme has, for the second time, won the prestigious United States Environmental Protection Agency (US EPA) Stratospheric Ozone Protection Award. The award was presented to Atul Bagai, Regional Network Coordinator for South Asia for UNEP's Division of Technology, Industry and Economics (DTIE) Ozone Action Programme.

The US EPA highlighted Bagai's work in assisting countries in the region, including both large countries like China and India and small countries like Bhutan and Afghanistan, to comply with their international commitments under the Montreal Protocol on Substances that Deplete the Ozone Layer. The award recognizes his work in "designing strategic approaches on development and implementation, of institutional mechanisms and innovative capacity building activities in the countries."

Mr Bagai joins six individuals and six organizations in receiving the award this year. In the Asia Pacific region, Dr. Sachidananda Satapathy from India's Ministry of Environment and Forests' Ozone Cell and the World Customs Organization's Regional Intelligence

Liaison Office for Asia and the Pacific were also honored with the award. The Stratospheric Ozone Protection Award winners have helped to eliminate the use of ozone depleting chemicals in the agriculture and aviation sectors, and in medical inhalers. The winners have also helped to lead the phase-out of ozone depleting substances in developing countries, raise awareness about skin cancer prevention, and monitor the status of ozone layer recovery.

Source: Ms. Satwant Kaur, Regional Information Officer, UNEP/ROAP

2007 UNEP Champions of the Earth Awards

The UNEP (United Nations Environment Programme) 2007 "Champions of the Earth Awards" for 2007 were given at a gala ceremony in Singapore. The awards recognize individuals whose extraordinary action and personal commitment to the environment are deemed outstanding and exceptional.

The following were the awardees:

Mr. Al Gore former Vice-President of U.S.A. for making environmental protection a pillar of his public service and for educating the world on the dangers posed by rising greenhouse gas emissions.

H.E. Mr. Cherif Rahmani, Minister for Land, Planning and Environment, Govt. of Algeria for advancing environmental law and for addressing the problem of desertification.

Mrs. Elisea (Bebet) Gillera Gozun of Philippines for pushing forward the environmental agenda by winning trust of business leaders, non-governmental organizations and political decision makers.

Ms. Viveka Bohn of Sweden for playing her leadership in global efforts to ensure chemical safety, especially through the successful strategic Approach to International Chemicals Management Processes.

Her Excellency Ms. Marina Silva, Minister of Environment Brazil for her tireless fight to protect the Amazon rain forest while balancing the needs of people.

His Royal Highness Prince Hassan Bin Talal of Jordan for his belief in trans-boundary collaboration to protect the environment.

Mr. Jacques Ragge and the *International Olympic Committee* for introducing stringent environmental requirements for cities bidding to host Olympic Games.

Kohl and Sindoor: the potential source of lead poisoning

Dr. V.P. Kapoor

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The cosmetics are the utility products used extensively worldwide for maintaining and improving general appearance of face and other parts of the body e.g. mouth, hand fingers, eye, hair etc. The main objective of the cosmetic application is to look more impressive, beautiful and smart to a considerable extent. Kohl (kajal/surma) and *Sindoor* (kumkum) are the two important traditional cosmetics, which are used since ancient times. Kohls are very popular in Asia, Africa and Middle East, which are applied around the eyes to beautify them. It is extensively used by women and generally believed to be useful as an eye tonic. In India, *Sindoor* is an essential cosmetic item for women,

who religiously and traditionally apply it on the forehead and at the parting of the hair. The *Sindoor* is used by the married women in India every day as well as on special occasions like Sankranti and Navratri to increase the longevity of their husbands. Women are frequently using these two traditional cosmetics without knowing the health hazards of these utility products. It is now well established that these items are the potential source of lead poisoning.

Health hazards of kohls

This traditional cosmetic is used for eye beautification in Asian, African and Middle Eastern countries. The

popularity of kohls can be understood by the fact that the product is available in developed countries viz. USA and EU countries because of its demand by their immigrant population. According to different published reports, kohl contains up to 50% lead content and may be a potential source of lead poisoning. C. Parry et. al., (*Environ Health Prospect*, 1991, **94**, 121-23) have analyzed 22 samples, purchased from USA, UK, Morocco and Mauritania which originated from India, Pakistan and Saudi Arabia. Nine of these samples contained lead levels less than 0.6%; six samples had 3.31 to 37.3% lead and remainder possessed lead content in excess of 50%. Another report (AD

Hardy et.al., *J Ethnopharmacol*, 1998, **60**, 223-34) is based on the analysis of 47 kohl samples used in Oman through X-ray power diffraction and scanning electron microscopy. Out of these, 18 samples were made in Oman and in five of these, the main component was galena (PbS). Of the other 13 samples, 12 were based on amorphous carbon and one on hematite (Fe₂O₃). The remaining 29 samples were made in other countries and have been found to contain either PbS or Pb₃O₄ or Fe₂O₃ or ZnO or CaCO₃ or H₃BO₃ as the main component.

Clinical trials had also been made in Israel to assess the impact of kohls with reference to blood lead, zinc protoporphyrin, haemoglobin, mean corpuscular volume (MCV), serum iron and calcium (A Nir et. al., *Isr J Med Sci*, 1992, **28**, 417-21). Assessment was made on infants, aged 6-16 months, on 24 kohl users and 30 non-kohl users. It was found that blood lead levels were significantly higher in infants to whom kohl was applied (11.2 vs 4.3 microgram/dl, P less than 0.001) and were greater than 20 microgram/dl in three of them. In the non-kohl users, blood lead levels were significantly higher in infants whose mothers used kohls (5.2 vs 2.8 microgram/dl, P less than 0.02). No significant difference was found in other parameters. The clinical trial clearly indicated that application of kohl to infant or mother's eyes was associated with a significant increase in the infants blood lead levels and in some cases with asymptomatic lead poisoning.

Hazards of Sindoor

Traditionally, the red *Sindoor* was made at home from turmeric and alum. The turmeric powder, which becomes red when mixed with lime juice or lime powder, moistened in water, or with alum, iodine and camphor, or with oil and sea shell powder (calcium salts), or *aguru*, *chandana* and *kasturi*. It can also be made of sandalwood mixed with musk, or from a mixture of saffron ground with kusumbha flower. Another traditional ingredient used in making

Sindoor was raw rice in water heated in a pan until it formed into a glue-like red carbonaceous compound, which solidified on cooling and finally powdered. It is also believed that in olden days, *sindoor* was also made with a special type of red marble stone, covered with turmeric and a little oil and left undisturbed for a few days, after which it turned into red powder.

However, these traditional preparations have long been forgotten after the emergence of synthetic dye industry, which offered a variety of brilliant and fast red dyes at a cheaper price. Now-a-days, *Sindoor* is produced from chemical dyes, synthetic materials and lead salts. Some of the manufactures produce it by powdering crude red lead (Pb₃O₄). Commonly *Sindoor* prepared at large scale mostly contains very toxic, low grade commercial red lead oxide as such or along with other synthetic or natural bulking materials. In general, manufacturers, aim is to produce a fast blood red powder at lowcost using any brilliant red dye without considering the hazards and after-effects of the product. It is not surprising that red colour might be obtained by using Rhodamine B dye, which can induce hereditary disorders. Red colour may also be derived from mercury sulphite, which can cause skin cancer. All these toxic substances can cause hair loss, oedema and erythema. The market is flooded with unbranded products, which generally cause toxicity problems.

Current status of lead poisoning

Mankind has been using lead for over 6000 years, and solely as a result of anthropogenic activities, lead has become the most ubiquitous toxic metal. Hippocrates was probably the first of the ancient physicians to recognize lead as the cause of colic. Lead toxicity was recognised and recorded as early as 2000 BC and its widespread use has been a cause of endemic chronic plumbism in several societies throughout history. The last three centuries also witnessed the worst outbreaks of lead poisoning among adults, which were occupational in

origin, although environmental pollution also reported adverse effects of lead on health. Many reviews and references are available in literature related to health effects of exposure to lead. Now-a-days, there is much concern about its exposure from occupational and community environment, contaminated food and consumer items, and water. In India, some industries especially those making batteries, cables, paints, sheets, pipes, industrial alloys are the major consumers of lead. The possible sources of lead exposure are contaminated soil and water, mining, ceramics, food adulterants, pencils, toys, industrial effluents, cosmetics and herbal medicines. In developed countries, lead exposure is on the decline due to implementation of environmental and occupational regulations but in developing countries lead poisoning continues to be a serious problem.

Amongst traditional cosmetics, kohl and *Sindoor* are the possible sources of lead exposure in India. The *Sindoor* available in market is usually of non standard specifications and parameters and the quality is generally unfit for skin application. As there are no strict regulations for cosmetics, there is every likelihood that some other harmful and banned red dyes could be used. The same situation exists for kohls as a lot of manufactures produced them through traditional practice without considering health hazards of the produce. Even most of the branded products do not carry the mandatory label of ingredients, colouring agent and Eco-mark. Eco-marked products assure the quality, performance and safety requirements of the Bureau of Indian Standards (BIS). These products are also required to declare the list of critical inputs and are not supposed to be manufactured from any carcinogenic or otherwise harmful ingredients. The presence of lead in cosmetics is strictly prohibited in UK and USA.

Conclusions

Kohl and *Sindoor* available in market contain appreciable amount of

lead and thus become a source of lead poisoning. Lead exposure can result in a wide range of biological effects, depending upon the level and duration of exposure. When traces of lead salts are ingested, inhaled or absorbed, these

can harm virtually every organ in the human body, especially the brain, kidney and reproductive system. The issue of traditional cosmetics containing lead requires a major attention for their thorough examination. The regulations

regarding the acceptable limits of lead concentration are yet to be fixed. Prioritizing identification, monitoring of sources and implementation of regulatory norms are absolutely necessary.

Invasive species: The concept, invasion process, and impact and management of invaders

Purnima Raizada

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Invasion is considered as the second most important threat to biodiversity after habitat destruction. Alien species, which locally become dominant and invade natural communities, are referred to as invasive species. Further, IUCN also defines alien invasive species, as a species that becomes established in natural or semi-natural ecosystem or habitat, is an agent of change and threatens biological diversity. Invasive species are so much important in the present scenario that, article 8(h) of the Biodiversity Convention asks for measures "to prevent the introduction, control or even eradication of those alien species which threaten ecosystems, habitats or species". These invaders could be plant, animal or microbial species. Invasive species are either accidentally introduced or they are introduced by man to fulfill his needs. After introduction, they can expand their population and create mono-specific thickets. In this way these species can affect ecosystem processes, biodiversity patterns and community structure. Some important invasive species across the world are *Salvinia molesta*, *Eucalyptus* species, *Hakea* species, *Lantana camara*, *Caesalpinia decapetala*, *Chromolaena odoratum*, *Eichhornia crassipes* and *Solanum mauritianum* in Africa; *Chrysanthemoides monilifera*, *S. mauritianum*, *Brassica tournefortii*, *Asparagus densiflorus*, *L. camara*, *Ardisia elliptica* and *Berberis thunbergii* in Australia; *Fallopia japonica*, *Impatiens glandulifera*, *Rhododendron*

ponticum, *Gleditsia triacanthos* *Crassula helmsii*, *Acer pseudoplatanus* and *Ailanthus altissima* in Europe; *Centaurea diffusa*, *Bromus tectorum*, *Hydrilla verticillata*, *Melaleuca quinquenervia*, *Mimosa pudica*, *Tamarix spp.*, *Panicum repens*, *E. crassipes*, *Centaurea solstitialis*, *Phragmites australis* and *Imperata cylindrica* in North American continent. Some invasive species found in Indian subcontinent, their country of origin, habitats invaded and impact on ecosystems are presented in table 1.

Factors conferring invasiveness

Factors which play a key role in the successful establishment and survival of these species are: unrestrained vegetative spread, escape from biotic constraints, prolific seed production, highly successful seed dispersal, germination, and colonization, adaptive morphological and ecological characters, superior propagule characteristics favoring greater mobility, and ability to supplant native flora either competing for resources or exerting allelopathic effects.

Invasion Process

There are three major phases of plant invasion: *introduction*, *colonization* and *naturalization*. When an ecosystem is disturbed either by natural processes or due to some anthropogenic factors it provides a kind of invasion window to the alien propagule. Gradually, it overcomes the environmental, reproductive and dispersal barriers and expands its population. Environmental

factors like resources availability favoring establishment of alien propagule are believed to be the most important at introduction phase because introduced propagule has to compete with the established flora that is already well adapted to the site.

Impacts of invaders

Invasive species modify all the major ecosystem processes in the way, which suits them best. Alteration in litter dynamics is the first and foremost impact observed in the ecosystem, which an invader invades. Gradually other ecosystem processes depending on litter dynamics *viz.* soil biota, nutrient dynamics and biogeochemical cycles are also modified. Later, geomorphology and hydrology of the area are also changed as invasion proceeds. During the course of establishment these invasive species also interfere with native species recruitment either by allelopathic suppression or by competing with seedlings for resources. The invasive species are also known to alter fire regimes.

Management strategy against invaders

Invasive species cause degradation of ecosystem. As an invasive species is established in an ecosystem it interferes with the growth and recruitment of other native species. Further, once an equilibrium among species has occurred, it further disturbs homeostasis of ecosystem and weakens it. Accidental introduction is not easily checked but intentional introduction of alien species

should be done with prior assessment so that they may not harm the ecological integrity of an ecosystem. For management of these species basic

strategy of prevention, eradication and control should be adopted as explained in the figure. While opting for biological control methods we should take care

that the biological agents may not create a problem in later years.

Table 1: Some important invasive species in india

Invading species	Country of Origin	Habitats invaded	Impact on ecosystem
<i>Ageratum conyzoides</i>	Central and South America	In wastelands and outskirts	Fast growth and easily dispersable seeds help in fast spreading and it also has allelopathic inhibition against native species.
<i>Eichhornia. crassipes</i>	Brazil	Ponds and water bodies having blockages	Hinders navigation, chokes water bodies and reduces biodiversity by causing anoxia and degrades water quality.
<i>Eypatorium odoratum</i>	Mexico	Forest roads	Capable of growing much faster than native species and is a problem in plantation areas.
<i>Eupatorium adenophorum</i>	America, mainly Mexico	Warm and humid areas having early successional communities developed after slash and burn agriculture	Reproductive capacity and ecological adaptive capacity are strong and it grows very fast and causes allelopathic inhibition
<i>Ipomoea carnea</i>	Tropical America	Wetland having large amount of sand and clay	Due to fast growth rate it is replacing indigenous species and also have negative effects on wetlands because of semi-aquatic nature.
<i>Lantana camara</i>	Tropical and subtropical America	Wastelands and disturbed forests areas	High nutrient extraction efficiency favors its faster growth than natives and supplant native vegetation.
<i>Mikania micrantha</i>	Tropical America	In jhum cultivated areas	Prevents forest regeneration in invaded areas.
<i>Prosopis juliflora</i>	West Indies and tropical America	In open dry places	It forms almost pure populations wherever it invades and excludes all native species due to its allelopathic effects.
<i>Parthenium hysterophorus</i>	West Indies, central and south America	Open wastelands and cultivated fields	Its prolific seed production and fast spreading capability favors its growth; it also has strong allelopathic effect.
<i>Salvinia molesta</i>	Southeastern Brazil	Best in stagnant or slow-flowing water	Suppresses growth of native specie in water bodis , forms floating mats.

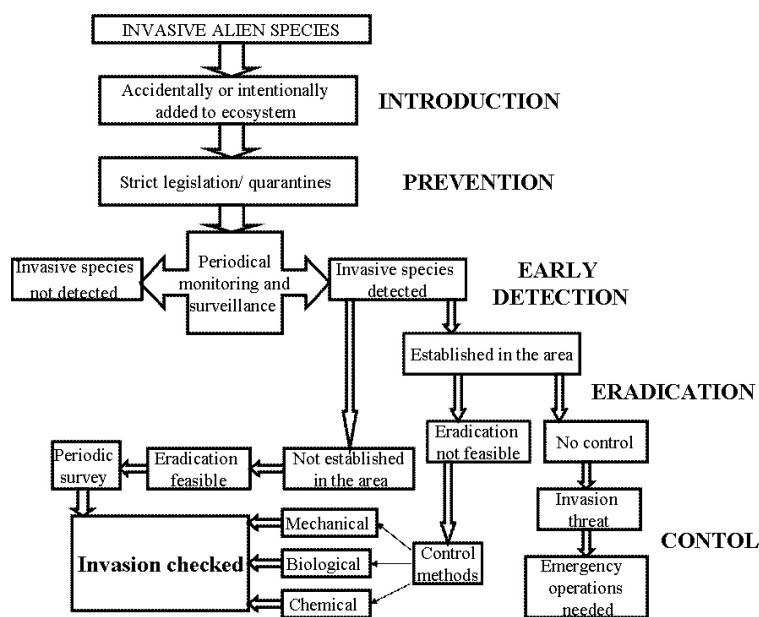


Figure: Management strategy against invasive species

Can climate change in the past serve as a basis for future indications?

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The response of the global dynamic system influenced by a range of forcing factors is well demonstrated by the past changes in the climatic scenario of the earth. Reliably, even the largest computers cannot simulate these changes. The past records, however, could provide instructive examples of the response of the planet to the past climatic changes. These examples may provide some clues as to how such changes may affect the globe in future.

During the last Glacial Maximum in the period 25,000 to 16,000 yrs. ago, the two largest continental areas of Asia and western Pacific experienced the onset of expansion of major aridity. This was preceded by periods of heavy rainfall, and consequently, stream discharge and lake levels were considerably higher than today. By 10,000 yrs ago (Holocene epoch) there was an end of glaciations and the climate in both temperate parts of China

and Australia returned to conditions somewhat wetter than what is today which has been well registered in lake levels and palaeo-vegetation patterns documented from the sediments. Conversely, interglacial warm periods saw a strengthening of the monsoon with increased rainfall.

Today, the pervasive influence of anthropogenic activities has so much changed the biological and physical condition of the earth that the use of past warm periods as analogues for future greenhouse changes presents a number of difficulties. Now, boundary conditions are significantly different from anything that existed before human intervention. The critical review from the evidence of the recent past is questionable. It is not clear whether the climatic changes are induced by greenhouse effect or due to the natural climatic variability. Although the evidence of human impact as an agency

of change remains circumstantial, the rapid fall in water levels in lacustrine system is the largest for the past 2000 yrs., and that points firmly in the direction of a greenhouse component already affecting the hydrogeological system.

Evidence of past climates now forms the basis of a global programme through the International Geosphere-Biosphere Program (IGBP). It is worth mentioning that the climate operates as a single, interconnected global system in which humanity has now become one of the lead players, and the atmospheric system and environment remain in a state of delicate balance.

About 15,000 years ago, the global climatic scenario was set for, as we know them today. At this time ice sheets of northern hemisphere retreated, temperature increased, sea level rose, until the ~7000 yrs. In India, the climatic scenario during the start of

Holocene (10,000 yrs.) produced significant responses especially in vegetation patterns and in hydrologic changes as recorded in the levels of closed lakes on land, estuaries and lagoons in the coastal areas. However, this significant change reacted with the ecosystems depending on the local geomorphology and monsoonal variations. The increase in CO₂ content to 75ppm in the atmosphere brings about the change from complete glacial to post-glacial environment. Many reconstructions of the palaeomonsoon over the World have relied on sediment cores and palynological succession responding to global climatic pattern. It is since the Last Glacial Maximum that the monsoon winds have abruptly intensified. This occurred in two steps, firstly, relative maximum of winds during the Early and Mid-Holocene (~9000 to 4000 yrs. BP), and somewhat reduced winds during the Late Holocene (~3500 yrs. BP). In most palynological and isotopic records the summer monsoon wind reduction is expressed as a long-term declining trend, which is attributed to the decreasing insolation in the Northern Hemisphere and reduced warming of the Tibetan Plateau. Such an interpretation is broadly supported from different continents and sub-continents, although in many cases deviations from this trend can be discerned for specific time-intervals. But, it broadly shows consistency with climate models produced so far.

Three domains of contrasting monsoon evolution within the wider South Asian monsoon region have been identified so far: The Indian Peninsula, where summer monsoon rainfall appears to be higher at present than at any other time in the Holocene; the mountaneous northern source of Ganga river- Brahmaputra river, where summer monsoon rainfall has decreased steadily since the Mid-Holocene; and the Sindhu and makran region, which is in the reach of a westerly winter and spring source of rainfall. The synchronicity of Early Holocene moist climate or Mid-Holocene aridity reported from several sites of both the

western Himalayas and Peninsular India may be due to the common influence of the SW monsoon.

The climate leaves impact on global sea level, which has already risen by around 10 to 25 centimeters during the last 100 years, at the rate of 1 to 2 millimeters per year. It is likely that most of this rise in sea level has been due to the increase in global temperature over the last 100 years. Global warming should, on average, cause the oceans to warm and expand thus increasing sea level. Climate models indicate that about 25% of the rise in sea level during the 20th century has been due to the thermal expansion of seawater. A second major cause of rising sea level is the melting of land-based ice caps. Presently, it is uncertain to what extent the melting of the Greenland and Antarctic ice caps has contributed to global sea level rise during the 20th century.

Forecasts of a rising sea level are based on climate model results, which indicate that the Earth's average surface temperature may increase by between 1.4 and 5.8°C during the 21st century. Global warming is expected to cause a further rise of between 9 and 88 centimeters in sea level by the year 2100, with a best estimate of 50 centimeters, if emissions of greenhouse gases remain uncontrolled. This expected rate of change (an average of 5 cm per decade) is significantly faster than that experienced over the last 100 years.

Forecasting sea level rise, however, involves many uncertainties. While most scientists believe that man-made greenhouse gas emissions are changing the climate, they are less sure about the details, and particularly the speed, of this change. Global warming is the main potential impact of greenhouse gas emissions, but other aspects of the climate besides temperature may also change. For example, some studies suggest that changes in precipitation will increase snow accumulation in Antarctica, which may help to moderate the net sea level rise. Another complication is that the sea level would not rise by the same amount all over the

globe due to the effects of the Earth's rotation, local coastline variations, variation in geomorphological patterns, changes in major ocean currents, regional land subsidence and emergence, and differences in tidal patterns or ecological changes induced by intrusion of sea water.

Nevertheless, some areas of Antarctica have warmed by 2.5°C during the past 50 years, a rate of warming 5 times faster than for the Earth as a whole. Whilst scientists believe this to reflect mostly regional changes in climate, the recent summertime disintegration of the Larsen Ice Shelf has renewed speculation that climatic changes in the polar regions have the potential to cause severe impacts via a rise in global sea level over the next 100 to 200 years.

The rate of observed sea level rise suggests that there has been a net positive contribution from the huge ice sheets of Greenland and Antarctica, but observations on the ice sheets do not yet allow meaningful quantitative estimates of their separate contributions. The ice sheets remain a major source of uncertainty in accounting for past changes in sea level because of insufficient data about these ice sheets over the last 100 years.

Monsoonal pattern is extricable linked to sea surface temperatures. With so many influencing factors, the South Asian monsoon might appear to be a hopelessly complicated phenomenon. However, the advent of computer climate models has definitely increased our understanding and know-how of the relative roles of all the governing factors. The application of models thus prepared for palaeomonsoon and climatic changes has led to successful dynamic interpretations of proxy records generated from sediments cores world over. The simulated variability of palaeomonsoons is critically important to predict as to how the monsoon will change under future climate change scenarios and should aid in explaining recent observations that suggest a strengthening of the monsoon with global warming.

NBRI Botanic Garden A Centre of Excellence for Conservation, Education and Bio-Aesthetics

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Introduction

National Botanical Research Institute (NBRI) at Lucknow (India) is one of the significant plant based national laboratory in India under the Council of Scientific & Industrial Research (CSIR), New Delhi. It was originally set-up by Government of Uttar Pradesh during 1948 as National Botanic Gardens (NBG) and later on taken over by CSIR in 1953.

The Botanic Garden at NBRI has been well known all over the world. It is the third largest and one of the oldest Botanic Gardens in India, besides Indian Botanic Garden, Howrah and Lalbaugh Gardens, Bangalore. Spread over in an area of 25 hectares, it is located in the heart of Lucknow, the capital city of Uttar Pradesh along southern bank of river Gomti. It is reputed for its well identified and aesthetically displayed plant wealth to capture a living nucleus of various plant species for posterity. Botanic Garden is also a member of BGCI, U.K. and International Association of Botanic Gardens (IABG). A repository of germplasm collection of various tropical and sub-tropical plant species, comprising 5,000 taxa, representing 212 families, the Botanic Garden has rich genetic treasure with the collection of trees, shrubs and herbs of ornamental, economic, medicinal, aromatic and rare importance, hailing from the indigenous and exotic sources.

History

The Botanic Garden surrounds, within its limits, historical 'Sikander Bagh' laid out around 1800 AD as a royal garden by Nawab Saadat Ali Khan and later adapted by Nawab Wajid Ali Shah, the last King of Avadh, during the first half of the 19th century. It was Nawab Wajid Ali Shah who gave to the garden its name 'Sikander Bagh', after his favourite queen, Sikander Mahal Begum.

Objectives

- ▶ A repository of germplasm collection of diversified groups of taxa with special reference to rare, endangered, endemic, ornamental and economic plant species.
- ▶ Introduction, multiplication, acclimatization, assessment and documentation of taxa procured from world over for developing wide genetic base.
- ▶ Domestication of wild plant species of ornamental significance.
- ▶ Development of new and novel ornamental cultivars for commercial exploitation.
- ▶ Exchange and sale of plant material to the connoisseurs. Supply of authentic plant material for research institutes, universities and other organizations.
- ▶ Organization and participation in Flower Shows and Science Exhibitions.
- ▶ Organization of training courses in Commercial Floriculture.
- ▶ Technical advice/consultancy on landscaping and establishment of Botanic Gardens.

GERMPLASM COLLECTIONS

Plant wealth of over 5,000 species/cultivars in the Botanic Garden is displayed in Arboretum, Conservatory, Cactus & Succulent House, Fern House, Orchidarium, Palm House. A brief account of the arboretum, plant houses and the most popular ornamental crops available in the garden has been furnished below.

Arboretum

The arboretum covers an area of 7 hectares and comprising nearly 400 species of trees and shrubs. Some of the notable indigenous and exotic tree species are: *Adansonia digitata*, *Aegle marmelos*, *Alstonia macrophylla*,

Annona muricata, *Bauhinia variegata*, *Brachychiton rupestris*, *Bixa orellana*, *Boswellia serrata*, *Butea monosperma*, *Chorisia x insigniosa*, *C. insignis*, *Coccoloba uvifera*, *Dalbergia sissoo*, *Dillenia indica*, *Ficus benghalensis*, *F. krishnae*, *F. religiosa*, *Jacaranda cuspidifolia*, *J. mimosaeifolia*, *Kigelia pinnata*, *Mitragyna parviflora*, *Oroxylum indicum*, *Pterocarpus marsupium*, *Santalum album*, *Shorea robusta*, *Strychnos nux-vomica*, *Syzygium jambos*, *Tabebuia palmeri*, *Tecomella undulata*, *Tectona grandis*, *Terminalia arjuna*, and *Wrightia tinctoria* etc.

Conservatory

An arch-shaped plant house, in an area of 1370 sq. m., is meant for conservation of indoor plants from tropics and sub-tropics of the world. Nearly 500 species/ cultivars are punctuated in beds and pots aesthetically. Few novel and interesting taxa are: *Alocasia x amazonica*, *Bambusa ventricosa*, *Dracaena marginata* 'Tricolor', *Fatsia papyrifera*, *Ficus* 'Long Island', *Ginkgo biloba*, *Heliconia rostrata*, *Hoya wightii*, *Nandina domestica*, *Pachystachys lutea*, *Vanilla planifolia* etc. Besides, a large collection of *Aglaonema*, *Alocasia*, *Anthurium*, *Asparagus*, *Calathea*, *Chlorophytum*, *Codiaeum*, *Dieffenbachia*, *Dracaena*, *Maranta*, *Peperomia*, *Philodendron*, *Pandanus*, *Syngonium* is also displayed aesthetically.

Cactus and Succulent House

A pagoda shaped glass house meant for the germplasm collection of cacti and succulents from arid regions is centrally located in 284 sq. m area. It conserves about 350 species/varieties. Plants have been displayed in raised beds and in pots. Some of the notable taxa are: *Adenium obesum*, *Agave*

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parviflora, *Beaucarnea recurvata*, *Cephalocereus senilis*, *Cereus grandiflorus*, *C. peruvianus*, *Cotyledon orbiculata*, *Dudleya virens*, *Dyckia remotifolia*, *Echinocactus grusonii*, *Euphorbia splendens*, *Gasteria maculata*, *Gymnocalycium mibianovichii*, *Haworthia fasciata*, *Kalanchoe marmorata*, *Mammillaria echinata*, *Melocactus nerye*, *N. stricta*, *Notonia grandiflora*, *Opuntia argentina*, *O. microdasys* 'Albida', *Pereskia aculeata*, *Stapelia gigantea*, and *Y. filamentosa* and some of the grafted cacti. Besides, a unique gymnosperm, *Welwitschia mirabilis* known as "Tree Tumbo" has been introduced from NBI, Kirstenbosch, RSA during 1989. This species has only 2 leaves throughout its life-span (over 500 years) which elongate continuously in opposite direction. It is very important from educational and evolutionary point of view. Among SAARC nations only NBRI Botanic Garden possesses this extremely rare taxon.

Fern House

The specially constructed house for growing ferns and fern allies is pyramidal in shape in an area of 400 sq.m. A germplasm collection comprising 60 species is being maintained in fern house. Notable taxa are: *Adiantum capillus-veneris*, *A. peruvianum*, *Anemia royundifolia*, *Blechnum occidentale*, *Bolbitis heteroclita*, *Diplazium esculentum*, *Drynaria quercifolia*, *Equisetum arvense*, *E. debile*, *Lygodium flexuosum*, *Microsorium alternifolium*, *Nephrolepis cordifolia*, *N. cordifolia* cv. 'duffii', *N. tuberosa*, *Ophioglossum reticulatum*, *Psilotum nudum*, *Pteris cretica* cv. 'Albolineata', etc.

Orchidarium

Orchids are a wondrous group of flowering plants known for their floral beauty, diversity and specific habitats. They belong to the family Orchidaceae. Orchid flowers are spectacularly beautiful in wide array of colours and aroma. They have the vase life of 10-30 days and in great demand in the

floriculture trade. India has a rich wealth of 170 genera and about 1200 species of orchids. More than 150 taxa of Indian orchids are of floricultural significance. Hardy species of orchids particularly from tropical and sub-tropical regions are being conserved in the newly installed Orchidarium. A collection of about 50 species including the genera *Arachnis*, *Coelogyne*, *Dendrobium*, *Eria*, *Paphiopedilum* (Lady's Slipper Orchids), *Peristylis*, *Spathoglottis*, *Phaius*, *Pholidota*, *Renanthera*, *Rhynchostylis*, *Vanda* and *Vanilla* has been developed for conservation. Some well known orchid cultivars like, *Arachnis* 'Apple Blossum', 'Annix-Black', 'Spider Orchid', *Aranda* 'Mosaic Magic', *Dendrobium* 'Soniard', *Vanda* 'Diana', 'John-club', 'Prolific', 'Tricolour', 'Miss Jaquine' are also introduced.

Palm House

Palm House covering an area of 765 sq. m., is maintaining the plant resources of family Arecaceae. Palm collections comprise over 70 species displayed in pots of various sizes and in the ground as well. Noteworthy taxa are: *Arenga pinnata*, *Caryota mitis*, *C. urens*, *Chamaedorea elegans*, *Chrysalidocarpus lutescens*, *Cocos nucifera*, *Elaias guineensis*, *Licuala grandis*, *Livistona chinensis*, *Phoenix reclinata*, *P. rupicola*, *Ptychosperma macarthurii*, *Sabal palmetto*, *Thrinax barbadensis* and *Washingtonia filifera* etc.

Bonsai Section

The technique of Bonsai is very popular throughout the world. A rich collection is maintained exhibiting 250 specimens trained in different styles for aesthetic and educative purpose. Some of them are even 45-50 years old. Important species are: *Acacia gotezai*, *Achras sapota*, *Bambusa ventricosa*, *Callistemon lanceolatus*, *Citrus microcarpa*, *Cycas revoluta*, *Drypetes roxburghii*, *Ficus benjamina nuda*, *F. indica*, *F. infectoria*, *Ficus* 'Long Island', *Morinda tinctoria*, *Psidium guajava*, *Punica granatum* etc. *Ficus* spp. with their prop roots, are major attraction.

ORNAMENTALS

Bougainvillea

Bougainvillea is a popular ornamental plant grown throughout the tropics and sub-tropics. This genus belongs to family Nyctageniaceae and was first reported by Commerson, a French Botanist from Rio-De-Janeiro, Brazil. Later, it was taken to Europe and subsequently introduced in India during 1860. A rich germplasm collection of 200 species/cultivars has been built-up in Bougainvillea Garden exhibiting about 165 varieties as per specific layout plan. The Institute has evolved 22 new cultivars like: 'Shubhra', 'Begum Sikander', 'Wajid Ali Shah', 'Mary Palmer Special', 'Chitra', 'Hawain Beauty', 'Arujna', 'Aruna', 'Los Banos Variegata', 'Mahara Variegata', 'Pallavi', etc. which are highly popular in nursery and floricultural trade.

Canna

Canna has magnificent flowers in different colours (bicoloured, spotted, blotched, margined) and remain in bloom almost round the year. A germplasm collection of nearly 50 cultivars is being maintained. Some of the notable ones are: 'Assault', 'Black Knight', 'Butter Cup', 'King Alfred', 'King Humbert', 'Lucifer', 'Presdient', 'Striatus', 'New Red', 'Orange King' and 'Trinacria Variegata'. Two new cultivars have been recently developed: *Canna generalis* 'Kanchan' and *Canna generalis* 'Agnisikha'.

Chrysanthemum

Chrysanthemum (Asteraceae), is a significant floral crop all over the world. *Chrysanthemum* is native to China and the National Flower of Japan. The Institute has a status of a National Repository of *Chrysanthemum* maintaining the largest collection of 250 cultivars. Of these, eighty are evolved at NBRI by conventional method or through mutation breeding. Some of the important cultivars viz.: 'Ajai', 'Apsara', 'Bindiya', 'Birbal Sahani', 'Chandi', 'Gauri', 'Guldusta', 'Jaya', 'Jayanti', 'Jubilee', 'Kundan', 'Lilith', 'Maghi', 'Peet Singar', 'Sharad Mala', 'Sharad

Har', 'Shyamal', 'Suneel', 'Vasantika', etc. have become immensely popular among growers and find mention in leading nursery catalogues. A large number of 'Dwarf-No- Pinch' type varieties have been selected and suitable for mini-pot culture. A Mini Chrysanthemum cv. 'Mother Teresa' got US Patent (Patent No. PP 13678) during 2003.

Cycads

Cycads are considered as the Living Fossils. They belong to a group of plants having ancient lineage possessing great significance from the evolutionary point of view and have been known from early Permian period, nearly 225 million years ago. A rich germplasm collection of cycads comprising 35 species under 8 genera viz.: *Cycas*, *Dioon*, *Encephalartos*, *Lepidozamia*, *Macrozamia*, *Microcycas*, *Stangeria* and *Zamia*, hailing from various phyto-geographical regions of Australia, India, South Africa and South America. This is the richest collection of cycads among all the Botanic Gardens in India. Further, collection of Cycads viz.: *Microcycas calocoma*, *Zamia floridana*, *Z. furfuracea*, *Z. portoricensis* in the Conservatory is of high academic significance from evolutionary point of view. *Microcycas calocoma* is a extremely rare cycad, introduced in the garden from Cuba and designated as the National Plant of Cuba.

Gladiolus

Gladiolus is a native of South Africa and belongs to family Iridaceae. Its cut-flowers can stay fresh for 5-6 days and used for vase decoration as well as bouquets. Foreseeing its immense potentiality as cut-flower in floricultural trade, NBRI initiated R & D work during 1970s for developing the new cultivars and standardization of agro-technology for commercial cultivation suitable for north Indian plains. Germplasm collection of 110 varieties has been developed besides development of new cultivars. Notable ones are: 'Rashmi', 'Surekha', 'Tambari', 'Classic White', 'Neelima' and 'Urvashi. Training

programmes have been organized for the transfer of technology to nearly 1000 progressive farmers and entrepreneurs all over the country along with planting material under the Rural Development Programme.

Lotus

Nelumbo nucifera Gaertn., the 'Sacred Lotus' is an elegant creation of nature. Genus *Nelumbo* belongs to family Nelumbonaceae and is represented by two species namely, *N. lutea* 'Yellow Lotus'. Since ancient times, lotus flower has been considered as a divine symbol of purity and peace. *Nelumbo* is also an important ornamental in floriculture and landscaping. Germplasm collection of Indian and exotic races in different shades of pink, white and yellow is being maintained in the aquatic bodies of the Botanic Garden. Besides, the germplasm collection of *Nymphaeas* and *Euryale ferox* (Makhana) is also being conserved in the aquatic bodies.

PLANT INTRODUCTION

It is one of the most significant and paramount activities for the enrichment of germplasm collection and developing wide genetic base. Plant material is procured from over 150 Botanic Gardens in India and abroad on exchange. Some of the important plant species recently introduced in the garden are: *Adansonia za*, *Adenantha microsperma*, *Billergia alfonsi-jonnis*, *Clerodendrum speciosissimum*, *Coreopsis grandiflora*, *Crescentia mirabilis*, *Dasilirion glucophyllum*, *D. serratifolium*, *Draecana draco*, *Ephedra tweediana*, *Hernandia nymphaefolia*, *Hesperaloe parviflora*, *Jacaranda cuspidifolia*, *Khaya senegalensis*, *Nolina longifolia*, *N. stricta*, *Pavetta revoluta*, *Senecio confuses*, *Sophora secundiflora*, and *Zamia pumila*, etc.

EX-SITU CONSERVATION

Flora of Indian subcontinent is very rich in diversity and endemism. Due to various natural and developmental

activities, over 4,000 taxa are under varying degrees of threat or even have become extinct. NBRI Botanic Garden plays important role in the conservation of genetic diversity and acts as an ideal centre for preserving RET taxa. A rich collection of some rare endangered, endemic and threatened plants consists of *Adhatoda beddomei*, *Allium hookerii*, *Anogeissus sericea* var. *nummularia*, *Commiphora wightii*, *Cycas beddomei*, *C. pectinata*, *Dendrobium nobile*, *Dischidia benghalensis*, *Erythrina resupinata*, *Frerea indica*, *Grewia optiva*, *Hoya wightii*, *Hyphaene dichotoma*, *Phoenix rupicola*, *Rauvolfia serpentina*, *Sophora mollis*, *Tecomella undulata*, *Trachycarpus takil*, *Vanilla planifolia*, *Vanilla walkerii*, *Walsura candollei*, etc.

Touch-'n'-Smell Garden

A Touch 'n'-Smell Garden is spread over an area of 0.1 ha has been developed for blinds and physically disabled persons. Hanging potted plants are displayed at a convenient height so that disabled visitors in wheel chairs can easily touch, feel and smell them. Plant labels and legends displayed are written in Braille system. Pre-recorded information through audio system has also been installed. A variety of plant species either having fragrant flowers, aromatic / coarse leaves have been planted in this garden. Some of the notable ones are: *Buddleia madagascarensis*, *Cestrum nocturnum*, *Crinum asiaticum*, *Cymbopogon martini*, *Ixora parviflora*, *Jasminum* spp., *Lantana camara* 'Flava', *Nyctanthes arbortristis*, *Ocimums* and *Polianthes tuberosa*.

ENVIRONMENTAL EDUCATION

Plants are important constituents of the biota on this planet and greatly influence the quality of global environment. Today human survival is threatened due to the destruction of plant diversity because we can live on this planet only as long as there are plants. Botanic Gardens comprising arboretum, herbal garden,

conservatories, green houses, experimental/display plots, aquatic bodies conserving incredibly diverse plant resources from various climatic regimes offer immense opportunities to the school children, college students, researchers as well as the general public to learn about the nature intricately. Visits of students, researchers, progressive farmers and the entrepreneurs are frequently organized in the botanic garden. Summer training courses for the school children are also organized from time to time. Thus the garden is dedicated to environmental education and the conservation of plant diversity.

SALE OF PLANTS AND SEEDS

Authentic plant material of a wide variety of indigenous, exotic and ornamental plant species is propagated for sale to inculcate the bio-aesthetic sense among the general public and for making the herbarium specimens for students and research scholars from various colleges, universities and institutions.

TECHNICAL CONSULTANCY, LANDSCAPING AND TRAINING

Botanic Garden renders technical

advice on landscaping and ornamental horticulture, for improving the environment, to individuals, private and public sectors and Government Organizations. Short education-cum-training programmes are conducted on cultivation of ornamentals, landscaping, garden layouts, bonsai and latest techniques in horticultural practices. Such programmes are generally sponsored by SIDBI and National Horticulture Mission for the horticulture officers, rural unemployed youths and the progressive farmers.

ANNUAL FLOWER SHOWS

The Institute organizes two Annual Flower Shows viz: Chrysanthemum & Coleus Show in December and Rose & Gladiolus Show during January every year. These shows are of international standard displaying R&D work on ornamental horticulture for promoting interest among the garden lovers, progressive farmers, connoisseurs and the general public towards the cultivation or ornamental plants for improving their environmental surroundings.

FUTURE PLAN OF WORK

NBRI Botanic Garden has been

recognized as the **Centre of Excellence** by the Ministry of Environment & Forests, Government of India, New Delhi. Under this programme as well as under the CSIR's Supra Institutional project the following new creations have been proposed.

Proposed Additions

- **Phytotron (Climate Controlled Plant House)**

A Phytotron with various chambers having different climatic regimes will be installed in the botanic garden simulating photoperiod, light intensity, temperature, relative humidity conditions for the ex-situ conservation studies on various groups of plants with special emphasis to the RET taxa and other biologically interesting plants. The studies will also be taken-up about the effect of increased carbon dioxide on plants in atmosphere during the next 20-30 years. It will be examined by increasing the carbon dioxide levels under the controlled conditions for different candidate species of plants.

- Rain Water Harvesting
- Use of Solar Energy for lighting in the Botanic Garden as
- Cycad Garden
- Moss Garden
- Seed-Bank



NEWS AND VIEWS

VEHICLE FUMES STUNT LUNG GROWTH

Experts already know toxic traffic fumes can trigger lung conditions such as asthma. But new research suggests pollution can stop the lung from growing to its full potential, even in children who are otherwise healthy.

Researchers at the University of Southern California have examined the lung function of 3,677 children annually from the age of 10 until they reached 18. Those who had lived within 500 meters of a motorway had much poorer lung function at the age of 18

than those who had lived 1,500 meters away or more, even when factors such as smoking in the home were taken into account.

Scientists do not know exactly how air pollution hampers lung development, but they believe lung inflammation in response to daily irritation by air pollutants may play a role.

As background air quality did not alter the picture, children living in the countryside but close to a main road would also be at risk, the researchers add.

Children living close to big roads in cities with high levels of background air pollution were likely to be at a greater risk of lung problems, however, because of the double effect on their lungs, they suggest.

Acid News
(Source: BBC News)

MORE HARMFUL TO HEART THAN SUSPECTED

A study published in the New England Journal of Medicine shows that a woman's risk of dying from

cardiovascular disease is linked to the particulate levels in the air where she lives and that the damage is greater than anyone had suspected.

The researchers used information from more than 65,000 participants aged 50 to 79, living in 36 cities across the United States. None of them had heart disease at the beginning of the study.

The study found women living in areas with high concentrations of particles were more prone to strokes, heart attacks and other forms of heart disease than those living where the air is cleaner.

The average particulate levels (PM_{2.5}) in the 36 cities covered by the study ranged from about 4 to almost 20 micrograms per cubic metre of air. Each 10-microgram rise carried a 76-per cent increase in the chances of dying from any cardiovascular cause.

Acid News
(Source: Guardian)

OIL-SEED RAPE PLANT CAUSES DAMAGE TO ENVIRONMENT

Rape plant was almost unknown in the U.K. before 1970. It is the product of an intensive crossbreeding programme after World War II. It is dependent upon large quantities of fertilizer and pesticides to which many pests are now developing immunity the crop is almost never found on organic farms. Despite its chemical hungry nature, rape now accounts for some 11% of all crops grown in the U.K. and the production has increased by 17% in the last year.

The demand for oil from the rape seed, originally used as an alternative for whale or petroleum based oils in lamps is increasing very rapidly. The oil can be used for making plastics, food, margarine, animal fodder, candles, soaps and lubricants. Rapeseed oil is also popular as a gastro alternative to olive oil.

But this versatility comes at a cost as the cultivation of rape is starting to cause concern. Two of the pesticides used to control the many diseases and parasites are suspected hormone disrupters.

Several complaints are also made every year about lung and throat irritation in people living close to fields of rape plants, which could be caused by pollen, volatile compounds released by the plants, or cross-reactions with grass pollens.

The Ecologist online Newsletter, U.K.

LET THERE BE LIGHT

The campaign against the century old incandescent light bulb has put environment conscious consumers in a dilemma. While a section of green lobby is promoting compact Fluorescent light (CFLs), another group is against the switch over because CFLs contain mercury, a deadly neurotoxin and if discarded haphazardly they can create serious environmental and health problems. While European countries are opting CFLs, they have in place stringent collection and recycling laws for discarded bulbs. Some experts are more keen on Light Emitting Diodes (LEDs) but presently they have limited use because their energy intensity is low. LEDs use 4% less energy than CFLs and have a 10-years life.

CFLs use only 20% energy used by light bulb. Everyday India uses 18,000MW of electricity for lighting and more of it is wasted due to inefficient light bulb. By replacing all ordinary light bulbs with CFLs India can reduce its CO₂ emission by 55 million tonnes. As far as mercury in CFLs is concerned, the Greenpeace says coal, which fires our thermal based power plants, also contains mercury and accounts for 70% of mercury emission in the country. So CFLs will reduce the energy required and hence the mercury emission from thermal power plants.

Agreeing that dangers of mercury contamination persist if these new age bulbs are not properly disposed, the Greenpeace says technology for safe disposal and recycling is available. India lacks a proper waste management system and if CFLs are made mandatory, it will mean that the lighting sector's annual consumption of mercury would multiply by more than 10 times as each

bulb contains 5 to 10 milligram of mercury.

In the absence of proper recycling systems, CFLs will be disposed along with other wastes and in the long run there will be mercury contamination. Mercury dangers the central nervous system, endocrine system, kidneys and other organs. And considering we still dispose our fluorescent tube and thermometers with household wastes, making CFLs mandatory does seem quite scary. In U.S.A. broken fluorescent lamps are considered hazardous and are not sent to landfills. Instead, they are sent to recycling centers that break the lamps under special conditions and safely recover the mercury.

Source: Kumkum Dasgupta
kumkumdasgupta@hindustatimes.co
Hindustan Times

COAL-FIRED POWER PLANTS WORST POINT SOURCE EMITTERS OF POLLUTANTS IN EUROPE

Coal-fired power plants dominate the twenty worst emitters of carbon dioxide and nitrogen oxides in 25 'old' European Union member countries. Belchatow (Poland), which burns brown coal tops the list in respect of carbon dioxide, emitting a massive 31 million tonnes each year. German plants, however, are among the worst CO₂ emitters.

Topping the list for sulphur dioxide is the coal-fired Puentes Power Plant in Spain with 312,00 tonnes emissions. Second highest is the Megalopolis Complex in Greece, which is fired with lignite from local deposits.

Worst emitter of nitrogen oxides is the Drax Plant in U.K. with 58,000 tonnes per year emissions. Also British plants account for nine of the 25 worst emitters of nitrogen oxides. Of the 25 largest sources of nitrogen oxides in Europe, 24 are power plants.

Source: Per Elvingson
Acid News (Sweden)



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International Workshop on Herbal Medicinal Plants and Traditional Herb Remedies

20-21 September 2007; Hanoi, Vietnam
Contact: Prof. Arun P. Kulshreshtha,
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New Delhi 110003, INDIA
E-mail: namstct@gmail.com, apknam@gmail.com;
Website: <http://www.namstct.org>

Tropical Ecology Congress 2007

2-5 December 2007; Srinagar, Garhwal, Uttarakhand, India
Contact: Prof. S.P. Singh
Vice-chancellor, HNB Garhwal University, Srinagar
Garhwal-246174, Uttarakhand, India
E-mail: iste_tec_07@yahoo.co.in

Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds

19-22 May 2008; Monterey, California, U.S.A.
Contact: <info@confgroupinc.com>
<chlorcon@battelle.org>
Website: www.battelle.org/chlorcon

Coastal Environment 2008

Seventh International Conference on Environmental Problems in Coastal Regions
19-21 May 2008; The New York Forest, U.K.
Contact: Wessex Institute of Technology, ACI 68,
Ashurst Lodge, Ashurst, Southampton, SO40 7AA, U.K.
E-mail: enquiries@wessex.ac.uk
Web: www.wessex.ac.uk

Waste Management 2008

Fourth International Conference on Waste Management and the Environment
2-4 June 2008; Granada, Spain
Conference website:
www.wessex.ac.uk/conferences/2008/waste08

International Conference On Plants & Environmental Pollution

August 25-30, 2008; Erciyes University Kayseri-Turkey
Contact: Prof. Dr. Munir Ozturk (Botany Department
Ege University-Turkey).
E-mail: munirozturk@gmail.com

Environmental Toxicology 2008

Second International Conference on Environmental Toxicology
4-6 June 2008, Granada, Spain
Conference website:
www.wessex.ac.uk/conferences/2008/toxic08

Third International Conference on Evaluation, Monitoring, Simulation, Management and Remediation of the Geological Environment and Landscape

16 - 18 June 2008, The New Forest, UK
Contact: Rachel Swinburn, Conference Manager
Geo-Environment & Landscape Evolution 2008
Wessex Institute of Technology, Ashurst Lodge,
Ashurst, Southampton, SO40 7AA
Email: rswinburn@wessex.ac.uk;
<http://www.wessex.ac.uk/geoenv2008cfp.html>

Water Pollution 2008

Ninth International Conference on Modelling, Monitoring and Management of Water Pollution
9 - 11 June 2008; Alicante, Spain
Contact: Kimberley Robberts, Conference Secretariat,
Water Pollution 2008
Wessex Institute of Technology, Ashurst Lodge,
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E-mail: krobberts@wessex.ac.uk;
Website: <http://www.wessex.ac.uk/water2008cfp.html>

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Sixteenth International Conference on Modeling, Monitoring and Management of Air Pollution
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Contact: Rachel Swinburn
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Southampton, SO40 7AA, U.K.
E-mail: rswinburn@wessex.ac.uk.
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