



# ENVIRONNEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

## Newsletter

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### A hard, dry future for the planet

The world is wasting water on a truly colossal scale, according to the United Nations. More than 80% of the used water on earth is neither collected nor treated – the equivalent to the planet leaving the taps full on and the plugs out. Demand for water is expected to increase by 55% over the next four decades. Rapid urbanization, climate change and the altering global economy are putting growing pressure on water supplies. In around 40 years' time, more than 40% of the world's - 3.9 billion people – are likely to be living in river areas in the grip of severe water stress. Unprecedented growth in demand for water is threatening global development goals and will exacerbate inequality between countries, sectors and regions. The OECD is calling for urgent reform of water management and suggests using economic instruments, such as taxation, tariffs and transfers, to encourage greater water efficiency.

Increasingly, underground water sources have been tapped to respond to growing demand and this process has tripled over the past 50 years. Transnational land acquisition, where countries acquire land outside their jurisdiction to get access to water, has risen from 20m hectares in 2009 to more than 70m today.

Water is not only what we drink, what we wash with, or what we use to irrigate; it is also embedded in the products that we eat, consume and use.

Water management can no longer be seen as a local issue, it has to be treated as a global one.

**Sarah Morrison**  
*In The INDEPENDENT*

- **Members of ISEB are requested to immediately intimate any change in their contact address including postal, Email, Fax, Telephone to ISEB office.**
- All correspondence should be addressed to: **The Secretary, International Society of Environmental Botanists**, National Botanical Research Institute Campus, Lucknow - 226 001 (India).
- **E-mail:** [isebnrilko@sify.com](mailto:isebnrilko@sify.com) **Website:** <http://isebindia.com>



## LETTERS

I thank you for asking me to write an article for Environews. Being preoccupied with several domestic and public activities, I deeply regret that I could not reply to you earlier. I know how completely committed you are with ISEB and its several programmes. Please forgive me for not being able to send you an article before the end of this month. I shall think of some topic and write to you later. In the meanwhile please accept my appreciation of the good work you are doing.

**H.Y.Mohan Ram**

INSA Hony Scientist  
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Thank you for the link to your informative News letter. Kindly let me know if I can also contribute some article in its forthcoming issues.

**Dr. Bhgwan Das Bulchandani**

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All three articles published in October 2011 issue of Environews are a brief, integrated, focused and analytical account of the current aspects of the environmental issues. I congratulate authors and editors for such comprehensive input to the bulletin. I wish to introduce a newly registered Society, "The Society for Science of Climate Change and Sustainable Environment" to the fellow ISEB members which may attract their attention. For details queries can be made to Dr D.C. Uprety, President (Email:dc\_uprety@yahoo.com), Prof A. K. Bhatnagar, Vice President (Email:akb\_du@rediffmail.com), Prof. Rana P Singh, Secretary (Email: ranapsingh1@hotmail.com) and Mr. Ashok Datta, Treasurer (Email:ssce\_environment@yahoo.com).

**Rana P. Singh**

Professor and Dean  
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I arrived in my country safely. I am still proud to be part of the 2010 conference. The news letter is very useful. Thanks and regards.

**Adekunle, Victor Ajibola PhD**

Senior Lecturer (Forest Ecology & Inventory)  
Federal University of Technology  
Department of Forestry and Wood Technology  
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I am currently working as a professor at Harris-Stowe State University, St. Louis, USA. I am planning to become a life time member of ISEB. I was wondering how to pay the membership fee (cheque, credit cards etc.). Also, I have attached a document to be published in you Environews. I have presented this information as a poster in Botanical Conference of America in United States. I was wondering if this work can be published?

**Dr. Anbreen Bashir,**

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On behalf of Professor H.S.Srivastava Foundation for Science and Society ([www.phssfoundation.org.in](http://www.phssfoundation.org.in)) and on my own behalf, I gratefully acknowledge your kind consent for the chairperson/member of various committees constituted to select awardees of "Professor H.S. Srivastava Life Time Achievement Award", "Professor H.S.Srivastava Award for Social Contributions" and "Professor H.S. Srivastava Young Scientist Award" for 2010-2012. The invitation for nominations have already been sent to the members for wider circulation and have also been placed on the society website. We shall be thankful to you for your valuable input and kind considerations. The meetings of various committees will be arranged time to time once sufficient nominations will be received to this end.

**Rana P. Singh**

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## NEWS FLASH

**Dr. Nitya Anand**, former Director of Central Drug Research Institute, Lucknow and a scientist of International repute has been Awarded Padmashri by the President of India for his significant contributions to the design, discovery and development of new drugs. During his long research career Dr. Anand also created trained medical chemists, who are holding very senior positions in research Institutes and pharmaceutical industry.

Dr. Nitya Anand is a Life member of ISEB and has been a source of inspiration and encouragement to this Society since its inception.

**Prof. Yash Pal Kalra**, a Life member of ISEB from Canada was presented the "Salute to Excellence Citation Award" by His Worship Stephen Mandel, Mayor of Edmonton, Alberta, Canada on November 28, 2011. The citation reads "Chemist Yash Pal Kalra has an extraordinary history of community involvement. In the past 35 years, he has volunteered for more than 40 organizations including the Alberta Hindi Parishad, Canadian Multicultural Education Foundation, Mahatma Gandhi Foundation for World Peace, and Young Men's Christian Association. He has served as president of eight national and international scientific societies and as a member of the organizing committees of 55 national and international conferences, symposia, and other scientific meetings. Prof. Kalra is also well-known at Edmonton Regional Science Fairs, which he has judged for 22 years".

**Dr. C.S. Nautiyal**, Director CSIR-NBRI and President ISEB, has been honoured with 'Parvat Gaurav Samman' by Parvatiya Mahaparishad, Lucknow.

**Dr. Mujeebur Rahman Khan**, Senior Associate Professor, Department of Plant Protection, Aligarh Muslim University has been elected as a Fellow of the National Academy of Agricultural Sciences, New Delhi. Dr. Khan is an internationally reputed nematologist of the country. He has worked as a Post-Doc. in North Carolina State University and California Department of Food and Agriculture, U.S.A. He has also worked in Commonwealth Institute of Parasitology, U.K.

**Dr. S.C. Sharma**, Vice President ISEB delivered a talk on "Global Warming, Urban Pollution and Solution" at the Isabella Thoburn P.G. College Lucknow on 10 February 2012. Dr. Sharma also interacted with the students and teachers of the I.T. College and advised them to take up the massive tree plantation programme in the urban and rural areas of Lucknow.

**Dr. R.D. Tripathi**, Senior Principal Scientist in CSIR-NBRI & Executive Member ISEB has been awarded "Archana Gold Medal (2011)" by Academy of Environmental Biology, Lucknow. Dr. Tripathi has made outstanding research contributions on various aspects of heavy metal/metalloid phytoremediation potential with a special emphasis on arsenic. He is involved in understanding arsenic metabolism in plants and in identification and development of low grain arsenic accumulating rice cultivars, safer for human consumption.

**Dr. Kamla Kulshreshtha** Senior Scientist NBRI and Joint Secretary ISEB attended the congress of Asian Pacific Association for the Study of the Liver (APASL) in Taipei, Taiwan during 16-19 February 2012, hosted by the Taiwan Association for the Study of the Liver (APASL).

**Prof. Sherwood Rowland**, the US chemistry professor who discovered that the Earth's protective ozone layer was being depleted by man-made chemicals, died recently. He was 84. Prof Rowland published a paper on the dangers of the chloroflourocarbons (CFCs) in 1974. His ideas were criticized at that time by other scientists and the chemical industry. But 20 years later, he won a Nobel Prize for his work. Rowland's calculations had led in the late 1970s to some restrictions being placed on CFCs which were then widely used as refrigerants, propellants in spray cans, solvents, and blowing agents to make foams. However, it was not until 1985 and the discovery that the chemicals were initiating a severe depletion, or "hole", in the ozone layer over Antarctica that impetus was given to a treaty to ban CFCs - the so-called Montreal Protocol.

### WELCOME NEW LIFE MEMBERS

**Dr. Alka R Upadhyay** is an Environment Specialist at DHI (India) Water & Environment Pvt Ltd., New Delhi.

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## DISTINGUISHED VISITOR TO ISEB OFFICE

Prof. Yash Pal Kalra, Retired Soil Chemist, Canadian Forest Service, Natural Resources Canada, Edmonton, Alberta, Canada visited ISEB office at NBRI Campus on 14.03.2012.

## Prof R.S. Ambasht – A tribute

Prof. R.S. Tripathi,

INSA Honorary Scientist NBRI & Advisor ISEB  
National Botanical Research Institute, Lucknow, India

The office bearers and members of International Society of Environmental Botanists are deeply shocked over the sad demise of Prof. Radhey Shyam Ambasht on January 2, 2012.

Prof. R.S. Ambasht was born on December 3, 1936 at Gyanpur (then a part of district Varanasi), Uttar Pradesh. He obtained his M.Sc. degree in Botany (1957) in first division with first rank from Banaras Hindu University, Varanasi and did his Ph.D. too from the same University on "Root habits in response to erosion, silting and inundation" under the supervision of Late Prof. R. Misra, FNA, the most distinguished plant ecologist of India. Prof. Ambasht started his teaching career in 1960 as a Lecturer in the Department of Botany at B.H.U., and later, he became Reader (1970) and Professor (1983) in the same Department. He also headed the Department (1988-1990) and was the Programme Coordinator, UGC Centre of Advanced Study in Botany (1989-1996). After his retirement as Professor in December, 1996, he continued his research and other academic activities as CSIR Emeritus Scientist, INSA Senior Scientist, INSA Honorary Scientist and as a BHU Professor Emeritus (Honorary).

During his long teaching and research career Prof. Ambasht completed several important research projects sponsored by different funding agencies on different aspects of ecology, produced 29 Ph.D.s under his supervision and published about 200 research and review papers in reputed national and international scientific journals and book chapters. Prof. Ambasht authored/edited several books. One of his most popular books "A Text Book of Plant Ecology" has undergone fifteen editions between 1969 and 2008, and his another book "Modern Trends in Environment and Pollution" has undergone four editions. He has edited three land mark multi-authored books viz., "Modern Trends in Ecology and Environment" (Leiden, The Netherlands), "Modern Trends in Applied Terrestrial Ecology" and "Modern Trends in Applied Aquatic Ecology" (both published from New York, USA). His researches on soil, water and nutrient conservation efficiencies of plants, pollution, and biological productivity of plant communities of wetlands, grasslands and forests, and nitrogen fixation by actinorrhizal nitrogen fixing tree species are extensively cited.

In recognition of his outstanding

researches in the field of ecology and environmental science, Prof. Ambasht was elected to the fellowships of Indian National Science Academy, New Delhi (FNA), The National Academy of Sciences, Allahabad (FNASc) and National Institute of Ecology, New Delhi (FNIE). He served on several important committees of the Govt. of India, universities and research organizations. He was closely associated with the activities of International Society for Tropical Ecology (served as its Secretary and Treasurer for four years each) and National Institute of Ecology (served as its President for three years). He was also conferred Birbal Sahni Gold Medal of Indian Botanical Society, Pranavananda Saraswati National Award of the UGC and the Platinum Jubilee Lecture Award of the Indian Science Congress Association. He delivered lectures and chaired sessions at many prestigious national and international conferences held in India and abroad and played a key role in promoting and popularizing ecological science. He was a distinguished teacher, an excellent researcher and a fine gentleman. In his passing away, India has lost a frontline ecologist and environmental scientist.

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## Cyanobacterial toxins: A growing environmental concern

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Cyanobacteria are morphologically diverse group of phototrophic prokaryotes. Eutrophication and climatic changes have increased the frequency and intensity of cyanobacterial blooms in freshwater bodies across the globe. Many of the bloom forming cyanobacteria produce toxic substances or cyanobacterial toxins thus posing serious threat to public health. Amongst the different categories of cyanobacterial toxins, microcystins (MCs) are the most prevalent in various freshwater bodies across the globe. Why do some cyanobacteria produce toxins? Whether toxins production confers any ecological advantage to the producer is still an open question, and their natural role remains an enigma. This article focuses on various aspects of cyanobacterial toxins especially the factors affecting cyanotoxin production, environmental fate of the cyanotoxins and their ecological role.

In the last 20 years, excessive pouring of nutrients and climatic changes have resulted in exuberant growth of cyanobacteria (a condition termed as 'cyanobacteria bloom') in freshwater bodies across the globe. Such blooms adversely affect the ecosystems and their biota, and are referred as 'CyanoHABs (Cyanobacterial Harmful Algal Blooms)'. CyanoHABs have far reaching effects on species interactions, microbial population, macrophyte population, aquatic biota, human health, ecosystem integrity as well as on industries and economies. Many of the surface-bloom forming cyanobacteria produce toxins (cyanotoxins) and present a potential risk to public health. In the present scenario, cyanotoxins emerge as a global environmental concern. Climate change has led to the geographical expansion of some toxic cyanobacteria.

### Cyanobacterial toxins or Cyanotoxins

Cyanobacteria produce a variety of secondary metabolites, some of which are toxic to invertebrates, mammals and other aquatic organisms. Toxic cyanobacteria are widely distributed, and have been recorded from every continent including Antarctica. Codd (1995) reported that 50-75% of the cyanobacterial blooms are toxic. However, toxicity varies at species and intra-species level, and with environmental conditions. A toxic cyanobacterium may or may not produce toxins. Likewise, it may produce more than one toxic compound. In freshwater habitats, *Microcystis* is the most common toxic cyanobacterium. Other genera include *Anabaena*, *Oscillatoria*, *Nostoc*, *Anabaenopsis*, *Planktothrix*, *Aphanizomenon*, *Cylindrospermopsis*, *Raphidiopsis*, *Lyngbya*, *Nodularia* and *Phormidium*.

Cyanotoxins vary widely in their chemical nature and structure, toxic potency, mode of action and organ affected (de Figueiredo et al., 2004). The most widely used approach to categorise cyanotoxins is based on the tissues affected (Sivonen and Jones, 1999). Accordingly, cyanotoxins are - hepatotoxins (microcystins and nodularins), neurotoxins (anatoxins and saxitoxins) and dermatotoxins (lipopolysaccharides). Hepatotoxins and neurotoxins have emerged as a major concern to the water supplying agencies due to high exposure risk and lethality, while lipopolysaccharides are produced by majority of cyanobacteria and have little health concern.

In natural freshwater bodies infested with cyanobacteria, microcystins (MCs) are the most prevalent cyanotoxins. One of the best-documented incidences of cyanotoxin related human casualties

is from Caruaru (Brazil). In February 1996, 126 patients became seriously ill after dialysis, of which 60 patients died in hospital. Later, it was found that water for dialysis came from a local reservoir infested with heavy cyanobacterial bloom (Jochimsen et al., 1998). Analyses of the reservoir water revealed the presence of microcystins. MCs have been reported in a drinking water supplying reservoir in the Brazilian-Amazonia region (Vieira et al., 2005). Nodularin has limited presence in cyanobacteria contaminated freshwaters.

In general, neurotoxins are less frequent in freshwaters; hence offer lesser exposure risk to that of MCs. Neurotoxins such as anatoxin-a, -a(s) and saxitoxins are alkaloids highly toxic to nerves. Anatoxin binds to the nicotinic receptor and acts as a postsynaptic depolarizing neuromuscular blocking agent. Acute exposure of anatoxin causes death within minutes to a few hours depending on the species and the amount of toxin ingested. Edwards et al. (1992) reported that dog poisonings in Scotland were due to the consumption of *Oscillatoria* containing anatoxin-a. Saxitoxin is a tricyclic alkaloid; it blocks neuronal transmission by binding to Na<sup>+</sup> channels in nerve cells. Resultantly, sodium gradient is stopped leading to muscle paralysis and death. Additional concern regarding the importance of cyanotoxins is reflected by their inclusion in the US Environmental Protection Agency (USEPA) drinking water contaminant list and in major reviews along with chemical warfare agents (Richardson and Ternes, 2005).

### Environmental factors affecting cyanotoxins production

Light and temperature are the two important factors influencing

cyanotoxins production in cyanobacteria. It was reported that under red and green light toxin production as well as toxicity (toxin to protein ratio) of the cyanobacteria increases compared to that of white light. Toxicity of the bloom also increases when light intensity decreases below  $40 \mu\text{E m}^{-2}\text{s}^{-1}$  (Utkilen and Gjørlme, 1992). Optimum temperature for cyanotoxins production is 20-25°C (Watanabe and Oishi, 1985). Utkilen and Gjørlme (1995) studied the effect of iron on toxin production by *Microcystis aeruginosa*. Jiang et al. (2008) used statistical approach to study the effect of different environmental factors (light intensity, temperature and iron, etc.) on the growth and MCs production by *Microcystis aeruginosa*. The intracellular MC content is related to N:P ratio of the medium. Level of cyanotoxins (extracellular) in a water body shows seasonal fluctuation depending upon the physico-chemical factors of water bodies and cyanobacterial species dominating at particular time. Kurmayer (2011) studied the effect of physiological factors on the production of the toxic heptapeptide MC from *Nostoc* sp. strain 152 and found that MC content per cell showed a maximum under P-PO<sub>4</sub>-reduced and irradiance-reduced conditions. Both intra- and extracellular MC concentrations were negatively related to P-PO<sub>4</sub> and irradiance. Joung et al. (2011) measured the dynamics of toxic and non-toxic cyanobacterium *Microcystis* in correlation with environmental factors using molecular techniques.

#### Environmental fate of cyanotoxins

Cyanotoxins are either membrane-bound or occur free within the cells. They are released passively in the medium with the aging and death of cyanobacterial population. During early growth phase, cyanotoxins remain inside the cells and released in the environment at late-log growth phase or after cell lyses. Active release of toxins may also occur from young growing cells. Watanabe and Oishi (1983) investigated the toxicity of a cultured

strain of *M. aeruginosa* during different growth phases (lag, exponential and stationary phases). They found maximal toxicity during late exponential or at stationary growth phase. Release (concentration) of cyanotoxins in the medium also increases with various water treatment practices.

In natural ecosystems, released cyanotoxins undergo photo- and bacterial degradation. In addition, a significant fraction of released cyanotoxin becomes unavailable (for exposure) due to adsorption over the soil surfaces depending upon environmental factors, soil property and total organic content of the soil (Edwards et al., 2008). Degradation is generally preceded by a lag period of about 9 to 10 days. MC-LR is stable in waters with high pH and temperatures, but readily biodegraded in ambient waters with a half-life of about one week (Codd and Bell, 1996).

#### Ecological role of cyanotoxins

Though substantial progress has been made on the toxicity of cyanotoxins, a little is known about the benefit it provides to the producing organisms. Most of the organisms used in toxicity tests (invertebrates and mammals) are neither natural enemies nor consumers of cyanobacteria. Ecological and physiological role of cyanotoxins remain an enigma. In natural ecosystems, MCs are supposed to be involved in metal ion chelation (Humble et al., 1997), intraspecific signaling (Dittmann et al., 2001), and protection against predators such as zooplankton (Rohrback et al., 2001) and in allelopathic interactions against competitive photoautotrophic organisms (Pflugmacher, 2002). Allelopathy refers to an inhibitory or stimulatory effect of plants and microorganisms on other plant species or microorganisms through the release of organic compounds. Such interactions occur in all aquatic habitats including phytoplankton communities. Phytoplankton allelopathy alters succession and the pattern of species dominance (Prince et al., 2008). However, information related to

allelopathic role of cyanotoxins on associated bacteria (phycospheric biota) and other algae are meagre.

Cyanotoxins have adverse effect on other aquatic biota. Use of cyanobacteria infested waters for irrigation is perceived as a threat to the yield and quality of crop products (Bibo et al., 2008). Symptoms of MCs toxicity may result directly due to toxic fraction and indirectly involving oxidative damage induced by the toxin. Järvenpää et al. (2007) found that exposure of MCs to broccoli (*Brassica oleracea*–Greenia Hg) seedlings had mild (<10%) growth inhibitory effect, while mustard (*Sinapis alba*) seedlings remained unaffected. MCs exposure inhibits superoxide dismutase and peroxidase activities in rape (*Brassica napus* L.) and rice (*Oryza sativa* L.) seedlings resulting in oxidative damage to the plants (Chen et al., 2004). A substantial proportion of MCs present in the irrigation water is retained by the plants, and accumulates differentially in various parts, maximal in root tissues (Järvenpää et al., 2007).

Growth inhibitory effect of MCs has also been reported in *Phaseolus vulgaris* L. and *Solanum tuberosum* L. (McElhiney et al., 2001), *Lepidium sativum* L. (Gehring et al., 2003), *Brassica napus* L. and *Oryza sativa* L. (Chen et al., 2004), *Brassica oleracea* var. *italica* and *Sinapis alba* (Järvenpää et al., 2007), *Spinacia oleracea* (Pflugmacher et al., 2007), *Pisum sativum*, *Lens esculenta*, *Zea mays* and *Triticum durum* (Saqrane et al., 2008). Uptake and translocation of cyanotoxins into edible plant parts could expose consumers to medically relevant toxic concentrations. Bioaccumulation of cyanotoxins in food chain and their effect on human health is an important issue.

#### The Microcystins (MCs)

MCs are cyclic heptapeptides consisting of five common amino acids and two variable L-amino acids. Based on single letter code classification of amino acids, variables of MC have been given different names depending upon the amino acids present at 2 and 4 positions (variable positions) of the structure. For example, MC-LR (the most common

cyanotoxin found in water supplies around the world) contains amino acids Leucine (L) and Arginine (R) at the position 2 and 4, respectively. The unusual aromatic amino acid Adda, a common constituent of all MCs is solely responsible for the toxicity of MCs. It is a common constituent of all MCs. More than 80 congeners of MC are known, variations in the amino acids at other positions also give rise to various MC variants.

During bloom formation, different variants of MCs may be produced causing repeated but varied poisoning in animals visiting the water bodies. The levels and relative proportions of MC variants are regulated by external growth stimuli. World Health Organization (WHO) has set a threshold

limit ( $1 \mu\text{g l}^{-1}$ ) for MC-LR in drinking waters. The International Agency for Research on Cancer (IARC) has classified MC-LR as a possible human carcinogen (group 2B) (IARC, 2006). Chronic consumption of MCs present in tap waters (at lower doses) could be a substantial risk factor for liver and colorectal cancer (Hernández et al., 2009). MCs inhibit protein phosphatase particularly, type-1 (PP1) and type-2 (PP2A) (members of protein serine/threonine phosphatase family) in liver cells causing rapid reorganization of all three major cytoskeleton components, microfilaments, microtubules and intermediate filaments.

**Concluding remarks and future perspectives**

Cyanobacterial toxins pose a threat to the water bodies and due to changing climate and increasing environmental pollution they are now considered as serious environmental concern. To minimize the risks associated with cyanotoxins exposure, there is a need to monitor toxin producing cyanobacterial species, and environmental factors responsible for the production of cyanotoxins. The physical and chemical parameters regulating the toxin production should be identified in order to develop better understanding of the mechanisms controlling toxin production. Understanding the regulatory factors will lead to the development of means to control the harmful cyanobacterial blooms.

## Cell-Telephony and Ecological Concerns

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With the advancement of information technology and electronic communication, the use of mobile-phone technology has escalated enormously in the recent past. There is huge mushrooming of cell-phone users` and hence the towers emitting electromagnetic frequency radiations (emf-r) in the environment. Other than TV, Radio and Cell-phone towers, other forms of communication technology (cordless phones, fax machines) and the use of internet services and satellite has also boosted emf-r cloud in the environment. In this whole scenario if emf-r has harmful effects then it will definitely affect individuals' health other biota, and thus ecology.

### Basics

Radiation is a natural component of earth's atmosphere. Emf spectrum could be divided into ionizing (eg x-rays, UV etc.) and non-ionizing (eg. emitted from high voltage power-lines, radio and TV towers, Photostat machines, cell-phone towers etc.). The non-ionizing

radiations being of relatively longer wavelength have relatively less power, thereby cause no immediate damage. Presumably for this reason, these are mistakenly assumed to be harmless. Modern man under the umbrella of development has infused the whole planet earth under the enormous cloud of such non-ionizing radiations. The intensity of these radiations are so much and so persistent now that every life-form of the urban biosphere is exposed to it. These radiations affect in dual ways, (a) thermal effect (since they generate heat on the surface, body or tissue they fall on and increase the temperature of the surroundings) and (b) non-thermal.

In the case of high tension power lines, the emf-r generated effects are localized and limited, unlike those from cell-phones and their towers, which are almost everywhere.

For any action of emf-r on biological systems, it is the power density (a product of strengths of electric and

magnetic fields measured in  $\text{W/m}^2$ ) that reduces with distance, and the Specific Absorption Rate (SAR). SAR depends on cell-phone wattage and body tissue. It will also depend on the conductivity, body weight and surface area of the absorptive system. For instance, it is higher in children than in adults. Service providers are required to report their SAR to regulating agency. As per Federal Communications Commission (FCC), 1999 the upper limit for SAR is  $1.6\text{W/Kg}$  body wt. This is with respect to man. One wonders the limits for insects and microbes. Further, this exposure depends on product of power density and duration of exposure apart from the distance and absence of obstacles. Its strength decreases with increasing distance, although the total energy radiated from the source remains the same. Insects, birds and microbes have no such protective obstacles like houses and buildings.

People love wireless communication. Cell-phone industry is therefore,

RADIO WAVE EXPOSURE STANDARDS in a few countries	Exposure level (W/cm <sup>2</sup> )	RADIO WAVE EXPOSURE STANDARDS in a few countries	Exposure level (W/cm <sup>2</sup> )
New South Wales, Australia	0.001	Australia	200
Salzburg, Austria (for pulsed transmissions)	0.1	New Zealand	200-1000
Russia	2-10	Japan	200-1000
Bulgaria	2-10	Germany	200-1000
Hungary	2-10	United States	200-1000
Switzerland	2-10	Canada	200-1000
China	7-10	United Kingdom	1000-10,000
Italy	10	source : <a href="http://www.goodhealthinfo.net/radiation/radio_wave_packet.pdf">http://www.goodhealthinfo.net/radiation/radio_wave_packet.pdf</a>	
Auckland, New Zealand	50		

thriving and progressing. Common man does not understand ecological principles and thus the consequences for posterity.

FCC that regulates the standards for such emissions uses thermal effects of the Radio-frequency(RF) radiations as the parameter of evaluation. It is here that the basic error seems to have crept into decision making. The thermal (and non-thermal) effects caused by each individual installation or gadget may be negligibly small, the production and use of RF generating devices is so huge and continuous that the cumulative impact has assumed dangerous proportions today.

Chandigarh, a very small city, with an urban area of 78 sq Km has 408 cell-phone towers. In a preliminary survey the range of emf-r was found to be between 564 and 97926  $\mu\text{W}/\text{m}^2$  as against the presumable permissible limit of  $10 \mu\text{W}/\text{m}^2$

Even if cell-phone is not in use or not in that area, the biota including the soil ecosystem is continuously exposed to its emf-r. The cumulative effect of daily exposure is expected to be enormous and devastating in long run. Those who use cell-phone handsets are getting voluntarily exposed to emf-r while those not using it get involuntary exposure to such radiations that too continuously. Many articles available in literature try to link the emf-r to cancer of various types, behavioral change, immediate

memory loss, fatal tissue damage, DNA strand breakage, suppression of endocrine and immune system, cataract of eyes, altered blood chemistry.

#### Standards & Guidelines

Apart from ICNIRP (International Commission on Non-Ionizing Radiation Protection) - an independent scientific commission established by the International Radiation Protection Association, there are national and international bodies like FCC of USA; IEEE - Institute of Electrical and Electronics Engineers; NRPB - National Radiological Protection Board (UK); NCRP - National Council on Radiation Protection and Measurements which are working to maintain the emf-r standards. Surprisingly, although the ecological principles and the biological systems anywhere are similar, the standards and guidelines vary. Several states have set their own national standards for exposure to emf-r. However, they vary by a factor of over 100. Strikingly for many developing nations there are no standards set.

The decision makers seem to have set standards keeping man under focus while ignoring other forms of biota under consideration. Usually, commercial interests influence the decision making. ICNIRP considered thermal effects while making its recommendations and commercial interests. Some nations finding it economically beneficial adopted it.

Same mistake India is likely to commit. Cell-phone industry and service provider groups, being monetarily strong, influence in decision making apart from modifying and interpreting the existing laws.

Guidelines normally set for average population cannot take care of the thresholds of a minority of sensitive people or low weight children or pregnant mothers. Air pollution guidelines, for example, are not focused on the needs of asthmatic patients. Similarly, emf-r guidelines are not designed to protect heart patients with implanted pacemakers that have low limits of emf-r disturbance.

#### Controversial perceptions on health effects

Controversies and public debates on the possible effects of RF radiations emitted from the cell-phones or their base station (that receive and transmit the signals) and transmitters on human health and other biotic components, soil structure and dynamics, apart from the whole terrestrial ecology have erupted.

On one side cell-phone companies and big industrial houses are giving impression that these wireless technologies are very safe, as cigarettes companies were saying 40 years ago but now total concept has changed with the findings that cigarettes are carcinogenic. They also argue that there is no



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technology that is free from any hazard. The radio stations and other such installations that are in use for the last many decades have not shown any perceivable direct or indirect effects on human health, other biota or even the ecology. According to them there is nothing wrong with the technology if used with recommended precautions. In nature there are many forces operative simultaneously; in the absence of any prior studies (in favor or against) evidencing the impact of emf-rs exclusively from the cell-phony, there seems no justification of the accusation against the technology or the gadget.

Environmentalists on the other hand often argue that for general public the exposure levels arising from the handset phones held close to the ear adversely affect the brain, leading to short-term memory loss, headache, brain-tumors, sleep disorders, cancers, depression and tiredness and uveal melanoma of eye etc. These radiations cause thermal and non-thermal impacts on the biota they fall on. In addition, these electronic gadgets indirectly affect personal safety of the public by increasing risk of accidents, hazards of waste pile-up and damage to the buildings from the towers in urban habitation.

Microwave ovens work on 2.45 Ghz frequency to cook food. Cell-phones use the same/very near high frequency waves to communicate with cell-phone towers to connect the phone call. However, the intensity of the cell-phone waves is much weaker. Microwave on high power cooks food quicker than if set at low power. Cell-phones and their transmission towers may have the same slow effect. Thermal effects of emf-r from cell-phone are well established. Long-term exposure to high intensity emf-r causes Microwave syndrome and health hazard. In Moscow, low intensity microwave bombardment  $5 \text{ W/cm}^2$  for 9 hours/day, from low intensity radar from 1950-1970 made on US embassy led three U.S. Ambassadors to death and also caused cancer in 30 women and children.

Several metabolic events in the body

itself also generate currents. Low frequency cell-phone emf-r also induces currents in the living tissue. The cells/tissues fail to detect such induced currents below the background level. Therefore, at low frequencies, exposure guidelines ensure that the level of current induced by electromagnetic fields is below that of natural body currents.

#### **Impacts on Biota**

Cell-telephony is a new technology incidentally with no proper long-term scientific studies reported on health effects, such as cancer. The data available that form the basis for guidelines or standards set by different countries are based on the thermal effects due to similar emf-r from the high tension wires passing through the agricultural fields.

Trees exposed to high frequency waves convert these absorbed radiations into electrical currents which flow into the soil leading to change in pH and soil temperature.

In an interesting study in the University of Leeds UK as reported by National Geography News (July 21, 2006), while comparing a million records on wild honeybees from over hundreds of sites in UK and the Netherlands before and after 1980, a dramatic decline in the diversity of bees to the tune of 80% of the sites was noticed. Likewise, in Florida, a veteran beekeeper David Hackenberg lost 364 of 400 colonies / beehives. Such disappearance was noticed in 24 other states also. The number of beehives dropped from 12000 to just 1000. This led to an emergency working group to look for the possible reasons including pathogen (invasive mite, fungal/bacterial/viral) attack. However, nothing conclusive except widespread failure of bee's immune system was expected. However, if it was true, mass death rather than disappearance would have been reported. The exodus of honeybees could have been because of emf-r cloud rather than microbial attack.

Similarly, drastic decline in the populations of hoverfly – another

pollinator in UK has become a source of worry for naturalists, horticulturists, agriculturists and biodiversity conservationists alike. This has consequently led to decline in insect-pollinated wild flowers with no effect on wind-pollinated flora. The reason, here also remains elusive.

Likewise, House-sparrow (*Passer domesticus*), a cosmopolitan bird from Britain had been till recently a bird of every city, town or village in India. Since 1990s it has become a bird of rare visibility. The situation is not so only in India but the world over, including urban Europe, the place of its origin. As the name suggests, this small omnivorous lived in and around buildings built by man and away from the forest carnivores. Many reasons, like use of pesticides or changed building architecture are attributed to the sudden disappearance of this man-friendly bird. But disappearance in a short span is not explained by such reasons. Nevertheless, the mushrooming of widespread cell-phone emf-r cloud in urban world coincides with the disappearance of house-sparrow. In general, the avian fauna being very sensitive could have been pushed to the edges and in area of hostile and unacceptable niches.

Being visible and man-friendly species, the house-sparrow caught our attention as disappearance of honeybees because of economic loss. One can speculate that densities of many micro-organisms of soil or small wild arthropods, annelids etc. in urban habitation overloaded with cell-phone towers/electro-clouds which might also have abandoned and remained unnoticed. In the absence of any inventory or baseline data on ecological indices, before the installation of cell-telephony in urban areas, such loss, if any, cannot be proved. Since the widespread use of cell-phone is about 20 years old, there has not been enough time for studying the long-term exposure effects on health of man and other biota, so the ecology.

We have experimentally proved that active cell-phone generated emf-r

retards seed germination and subsequent seedling growth, reduces root differentiation and damages root hair surfaces, causes abiotic stress and affects metabolism in comparison to respective controls. Likewise, the brain differentiation in chick embryos of fertilized hen eggs exposed to cell-phone emf-r for 4 hours gets affected.

The brood size of queen honeybee, pollen carrying capacity and bee return gets reduced under the influence of cell-phone generated emf-r.

#### **Environmental Consequences:**

We have laws against air, water and noise pollution but ignored on radiofrequency radiations in the country. The latest efforts are cosmetic.

On account of increasing e.m.f-r clouds, concerns of health effects on man and other biota apart, environmental consequences on account of global warming and biodiversity loss, both related and on focus of world's most important conventions, are weighing heavy on ecologists' worry.

### **Remediating soil lead with fish bones**

Excessive blood lead can cause delays in neurological and physical development in children, and high blood pressure, kidney problems, and cancer in adults. Lead added to house paints and fuels can linger on for decades in urban areas, and children can be exposed through the soil in yards and playgrounds.

Now researchers are using fish bones and other phosphate-rich amendments to remediate lead in urban soils. Fish bones are made of the phosphate mineral apatite, which readily combines with lead to form pyromorphite, a stable crystalline mineral that can't be absorbed by the human digestive system. Recent studies have shown that phosphates can also immobilize other potentially toxic metals, including copper, zinc, cadmium, and uranium.

Some researchers favour the use of organic amendments such as composts that are high in iron, as well as phosphates. Whereas phosphates transform lead into other compounds, iron compounds physically bind with lead through adsorption, a process in which one compound adheres to the surface of another. When lead adsorbs to iron based compounds, these are no longer soluble and cannot be absorbed through the lining of small intestine, without realizing it, man urban gardeners are remediating their soils by adding fertilizers and compost that

contain phosphate and iron. Lead contamination is a pervasive problem, and the traditional ways of responding are neither economically nor ecologically sustainable.

Using fish bones also avoids ecological issues involved with mining phosphates, and the bones will not dissolve but will remain in place to stabilize metals for a very long time. Phosphate immobilization is not recommended for sites with lead levels above 4,000 ppm, such as those heavily contaminated with lead paint.

Bones from weight-bearing animals, such as cattle, contain the same chemical form of apatite as do fish bones but in a highly crystallized form that combines less readily with metals.

**Source: Kris S. Freeman,  
In Environmental Health Perspectives**

### **Paper cups for hot drinks**

A wide range of paper cups from single-wall plain paper cups to latest triple wall hot cups are used for hot drinks like tea and coffee. The primary difference is the insulating properties of the specific cup type. Plain white single wall hot cups are perfect for warm drinks; however, a cup used piping hot coffee would be rather uncomfortable to hold. Due to their single-wall construction there is no additional layer to insulate the heat of the beverage. Double wall and hot ripple cups are specifically designed to withstand much high temperatures, the

dual layers work in a similar way to a thermos flask; trapping air and isolating the user's hand from hot drinks.

Recent findings suggest that polystyrene cup is the better insulator, with the paper cup in second place, while a plastic cup has inferior insulating properties. However, some companies are using double-layered disposable paper cups with an air pocket in between to trap the heat and provide an extra layer of insulation.

Of late, there has been a lot of emphasis on the use of biodegradable hot drink paper cups as traditional PE coated hot drink cups use non-renewable materials for their inner lining. Obviously this lining is required to make the cups watertight, so the only way to make paper coffee cups more eco-friendly is to replace the PE lining with eco-friendly alternative. The new range of biodegradable paper cup use a PLA (Polylactic acid) lining instead of the traditional polyethylene coating. Previously PLA has been mainly used for glasses designed for cold drink as PLA would begin to dissolve if it touched a hot drink. The latest varieties are temperature treated to make them suitable for use with piping hot drinks; this advance has made the coating appropriate for use with paper coffee cups.

### **Desert plant extracts to cure date disease**

An Algerian research team has discovered four poisonous plants from

the Sahara desert which have proven effective in killing a fungus that is ravaging date palms in Algeria and Morocco – raising hopes that a cure might finally have been found for the century-old problem. The fungus, which spreads mostly through root contact, can currently only be tackled by isolating healthy palms from diseased counterparts. The disease known as Bayoud disease has been termed a “plague to Saharan agriculture” by FAO. The research team found that the extracts from plants successfully inhibited growth of *Fusarium oxysporum* forma specialis *albedinis*, which causes Bayoud disease. Most desert plants produce substances that help them adapt to their environment and fend off diseases.

Bayoud inflicts serious damage on the production of dates in North Africa, it has nearly wiped out many of the best strains of the tree that yield high quality dates. The new natural treatment could help increase production of dates in the region while decreasing their production costs. The new approach would be cheaper than current approaches to tackling the disease.

According to the FAO, the Arab states are the main producers and exporters of dates. Around 70% of the 120 million date palm trees are found in Arab countries, with an annual production value of more than US \$ 1 billion. The disease continues to advance relentlessly to the east and in due course it will pose serious problems of human, social and economic nature to other date-producing areas of the world. The new natural treatment could help increase production of dates in the region while decreasing their production cost. The new approach would also be cheaper than current approaches to tackling the disease.

**Toufik Bougada**

**In Science and Development Network**

### Plants back to life after 30,000 frozen years

Scientists in Russia have grown plants of *Silene stenophylla* from fruit stored away in permafrost by squirrels over 30,000 years ago. The fruit was found in squirrel hibernation burrows on the banks of Kolyma River in Siberia. This is the oldest plant material by far to have been brought to life. Prior to this, the record lay with date palm seeds stored for 2,000 years at Masada in Israel. All squirrel burrowing were found at depths of 20-40 m from the surface and located in layers containing bones of large mammals as well as plant remains. The presence of vertical ice wedges demonstrates that it has been continuously frozen and never thawed. Accordingly, the fossil burrows and their content has never been defrosted since burials and simultaneous freezing. While the scientists' all attempts to germinate mature seeds failed, they succeeded in propagating placental tissue of fruits in petri dishes in the laboratory. This is by far the most extraordinary examples of extreme longevity for material from higher plants.

It is surprising that viable material was found from this placental tissue rather than mature seeds. The scientists believe that the tissue cells are full of sucrose that would have formed food for the growing plants. Sugars are preservatives; they are even being researched as a way of keeping vaccines fresh in the hot climates without the need for refrigeration. So it may be that the sugar-rich cells were able to survive in a potentially viable state for so long.

*Silene stenophylla* plants still grow on the Siberian tundra; and when the researchers compared modern-day plants against their resurrected cousins, they found subtle differences in the shape of petals and the sex of flowers.

The scientists suggest that research of this kind can help in studies of evolution, and shed light on environmental conditions in past millennia. But perhaps the most exciting suggestion is that it might be possible, using the same techniques, to raise plants that are now extinct.

**Source: Richard Black**

**Environment Correspondent BBC News**

### Green walls to improve urban environment

Vertical gardens are cropping up all over cities these days, transforming drab urban facades into vibrant jungles of colour. These lush expanses have found their way onto the sites in recent years revitalizing public buildings, hotels, offices and even multi-storey car park in Netherlands.

Biotecture Ltd. U.K. have developed a modular hydroponic system – where plants sit in a soil-free set up with nutrients delivered through irrigation channels – can be retrofitted to just about any wall. A recent creation erected on the wall of an underground station in central London has improved the air quality. The 200-square meter wall, one of the grimmest thoroughfares of London is being monitored by the scientists of Imperial College London. They have taken initial samples and going at regular intervals to take leaf samples. The leaves are then washed to see how much particulate matter has adhered to them. The leaves also have an electrostatic charge that also attracts particles. Researchers believe that green walls in urban canyon environment (areas where walls are higher than the width of the road separating them) are more effective than trees at collecting particles because the way the wind eddies around and then moves down the wall.

**Source: Mathew Knight (CNN)**



## CONFERENCES

### **International Conference on Environment, Energy and Biotechnology (ICEEB 2012)**

5 - 6 May 2012; Kuala Lumpur, Malaysia

Contact name: Conference Secretary

Email: iceeb@cbees.org

Website: <http://www.iceeb.org/>

### **1st National Symposium and Workshop on Environmental Science**

7 - 8 May 2012 Manila, Philippines

Contact Name: Dr. Perez

Website: [http://](http://www.isem.upd.edu.ph/sympmain.html)

[www.isem.upd.edu.ph/sympmain.html](http://www.isem.upd.edu.ph/sympmain.html)

### **3rd International Conference on Environmental Research and Technology (ICERT 2012)**

30 May-1 June 2012, Penang, Malaysia

Contact name: Mardiana I. Ahmad

E-mail: [icert.usm@gmail.com](mailto:icert.usm@gmail.com)

Website: <http://icert2012.webstarts.com>

### **The 2nd International Conference on Algal Biomass, Biofuels and Bioproducts**

10-13 June, 2012, Westin San Diego, USA

Contact: Charlotte Alman

Senior Conference Project Lead

Email: [customerservice-algal12@elsevier.com](mailto:customerservice-algal12@elsevier.com)

### **XII International Symposium for Environmental Geotechnology, Energy and Global Sustainable Development**

27-29 June, 2012, Los Angeles, California, U.S.A.

Contact name: Gustavo Borel Menezes

Website: <http://www.isegnet.org/2012/>

### **4th International Congress on Arsenic in the Environment**

22 - 27 July 2012 Cairns, Queensland, Australia

Contact name: Leigh Goss

Website: <http://www.As2012.com.au>

### **12<sup>th</sup> National & 3<sup>rd</sup> International Conference of Botany**

1-3 September 2012; Qaid-i-Azam University, Islamabad, Pakistan

Contact: Prof. Dr. Zabta Khan Shinwari

E-mail: [shinwari2008@gmail.com](mailto:shinwari2008@gmail.com)

Website: <http://www.pakbs.org>

### **8th International Congress on Education in Botanic Gardens**

12-16 November 2012; Ciudad de México, Mexico

E-mail: [BGCI@jangomail.com](mailto:BGCI@jangomail.com)

### **13th International Symposium on Environmental Issues and Waste Management in Energy and Mineral Industries**

28 - 30 November 2012, New Delhi

Contact name: Dr. Raj Singhal

Website: <http://www.mpes-cami-swemp.com/intro.html>

### **2nd International Conference on Food and Environment**

22 - 24 April, 2013; Budapest, Hungary

Contact: Irene Moreno Millan

Conference Secretariat

Wessex Institute of Technology, Ashurst Lodge, Ashurst

Southampton, SO40 7AA

E-mail: [imoreno@wessex.ac.uk](mailto:imoreno@wessex.ac.uk)



## BOOKS

### **Fifty Plants That Changed the Course of History**

By Bill Laws

F&W Media International/David & Charles 2010

Price: £ 12.99

### **Food and Environment**

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C.A. Brebbia

2011

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