



# ENVIRONNEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

*Newsletter*

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## HAPPY NEW YEAR 2005

*President and members of the  
Executive of International Society of  
Environmental Botanists Wish a  
very Happy, Prosperous and  
Fruitful New Year to all  
patrons and members of  
ISEB & valued readers  
of 'Environews'*

- 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** : [isebnbrilko@satyam.net.in](mailto:isebnbrilko@satyam.net.in) □ **Website** : <http://www.geocities.com/isebindia/index.html>



## LETTERS

It was my great pleasure to get hard copy of latest issue of ENVIRONNEWS Newsletter at Vancouver, Canada where I had recently moved from Nepal. It was full of interesting articles and News and Views section, as in previous issues featured highly relevant information for an environmentally, socio-economically and politically sustainable development.

Information on ICPEP-3 to be held next year at Lucknow is a piece of welcome news. You deserve high appreciation for the healthy growth of ISEB. Despite my interest to attend, I am not sure at this time. I am interested to know about potential sponsors from your side. Personally, I may communicate to Dr. M. Munawar, based at Toronto for any possible support.

I am trying to settle here and get into track of professional job of an environmental botanist/wetland ecologist. I will promote the cause of ISEB such as by contributing a photocopy of the Newsletter at public/University libraries and conveying information of ICPEP-3 to relevant Professors/academia. Please, inform me of any relevant support from my side. I will try to co-operate.

Best wishes to you and all distinguished members of the organizing committees of ICPEP-3.

**Dr. Purushottam Shrestha**

9126-138 St., Surrey, BC Vancouver #V 7Y 5 Canada

e-mail: spuru@hotmail.com

We are very interested in Third International Conference on Plant & Environmental pollution (ICPEP - 3), especially in Plant Response to Environmental Pollution.

Would you be so kind to send us more details how to participate and the most important deadlines. Is it possible to receive some sponsorship for young scientists and M.Sc. students?

**Prof. A. Uzunova**

Department of Botany, Faculty of Biology, Sofia University,  
BU-1000 Sofia (Bulgaria)

e-mail: uzunova@biofac.uni-sofia.bg

With this e-mail we wish to announce some important issues on the upcoming **17th International Botanical Congress (IBC 2005)** to be held from 17 to 23 July 2005 in Vienna, Austria (nomenclature sessions 12 to 16 July). Please consult our congress website <http://www.abc2005.ac.at/> for the following online services:

The Second Circular containing the preliminary program and other information; Abstract submission (deadline 31 January 2005); Registration (deadline for reduced fee 15 April 2005); Accommodation; The updated Program; General & additional information. Please distribute this information to all members of ISEB, who might be interested in attending the IBC 2005.

**Dr. Josef Greimler**

Secretary-General, IBC 2005, Institute of Botany  
University of Vienna, Rennweg 14, A-1030 Vienna, Austria

e-mail: office@abc2005.ac.at

I am glad to see that the list of pre-registered scientists for ICPEP-3 is growing every day. I am trying to contribute to the publicity work by getting the conference announced in as much calendars of events as possible. It is now announced by the websites of the University of Hohenheim/Centre of Agriculture in the Tropics and

Subtropics, the German Ecological Society (GfÖ) and recently by the Federal Ministry of Education and Research under:

[http://www.fona.de/de/4\\_serviceangebote/termine/index.php?we\\_objectID=759](http://www.fona.de/de/4_serviceangebote/termine/index.php?we_objectID=759)

**Dr. Andreas Klumpp**

Life Science Center (Section 3) c/o Institute for Landscape and Plant Ecology (320), August-von-Hartmann-Str. 3, University of Hohenheim, D-70593 Stuttgart, Germany

e-mail: aklumpp@uni-hohenheim.de;

This is to bring to your kind attention that we have shifted to our new home and my new residential mailing address will be as under: SHIVISHA, 1/19 Vipul Khand, Gomti Nagar, Lucknow-226010, India (Phone: +91-522-2392919)

**Dr. Nandita Singh**

Scientist, Eco-Auditing,  
Environmental Sciences Division,

National Botanical Research Institute, Lucknow-226001, India.

e-mail: nanditasp@hotmail.com;

Uganda Wetlands & Resource Conservation Association (UWRCA) is engaged in mobilizing the resource end users and owners into viable working groups and legalizing their status across the Country. We recognize you as Environmental friendly cadre by conviction.

We are pro-your programme or project, we are impressed about your programme through ICT beyond words can say. Indeed we have time for this programme and our problem is that we have limited source of funds accountable to the UWRCA members. Is it possible to get a sponsor for Air ticket and upkeep facilities for participation in your Conference?

The programmes/projects developed in UWRCA based on the history of Uganda, Africa at large and World wide should be used as a model and as a resource for Research, Trade, Science and Technology education, lobbying and advocacy among the interested Government and Community projects or programme donor sponsors. Uganda Government and identified donors have interests in UWRCA and are planning to fund our cause.

It is in this context that you consider our status.

We trust and hope that this communication to you/your good organization will dully attract your esteemed interest and attention.

**Dr. Milton Egesa**

Uganda Wetlands & Resource Conservation Association  
(UWRCA) Luwero University, Uganda.

e-mail: uwrca@yahoo.com

Two Indian scientists viz. Dr. Venkat Gunale and Dr. D.B. Chaugule of the University of Pune in India collaborated with us in a recent marine algal survey carried out in the Southern Coast of Sri Lanka. During the survey, we identified 11 new records for the island. We anticipate further collaboration in the future.

We wished to share above information with the readers of **Environews**.

**Dr. Morley P. de Silva**

Professor of Botany & Director Graduate Studies,  
University of Ruhuna, Maharagama, Sri Lanka

e-mail: morley@bot.ruh.ac.lk

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## NEWS FLASH

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**P**rof. Mohd. Iqbal, Head, Department of Botany, Hamdard University, New Delhi and a **Councilor** of **ISEB** attended 24<sup>th</sup> Annual Session of the Academy of Environmental Biology and “*National Symposium on Biodiversity, Biotechnology and Environmental Toxicology in the new Millennium*” at the Institute of Science, Mumbai from 22 to 24 November, 2004, where he was awarded **Archana Medal** an *Environmental Research Oriented Award* by **The Academy of Environmental Biology**. On this occasion he delivered the Dr. V. N. Sahay memorial lecture on “Does the environmental degradation influence the therapeutic properties of a medicinal plant?” He was also one of the judges for the ‘Best Research Paper Medal’ Competition session in this symposium.

**D**r. M.R. Suseela, Scientist & Group Leader of Phycology Section and a Life Member of ISEB attended XI International Conference on Harmful Algal Blooms held in Capetown, South Africa during 14-19 November 2004. She presented a paper entitled “Harmful, Algal Blooms of Peninsular Coast of India”.

**D**r. Amit Pal, Lecturer, Institute of Environment & Development Studies, Bundelkhand University, Jhansi and one of the **Editors** of **Environews** attended 24<sup>th</sup> Annual Session of the Academy of Environmental Biology and “*National Symposium on Biodiversity, Biotechnology and Environmental Toxicology in the new Millennium*” at the Institute of Science, Mumbai from 22 to 24 November, 2004. He also Co-chaired the BRPM (Best Research Paper Medal) Competition session in this symposium.

**P**rof. Chitralkha Chatterjee of the Botany Department of Lucknow University & a Life Member of ISEB has been awarded the “Dr. R.B. Ekbote Award” by the Maharashtra Association for the Cultivation of Sciences, Pune, for her meritorious services and remarkable role in applied and basic research in the field of plant nutrition. This is the sixth award bagged by Ms. Chatterjee for her research on micronutrients. This is a rare distinction for her because she is working in a non-agricultural university.

**D**r. R.D. Tripathi, Scientist & Group Leader, Ecotoxicology & Bioremediation

Group, NBRI, Lucknow and Editor ‘*Environews*’, delivered a lead lecture “Strategies for phytoremediation of heavy metal pollution involving phytochelatin by the plants” in the International Conference on Soil and Groundwater Contamination, Risk Assessment and Remedial Measures, December 8-11, 2004 organized by National Geophysical Research Institute, Hyderabad, India.

**T**he Eco-education Division of the National Botanical Research Institute (NBRI), Lucknow organized an interactive meeting for women of Kalli village, Rae Bareilly Road, as a part of the sponsored project of the Department of Science & Technology (Department of Nutritional Garden by women folk for household food security). The Division is working in this village since last many months. It has motivated rural women in this village to raise home gardens with selected vegetables for supplementing and complimenting the nutritional requirement of the household. The scientists of Eco-education Division under the leadership of Kamla Kulshreshtha used to make regular visits to the village to motivate and to provide them with expert guidance for raising the home garden.

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## NEW LIFE MEMBERS

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**Mr. Deepak Wahal** is working at the National Botanical Research Institute, Lucknow and is associated with the Economic Botany Information Service (EBIS) of the Institute. He is an Editor of NBRI Newsletter – a quarterly house journal and Applied Botany Abstracts (ABA), a quarterly abstracting journal and other publications of the Institute. He has visited U.K. to attend the International Graduate Summer School (IGSS) in Librarianship and Information Science, held at the College of Librarianship Wales, Aberystwyth, U.K.

**Dr. Ms. Vartika Rai** is working as a Scientist in the Society of Ethnobotanists, Lucknow on a Department of Science & Technology sponsored project for women scientists entitled “Development of SOP’s and detection of heavy metals and pesticide residues in some indigenous formulations viz. Supari pak, Ashokarist and Kumariasav” Dr. Rai was awarded Ph.D.

degree on “The effect of heavy metals on some important medicinal plants”. Her current research interest is on the study of heavy metal and pesticide residue in herbal drugs and standardization of medicinal plants.

**Dr. Samir V. Sawant** is working as a Scientist in the Plant Molecular Biology & Genetic Engineering Division of NBRI, Lucknow. His main objective of research is exploring the molecular details of transcription regulation in plants. Dr. Sawant was awarded Ph.D. degree on ‘Development of an artificial synthetic promoter for high level expression of transgenes in plants’. He is a gold medallist in M.Sc. (Biotechnology, Goa University) and in B.Sc. (Biochemistry, Mumbai University). He is a co-investigator in various U.S. patents filed/awarded.

# ENVIRONEWS – JOURNEY THROUGH A DECADE

(*Environews*, which was launched on 1 January 1995 completes 10 years of its publication. On this occasion, messages have been received from readers, some of which are reproduced here)

It is a matter of utmost satisfaction and rejoicing that International Society of Environmental Botanists and its quarterly newsletter, *Environews* have completed 10 years of their existence, and are now entering in the second decade. During all these years both, ISEB and *Environews*, have steadily grown in stature and popularity. The ever increasing fan mail and letters of appreciation pouring from different parts of the world reflect the global reach of the newsletter and the recognition won by it among the scientific community.

*Environews* was primarily launched to create awareness on current environmental issues and to inform and educate, both technical and non-technical people about the latest researches in Environmental and Plant Sciences in a simple and popular language. There are any number of scientific and technical journals/periodicals, some of very high standard, for 'specialists' but, very few are for 'generalists'. *Environews* was founded to fill this void and I am very happy to note that it is carrying out its mandate successfully

I wish to extend my warmest greetings and good wishes to the members of ISEB and readers of *Environews* for the **NEW YEAR**.

**P. Pushpangadan**

*President, ISEB & Director NBRI, Lucknow, India*

I am very happy that you are bringing out a Special Newsletter in January 2005. I enclose a short article. I wish you continued success.

**Prof. M.S. Swaminathan**

*Chairman, National Commission on Farmers, Govt. of India;  
Chairman, M.S. Swaminathan Research Foundation, Chennai, India*

(*Note: See article "Mission 2007: A Nutrition Secure India" on page 5*)

The quarterly *Environews* was launched by the ISEB on January 1, 1995. Thus, on the occasion of its 10<sup>th</sup> anniversary, I offer my congratulations and warmest best wishes to ISEB and the publishers of the "newsletter" for their continued success.

One of the main objectives of *Environews* has been to bring awareness of global and local environmental issues to government and industry personnel, colleagues in research, educators, students at all levels and, simply the public at large. I commend ISEB for its fine efforts.

Since its inauguration, scientists have written some 62 popular articles in *Environews* from various parts of the world (among others, Bangladesh, Canada, China, Egypt, Germany, Finland, India, Spain, Turkey, UK and USA) on diverse topics ranging from air, soil and water pollution, their impacts, biodiversity, environmental monitoring, conservation and remediation, biotechnology, public policy and education. I have used several of those articles in my classroom discussions with students, with much success. I hope that many of you have been similarly and richly rewarded.

As we move into the next decade, I strongly encourage the readership to become more actively involved in expressing your views and promote the dialogue on the environment and its conservation

through *Environews*. It is a wonderful opportunity and it is a most rewarding experience to share your thoughts with your colleagues and with the society.

Again, I congratulate Dr. P. Pushpangadan, the President and executives of the ISEB for their efforts and, in particular, Dr. K.J. Ahmad for his unfailing dedication during the past 10 years. He deserves much credit and recognition.

**Sagar Krupa**

*Professor, Department of Plant Pathology  
University of Minnesota, USA (Life Member, ISEB)*

Many congratulations on the tenth anniversary of *Environews*. I have enjoyed this publication since the first issue and have kept all the copies because it is a most useful reference. The editors are to be congratulated on this important publication that is helping to draw attention to the plight of the environment world-wide. May you continue this work for the next decade and longer.

**Prof. Sir Ghilleen T. Prance FRS, VMH**

*(Former Director, Royal Botanic Gardens, Kew, England);  
(Life Member, ISEB)*

## ***Greetings to all, and the best for 2005!***

The start of a new year traditionally invites people to reexamine their well being, the status of their personal, social and geographical environment, and to consider what reforms they may make to hopefully improve the situation. I encourage you to include in your list of aspirations, a deeper commitment to the goals of the ISEB for 2005. And what better time than at the 10<sup>th</sup> anniversary of *Environews* for the Society. Having come through a 10-year span in which most views indicate a sluggish worldwide attempt at sustainable development, international concern is even greater that we are not yet putting into place the appropriate efforts to avert major irreversible damage to human, social and ecosystem health.

Let's use our New Year's optimism to forge new and stronger attempts to identify and verify our environmental problems, and to work towards solutions on an international basis. That's where ISEB comes in. The Society has proven that it has the strength to exist ever stronger for a decade. It has provided the framework of goals and means for all committed scientists from the international community to unite in a concerted effort towards a better world. Lend your support towards ISEB and work to bring in new members. Together we can make it happen.

**Prof. Richard F.E. Crang**

*Department of Plant Biology, University of Illinois, Urbana, IL  
61801-3707, U.S.A.  
(Life Member ISEB)*

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3rd December 1994 was a memorable day in my life when I was invited to chair a meeting of plant scientists, academicians, environmentalists and NGOs. This meeting laid the foundation of International Society of Environmental Botanists (ISEB). It was a proud moment for me to be elected its first President. It was a challenging task for me to organise a team of talented and dedicated workers who could be entrusted with the job of starting this society from a scratch and nursing it in its formative years. Over the next few years the seed that was sown became a seedling and subsequently, a tender sapling.

Subsequent to my superannuation as Director of NBRI, Dr. P. Pushpangadan was elected as the President of ISEB. I feel happy that my worthy successor nursed this tender sapling with great care and devotion and now it is a full grown plant which has started to bloom and the fragrance of the bloom is reaching different corners of the

world. The organisation of two highly successful and well attended international conferences in 1996 and 2002 were two major milestones in the brief history of ISEB for which it could justifiably be proud of. A third conference is planned for late 2005 and I am quite confident that it will bring even greater laurels to ISEB.

Environeews, the quarterly newsletter of ISEB is completing 10 years of its publication and over the years it has won international acclaim as a popular science newsletter of great merit.

My continued association with ISEB in its day to day activities is a most satisfying and rewarding experience for me which I greatly cherish. I rededicate myself to work for the growth and development of ISEB in years to come

*P.V. Sane*

*Past President, ISEB & Former Director, NBRI  
Mahanagar Extension, Lucknow, India*

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## MISSION 2007: A NUTRITION SECURE INDIA

M.S. SWAMINATHAN

India, in spite of the impressive progress made in enhancing food production in recent decades, is the home of a very large number of chronically undernourished children, women and men. A recent analysis of the reasons for food insecurity in rural and urban India by the M S Swaminathan Research Foundation and the UN World Food Program has revealed that inadequate purchasing power arising from inadequate employment / livelihood opportunities is the primary cause of under- and mal-nutrition. This situation is due to both high population pressure on land, and slow growth rate in non-farm employment opportunities. Maternal and foetal under-nutrition results in the incidence of low-birth weight babies, with serious long term consequences to the mental and physical development of the child.

Because of substantial grain reserves with the Government as a result of the operation of a minimum support price for wheat, rice and other cereals, the Government of India has introduced in recent years a wide range of nutrition safety-net programs for those suffering from poverty. India operates the world's largest Integrated Child Development Service (ICDS) and nutritious school meal program. In spite of all such innovative social support programs, the incidence of both endemic and hidden hunger (caused

by micro-nutrient deficiencies) is high. Recently, a special Employment Guarantee Scheme (EGS) has been introduced in 150 out of the 600 districts of India. The National EGS provided 5 kgs. of wheat or rice per person per day and 25% of the total wage in cash.

The following are the other steps being taken to bring down significantly poverty-induced endemic hunger by 15 August, 2007, which marks the 60<sup>th</sup> anniversary of India's independence.

1. Implement all nutrition safety net schemes in an integrated manner on a life-cycle basis; fill gaps with reference to adolescent girls and pregnant women to avoid children with low birth weight, as well as to infants with 0-2 age group.
2. Promote the widening of the food security basket by encouraging the establishment of **Community Grain Banks** based on local grains (millets, pulses, etc).
3. Organise a Food Guarantee Programme combining the principles of Employment Guarantee Scheme and Food for Work. Engender the Food for Work Programme so as to assist women to undertake a wide variety of human and social development programmes.

4. Sustain, strengthen and spread the on-going self-help revolution (SHGs) by ensuring backward linkages with technology and credit and forward linkages with markets.
5. Enhance the productivity of cropping and farming systems by helping to bridge the prevailing wide gap between potential and actual yields, through mutually reinforcing packages of technology, services and public policies.
6. Promote a Food based approach to Nutrition Security through the widespread cultivation and consumption of vegetables, fruits and a wide range of millets, legumes, tubers and by introducing a nutrition dimension in land use planning.
7. Ensure access to clean drinking water, environmental hygiene, primary health care and elementary education.

These steps may help to remove the image of India being a country with grain mountains and hungry millions.

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**Prof. M. S. Swaminathan, F.R.S.** is Chairman, National Commission on Farmers, Govt. of India; President, Pugwash Conferences on Science and World Affairs; Chairman, M S Swaminathan Research Foundation, Chennai, India.

# CHROMIUM POLLUTION AND BIOREMEDIATION

SUMIT YADAV, O. P. SHUKLA & U. N. RAI

## INTRODUCTION:

Tannery effluent is a major source of aquatic pollution in India with high chemical oxygen demand (COD), biological oxygen demand (BOD), and hexavalent chromium. There are a large number of tanneries scattered all over the country but the main areas of their concentration are Tamilnadu, Uttar Pradesh and West Bengal.

Chromium, a steel-grey, lustrous, hard and brittle metal, occurs in nature in bound forms that constitute 0.1–0.3 mg kg<sup>-1</sup> of the Earth's crust. It has several oxidation states ranging from Cr (-II) to Cr (+VI), the trivalent and hexavalent states are the most stable ones. A maximum acceptable concentration of 0.05 mg/L (50 µg/L) for chromium in drinking water has been established on the basis of health considerations.

Hexavalent chromium [Cr (VI)] compounds are being used in a wide variety of commercial processes and unregulated disposal of the chromium containing effluent has led to the contamination of soil, sediment, surface and ground waters. In trace amounts, chromium is considered an essential nutrient for numerous organisms, but at higher level, it is toxic and mutagenic. Nearly 80% of the tanneries in India are engaged in the chrome tanning processes. Most of them discharge untreated wastewater into the environment. In such aqueous waste, Cr(VI) is present as either dichromate (Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup>) in acidic environments or as chromate (CrO<sub>4</sub><sup>-</sup>) in alkaline environments.

## IMPACT ON ENVIRONMENT:

In humans, exposure to hexavalent chromium salts for periods of 2 to 26 years has been implicated as a cause of cancer of the digestive tract. High levels of chromium and zinc in soil have been correlated with regional incidences of stomach cancer. Based on exposure to chromium via inhalation, the International Agency for Research on Cancer has categorized "chromium and certain chromium compounds" in Group 1:

sufficient evidence for carcinogenicity in humans and animals.

In plants, high levels of Cr supply can inhibit seed germination and subsequent seedling growth. The deleterious effect of Cr is less pronounced on seed germination than on seedling growth. Barley seeds germinated and grew well at Cr(VI) levels of up to 100 mg kg<sup>-1</sup> in soil but were always slower in development due to Cr inhibition of diastase, which is responsible for mobilizing the reserve starch necessary for initial growth. At 500 mg kg<sup>-1</sup> Cr no seed germination occurred. In another study, Cr(VI) concentrations up to 2 mM supplied as K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> (588 mg kg<sup>-1</sup> Cr) did not affect germination of pea seeds significantly. However, high levels of organic matter (5%) and/or low levels of soil pH significantly reduced Cr toxicity on germination due to the extremely low bio-availability of Cr under these conditions.

One potentially important source of increasing Cr levels in plant shoots is foliar application of Cr. Interestingly, research has shown that when Cr(III) or Cr(VI) is applied through the leaf surface, on lettuce and bean plants, they were not translocated from the leaves to other plant parts.. Surprisingly, Cr(III) was absorbed more rapidly than Cr(VI). The lack of Cr transport in plant tissues might be due to the localization of Cr in leaf cells as well as the tendency of Cr ions to bind or precipitate in an insoluble form.

## BIOREMEDIATION OF CHROMIUM:

Some research workers suggest that by using Cr (VI) contaminated groundwater to irrigate organic matter rich soil they could remove Cr from water by reduction and precipitation in the soil as Cr (III). Their initial investigations in a soil column study indicated that application of relatively large volumes of water spiked with 1 mg l<sup>-1</sup> Cr (VI) yielded outflow Cr levels. Chromate adsorption accounted for <1% of the total immobilized Cr and the amount taken up by alfalfa shoots was <0.5% of the total added. In a study Losi et al. (1994) examined the processes

responsible for Cr (VI) reduction in soil. They found that organic matter content, bioactivity, and oxygen status were among the important factors. Under aerobic, field-moist conditions, organic matter rich soil reduced 96% of added Cr (VI). Sterile soils receiving similar amendments reduced only 75% of the original Cr (VI), demonstrating the importance of the presence of soil microorganisms in conjunction with a readily available carbon source. These studies emphasize the role of soil organic matter in the reduction of Cr (VI) to Cr (III). Organic matter enhances the reduction of chromate in soil by increasing microbial activities. Realizing the potential importance of soil microorganisms in reducing Cr (VI) in contaminated soils, several groups attempted to identify and isolate microorganisms. Recent researchers suggest that Cr-resistant microorganisms are present in all soils even in those with no history of Cr-contamination. Bacterial populations resistant to as much as 500 mg L<sup>-1</sup> Cr (VI) and fungal populations resistant to 1000 mg L<sup>-1</sup> Cr (VI) were directly isolated from 2 uncontaminated soils. In an attempt to evaluate the use of Cr-resistant bacteria for the bioremediation of Cr (VI)-contaminated soils researchers have isolated a population of *P. mendocina* from a sewage sludge and used it for the reduction of Cr (VI) to Cr (III) in a soil microcosm study. Their results indicate that *P. mendocina* was able to immobilize 100 mg kg<sup>-1</sup> Cr (VI) in 8 h by reducing it to Cr (III). The Cr (VI)- contaminated soils, after the microbiological treatment, supported growth of wheat seedlings without exerting any toxic effects, illustrating the usefulness of the microbiological treatment in the bioremediation of chromate-contaminated sites.

## BIOACCUMULATION AND BIOSORPTION:

Many microbes by cellular activities and/or their products significantly contribute in these biogeochemical cycles. Biotechnological approaches to the abatement of toxic metal pollution consist

of selectively using and enhancing these natural processes to treat particular wastes. The processes by which the microorganisms interact with the toxic metals enabling their removal/and recovery are bio-sorption, bioaccumulation and enzymatic reduction.

#### PHYTOREMEDIATION:

Phytoremediation of Cr pollution can be achieved by extraction of the metal from polluted soils into harvestable plant tissues (phytoextraction), by the accumulation of the element in the root tissues of aquatic plants growing in contaminated water (rhizofiltration), or by the *in situ* detoxification of the metal through plant-based chelation, reduction, and oxidation mechanisms (phytoremediation).

#### PHYTOEXTRACTION:

Research on the phytoextraction of Cr from contaminated soils and sediments has been scarce. Very few plant species such as *Sutera fodina*, *Dicoma niccolifera* and *Leptospermum scoparium* have been reported to accumulate Cr to high concentrations in their tissues. Attempts are being made to use promising aquatic plant species for the phytoextraction of Cr

from contaminated tannery sludge, the ability of three plant species (*Scirpus lacustris*, *Phragmites karka* and *Bacopa monnieri*) to absorb, translocate and concentrate Cr in their tissues. For the phytoextraction process to be effective substantial amounts of Cr removed from the root medium must be translocated to the harvestable plant parts so that it can be completely removed from the contaminated site. Clearly, more research needs to be done in this area to utilize available Cr hyper-accumulator plant species.

#### MOLECULAR APPROACHES IN REMEDIATION OF CHROMIUM:

Another approach is to use molecular techniques to genetically engineer plants that can hyperaccumulate Cr and other heavy metals. In a recent study it was found that there is a high correlation in Cr content in shoots of many plant species with the content of other heavy metals such as cadmium, copper, nickel and zinc. Traits impacting the accumulation of these heavy metals in plant shoots were found to be associated. Using recent molecular approaches, it will be possible to evolve plants suitable for phytoremediation of soils and waters contaminated with Cr and/or other heavy metals.

#### CONCLUSION:

Thus chromium bioremediation through micro-organism or plants may be the best-suited technology in present context to clean up Cr contaminated sites and these technologies are eco-friendly and cost effective. Cr (VI) is readily immobilized in soils by adsorption, reduction, and precipitation processes, with only a fraction of the total Cr concentrations available for plant uptake. When taken up by plants, >99% of the absorbed Cr is retained in the roots where it is reduced to Cr (III) species in a short time. Phytotoxic levels of Cr in most plants seem to limit its accumulation in the food chain. Because most plants have low Cr concentrations, even when grown on Cr rich soils, the food chain is well protected against Cr toxicity. In regions, where Cr (VI) contamination of the environment represent a major area of concern, the use of Cr-hyper-accumulator plant species or Cr-reducing microorganisms may represent a cost efficient and highly effective technology for the removal and detoxification of the toxic forms of Cr.

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*Authors are associated with the Ecotoxicology and Bioremediation Group of the National Botanical Research Institute, Lucknow -226 001, India*

## SCOTOBIOLOGY – THE BIOLOGY OF DARKNESS

### TONY BIDWELL & PETER GOERING

The development of plants, particularly those in temperate zones varies with season and most plants detect season by the duration of darkness. Hence “short-day plants” require long nights, and “long day plants” require short nights. Short-day plants normally bloom in the autumn when the days are shorter. Long nights initiate the onset of flowering, and later, as nights lengthen, the onset of dormancy, which enables plants to withstand the vigours of winter. If short-day/long-night plants are illuminated even briefly during a long night, they detect this as two short “nights”, under continuous night-time light pollution plants respond as if there were no night. In either case flowering and development are compromised. The effects of successive

nightly illumination are cumulative, flowering and dormancy – and hence survival – of short day-plants

Birds suffer huge losses due to light pollution. There has been a tremendous increase in the number of brightly illuminated tall infrastructure, including buildings, power plants, chimneys, telecommunication towers and wind generators. Birds are disoriented by bright lights, and either fly toward them or are unable to see structures behind them. The behaviour of many animals, including mammals, amphibians and insects can be seriously affected by light pollution.

The effects of light pollution are also considerable at the community and ecosystem level. Disturbance of plant and

animal life-cycles within a community affects the survival of otherwise unaffected members. Light pollution from cities and highways is sufficiently widespread to affect very large areas, and the effects on individual organisms can disrupt the population balance and thus the integrity of whole communities.

Human health is more severely affected by light pollution than is generally realized. Human hormone regulation, physiology and behaviour have evolved in a diurnal pattern of night and day. The normal operation of sleep/wake cycles, hormone cycles, the immune system and other biochemical behaviour, depends on the daily alternation of light and dark. For example the immune system functions more strongly during the day to protect

the body against invasion, while antibody production is highest at daytime. At night, the killer cells that attack tumour and establish invasion are more active. Night-time light pollution imbalances the different activities of the immune systems, to the serious detriment of health, and disrupts circadian hormone cycles with resulting emotional, physical and psychological change.

Light pollution may become a major ecological and human health issue if we continue to ignore the evidence of its increasing impacts. A hopeful aspect of the problem is that much light pollution is unnecessary and could be easily

controlled. The lights on high structures to prevent airplane collisions are of course essential, but their effects may be ameliorated by using specific wavelengths or flashing lights. The light pollution from internal illumination of large buildings could be reduced by curtains and floodlighting of buildings and statues could be dramatically reduced.

A major reduction of light pollution can be achieved with shaded/focused street, highway area and advertising lightings; less powerful, downward-focussed street can provide adequate lighting without skyward pollution. Finally, reducing light pollution would also lower

the environment impacts associated with electricity generation.

More work in the science of scotobiology needed to understand the impacts of light pollution, and to promote practical solutions.

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## **NATIONAL WORKSHOP ON AQUATIC WEEDS: THREAT TO ENVIRONMENT OR BOON IN DISGUISE**

**SHAILENDRA MATHUR**

A National Workshop on 'Aquatic Weeds – Threat to Environment or Boon in Disguise' was held at College of Technology and Engineering, Udaipur, India on September 4, 2004 with special attention to the water hyacinth. The objectives of the workshop were to identify the problems created by aquatic weeds and to identify the various technologies to control them. This workshop was inaugurated by an agronomist Dr. A.S. Paroda, Chairman, Agricultural Scientist Recruitment Board, New Delhi and presided over by Dr. K.N. Nag, Ex Vice Chancellor of Rajasthan Agricultural University, Bikaner. Dr. A.N. Mathur, Dean of the College delivered the welcome address and Dr. S.M. Mathur Convener of the workshop highlighted the aims and profile of the scientists participating in this workshop. Eminent scientists, from all corners of the country and from the field of engineering, agriculture, environmental sciences, Botany, Chemistry, Pollution control etc. participated in the workshop. Many postgraduate students from various disciplines were also registered for the workshop.

This workshop was divided in two Technical Sessions. The first session dealt with the discussion on the general aquatic weeds whereas the second session was dedicated to the water hyacinth. The presented papers were discussed at length

and recommendations were formulated for the management of aquatic weeds. A poster session was also arranged to explain the various uses of the water hyacinth. Dr. S.M. Mathur also developed a multimedia on theme of the workshop entitled 'Water hyacinth-Threat to Environment or Boon in Disguise' and presented it in the workshop. It was very much appreciated by the students and scientists. A water hyacinth chopper cum crusher developed by Dr. Mathur at CTAE, Udaipur India, was also demonstrated in this workshop. The machine was capable of reducing the volume and weight of water hyacinth to reduce the cost of transportation.

Scientists were of the opinion that water hyacinth should not be allowed to grow in fresh water lakes as a crop but it should be allowed to grow in sewerage water or in the downstream of the industrial waste. Various control methods like chemical, biological, mechanical and manual were discussed at length in this workshop. Scientists were of the opinion that chemical control of water hyacinth in the fresh water lakes should not be advocated because the water stored in these lakes is utilized for drinking purpose. On the other hand many scientists had presented their work on biological control of water hyacinth but it was suggested that it is a slow processes and the results are not much encouraging. Therefore, it was

concluded that in the fresh water lakes precautionary measures should be taken not to allow the water hyacinth to grow. To control it in fresh water one should use the mechanical and manual methods. Scientists also presented their work on the utilization of water hyacinth. The harvested water hyacinth should be chopped and crushed on the site itself and transported to the various places for utilization such as in biogas plants, as soil mulch, as fertilizers etc. It will compensate the cost of harvesting also. The workshop was concluded with the concluding remarks of Prof. B.L. Chaudhary, Vice Chancellor of the Mohanlal Sukhadia University, Udaipur, India. He mentioned that water hyacinth should be controlled and utilized as per the need of the situation and each aquatic plant should not be considered as a weed. Some aquatic plants play very important role in nutrient recycling in the fresh water. For more details of the workshop and technical reports please log on to [www.mpuat.ac.in/workshop.htm](http://www.mpuat.ac.in/workshop.htm) or contact Dr. S.M. Mathur convener of the workshop at [shiloo592003@yahoo.co.in](mailto:shiloo592003@yahoo.co.in)

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*The Author is Associate Professor at the Department of Farm Machinery & Power Engineering, College of Technology & Engineering, Udaipur-313 001 (Rajasthan), India.*



# LICHENS IN THE CHANGED ENVIRONMENT OF LUCKNOW

D.K. UPRETI

Lichen flora of Lucknow district with reference to air pollution monitoring was studied recently. An extensive survey and collection of lichens was performed in and around Lucknow district. To assess the status of Lichen distribution of Lucknow district in the past, specimens preserved in the Lichen Herbarium were segregated and identified up to the species level.

The lichen collection of the district was initiated in four major areas, e.g. North-East, North-West, South-East, South-West, in 1 x 1 Sq Km grid. The distribution of each species was plotted in the grid in all directions. The detailed distributional account of the epiphytic lichens, segregated the district into four zones:

- a) Zone A - An area in center of the city up to 5 Km all around - No lichen Growth
- b) Zone B - An area with old historical buildings - presence of some

calcicolous (lime plaster) lichens

- c) Zone C - Areas with scattered Mango trees - scarce growth of few crustose and foliose lichens
- d) Zone D - Areas in the boundary of Lucknow district - Normal growth of different epiphytic lichen genera together with some folicolous (on leaves) lichens.

Among these zones of Lucknow district, north-east zone has the highest concentration of the metals such as Fe, Ni, Zn and Hg, while south-west zone of the district exhibits higher accumulation of Pb. The key sources for the metal accumulation in lichens are heavy motor traffic, frequent use of generator sets for electricity, burning of fuel wood and use of pesticides in the mango orchards.

The comparison of the present lichen diversity with an earlier study carried out

during the year 1960-1980, exhibits a distinct change in Lichen flora of the district. Out of the 18 species recorded in the past from the Lucknow district, 14 species are common to the present study. It seems that the remaining 4 species (*Julella* sp., *Opegrapha herpetica*, *Peltula euploca*, *Phylliscum macrosporum*) of the former study have become totally extinct from the area. The change in Lichen diversity in the district is mainly due to the change in the environmental conditions during the last 25 years. In the last 2 decades, there has been a rapid increase in the urbanization of Lucknow district causing air pollution and changing the environmental conditions.

*The author is Scientist & Head of Lichenology Laboratory, National Botanical Research Institute, Lucknow-226001, India.*

## NEWS AND VIEWS



### DUST, LAND-USE AND CLIMATE CHANGE

Mineral dust is an important component of the atmospheric aerosol loading, with 1-2 Pg of dust eroded by the wind from base soils and lofted into the atmosphere every year. Atmospheric dust effects regional climates by altering the balance of incoming and outgoing radiation, influencing cloud properties and affecting atmospheric chemical processes. The net climatic impact could be large, but it is currently very unclear whether dust will produce warmer or colder conditions at a regional scale, and unclear how regional changes will affect the global climate.

Part of the uncertainty is due to the different effects atmospheric dust can have on the climate, depending on the colour, size and mineralogy of the dust clouds in

the atmosphere, and the nature of the surface (dark or light) over which the dust clouds occur. According to one estimate, about half of the dust in the atmosphere is derived from human activities - primarily agriculture and deforestation, road-building and construction activities.

A recent study has shown that the frequency of dust storms in cropped and grazed lands was higher than in areas of natural vegetation with comparable climate of vegetation cover. The analysis of potential changes in dust emissions showed that the effect of climate changes, rather than changes in land-uses will be more important in determining the effects of atmospheric dust on regional climates.

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(Condensed from Global Change  
Newsletter, Stockholm, Sweden)*

### KILLER KITCHEN GASES THREATEN RURAL WOMEN

Indoor air pollution remains a silent and unreported killer, with rural women and children most susceptible. Nearly half of the world use solid fuels such as dung, wood, agricultural residues and coal in the households. Smoke from these chemicals that lead to respiratory illnesses - bronchitis and pneumonia. The indoor concentration of health-damaging pollutants from a typical wood-fire cooking stove generates carbon monoxide and other noxious fumes anywhere between seven and 500 times over the permissible limits.

Acrid smoke rising from stoves and fires inside homes is associated with around 1.6 million deaths per year in developing countries - that is one life lost every 20 seconds to the killer in the kitchen

says a statement by WHO and UNDP. In this regard, the World Health Organization (WHO) and United Nations Development Programme (UNDP) had marked the World Rural Women's Day on October 15, 2004 by drawing attention to indoor air pollution.

Finding cleaner solutions is the main challenge in the battle against indoor air pollution which is a huge blight on the lives of rural women and their children.

**Prasanna Chitrakar**  
*Clean Energy News, Nepal*

### TRAFFIC JAM TRIGGERS HEART ATTACK

Air pollution might trigger heart attacks according to a study carried out in southern Germany and published in the *New England Journal of Medicine*. The risk of a heart attack was greatest within an hour of being in traffic. People who live near major roads are at greater risk of dying from lung and heart problem. Research also shows that people in cars and buses are exposed to 10 times the pollutants and toxic compounds as people on the side walk, largely because of emissions from the tail pipes of cars in front of them.

Air pollution worsens hardening of the arteries, blood vessels and disturbs the heart's natural rhythm. In the short term particles increase inflammation, which can cause the rupture of plaques in arteries around the heart. Those ruptures can lead to blood clots that choke off blood supply and cause a heart attack.

Traffic jams were more likely to take toll on women and on people 60 and older.

*USA Today.*

### GLOBAL WARMING – A SECURITY THREAT

A growing number of analysts argue that global warming linked to greenhouse gas emissions is not just a green issue, it might eventually top terrorism on the global security agenda, provoking new conflicts and inflaming old ones. The biggest security problem from global warming would be forced migrations, the

dislocation of people because of flooding or drought. Drastic ecosystem changes could alter the resource base and uproot rural people. Forced migrations of people almost always cause problems.

Rising sea levels force millions of Bangladeshis into India, fuelling ethnic tensions and political conflicts. In Africa, crops wither in the parched landscape bringing strife to the country side and leading city dwellers to clash with the army as they loot shops for food. According to former Canadian Environment Minister David Anderson the global warming posed a greater long-term threat to humanity than terrorism because it could force hundreds of millions from their homes. Global warming is a source of violence in heavily populated Central Nigeria where nomadic cattle herders and peasant farmers have been locked in conflict over scarce land for decades as the Sahara Desert creeps southward.

Climate change is taking its worst toll on the developing world, although the bulk of greenhouse gas emissions stem from the rich nations. The frequency and impact of natural disasters are on the rise, driven by an unpredictably changing climate. The poor are the most threatened by these catastrophes and the least equipped to recover.

Kyoto Protocol obliges rich nations to cut overall emission of heat-trapping carbon dioxide to 5.2 per cent below 1990 levels by 2008-12 by cutting use of coal, oil and natural gas and shifting to cleaner energies like solar or wind power.

*Source: Reuters*

### BLACKOUT CLEARED THE AIR

The wide-reaching electricity blackout that affected the eastern United States in August last year cleared the air considerably. One day after many power plants shut down, the concentration of sulphur dioxide and ground level ozone had fallen by 90 and 50 per cent respectively, while the concentration of particulates fell by 70 per cent and visibility was improved by around 32 km. The improvement in air quality was so great that it could not only be measured but one could actually see it as a much clearer and less hazy sky.

*Source: Environment News Service/ Acid News*

### ARCTIC MELTDOWN

The Arctic region has warmed twice as fast as the rest of the world over the past 50 years. Arctic Ocean ice has shrunk by as much as 20%. Temperatures in winter are rising faster than those in summer – as much as 3°C to 4°C in Alaska and western Canada. Over the past three decades, sea ice in the Arctic Ocean has declined an average of 8% annually.

As protective sea ice disappears and permafrost underlying the land's surface softens, coastal erosion will speed up dramatically. Floods will inundate marshes and estuaries, damaging both human and animal habitats. Rising temperatures will let forests expand north into areas that now support only scrubby flora. Trees absorb more heat than bushes, speeding up local warming. Loss of tundra will also rob many animals of breeding and feeding grounds.

85% of the sun's energy is reflected by ice, 20% by vegetation and dark soil and 10% by Ocean water. As ice melts, darker seawater and exposed land reflect less of the sun's energy, making the remaining ice melt even faster. This is the reason why Arctic warms more quickly. Sea level is expected to climb from 10.2 cm to 0.9 meter by 2100, mainly from expanded warmer water and melting glaciers.

On the other hand, a drastic reduction in polar ice during summer months could open reliable shipping lanes along the northern coast of Russia and Canada, making transportation cheaper and increasing access to oil and other natural resources. Some species may actually benefit from global warming. Cod and arctic char fish could expand their range. Some crops, including barley and alfalfa could be grown in areas that are too cold today.

*Source: Michael D. Lemonick  
In TIME magazine (U.S.A.)*

### HAZARDS OF CANDLE SMOKE

Church candles and incense can be dangerous to the lungs, according to a study by Dutch scientists. Church air appears considerably higher in cancer causing polycyclic hydrocarbons than air beside busy roads and it has particulate matter levels up to 20 times the European limits, says the study. With all those church candles lighting up for Christmas, December was especially a dangerous month for the lungs.

The Dutch scientists made this conclusion after an unusual experiment wherein they analyzed particulate matter concentration found in the air of a small chapel and a large basilica following lengthy use of candles in a simulated service in which incense was burnt. Fine particulate matter contains different types of toxic chemicals, including soot, metals and various carcinogenic molecules. The particles can penetrate very deep into the lungs and trigger various lung and heart conditions.

*PTI, New Delhi.*

#### NO-MORPHINE POPPY

Ordinary opium poppies, *Papaver somniferum*, are the source of morphine and codeine, as well as heroin and opium. An Australian and German research team has described the naturally occurring mutant poppy which produces no morphine and codeine, but produces alkaloids that can be used to make painkillers. Australian farmers call the mutant poppy "Norman", from "no morphine". The mutant poppy looks the same as normal poppy except that the latex is pink or red rather than white or cream.

The researchers looked at 17,000 poppy genes and identified 10 that were involved in blocking the biochemical pathway that leads to morphine production. The researchers are now looking at the pathway to determine which genes could be switched off to produce other poppies with useful pharmaceutical benefits. For example, poppies could in the future accumulate alkaloids used in anticancer agents or in cardiovascular medicine.

*(ABC Science online)*

#### HIBISCUS FLOWERS COULD PREVENT HEART PROBLEMS

A research team at Chung Shan University in Taiwan has shown that extract of hibiscus flower reduces cholesterol and lipid build-up in rat arteries. It is likely that the effect occurs through compounds called flavonoids, which occur in the hibiscus flower. These are known to have a strong antioxidant effect and so prevent the oxidation of low density, lipoprotein (LDL) or 'bad' cholesterol. This is likely to help prevent heart disease.

Many folk medicine traditions use the hibiscus flower to treat high blood pressure and liver problems. It might turn out that a tea made of hibiscus flowers can help keep the heart healthy.

*Susan Aldridge,*

*From: Journal of the Science of Food and Agriculture*

#### DIRTY AIR, DIRTY POWER

According to the findings of a report from the consulting firm Abt Associates, power plant pollution in U.S.A. cut shorts nearly 24,000 lives, including 2800 from lung cancer as well as nearly 38,200 heart attacks each year. Each of those people whose lives were cut short lost an average of 14 years.

*Source: Acid News (Goeteborg, Sweden)*

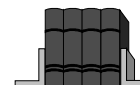
#### ECO-EDUCATION IS A MUST

With environmental degradation generating grave concern worldwide during the last few decades, many organizations have started exploring effective and meaningful ways to impart eco-education to the masses, especially the younger generation. A fallout of this is Supreme Court intervention in December 2003, directing all state governments to include environmental studies as a compulsory subject in the university curriculum.

The University Grants Commission (UGC) – the key regulatory body for higher education – is also involved in the process. The organization has evolved a six month long mandatory core module course for all the universities and colleges under its jurisdiction. Provision has been made to combine theoretical knowledge and fieldwork in a balanced manner. The course will have eight units, covering a wide array of issues (like linkages between social issues and the environment). The priority areas are as follows: create awareness and sensitivity about environment and allied issues; enhance knowledge and understanding about environmental issues and challenges; imbibe an attitude for environment; and motivate students to maintain or improve the quality of environment.

*Down to Earth, New Delhi.*

## BOOKS



### New tools for Environmental Protection: Education, Information and Voluntary Measures

Edited by Thomas Dietz & Paul C. Stern 2002  
U.S.A. National Academy Press, Washington D.C.

ISBN: 0309-084229 Price: US \$ 55.00

### State of Environment – 2004

By N.S. Tiwana, Neelima Jerath, Puja & J. Chadha

ISBN: 81-88362-09-3

Published by Punjab State Council for Science & Technology, Chandigarh, India.

### The IGBP Series

#### Global Change and the Earth System: A Planet under Pressure

By W. Steffen, A. Sanderson, P.D. Tyson, J. Jager, A. Matson, B. Moore III, F. Oldfield, K. Richardson, H.J. Schellnhuber, B.L. Turner II, R.J. Wasson

The IGBP Series, Springer

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ISBN: 3-540-42400-8 Price • 129.95

### Biofuels for Transport – An International Perspective (2004)

ISBN: 92-64-01512-4

Published by International Ecology Agency.

### Plant Responses under Environmental Stress

#### (Proceedings Second International Conference on Plants & Environmental Pollution)

Edited by R.D. Tripathi, Kamla Kulshrestha, Madhoolika Agrawal, K.J. Ahmad, C.K. Varshney, S.V. Krupa & P. Pushpangadan

I.B.P. Publishers, India 2005

## CONFERENCES

### **International Conference – 'Education for a Sustainable Future'(ESF)**

18 –20 January 2005, CEE,  
Ahmedabad, India

**Contact:** Meena Raghunathan,  
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**Website:** www.ceeindia.org/esf

### **International Conference on Integrated Assessment of Water Resources and Global Change: A North-South Analysis**

23-25 February 2005, Bonn, Germany

**Contact:** <http://www.zef.de/watershed2005>

### **COASTAL ENGINEERING 2005**

Seventh International Conference on Modelling, Measurements, Engineering and Management of Seas and Coastal Regions

13 - 15 April 2005, Algarve, Portugal

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<http://www.wessex.ac.uk/conferences/2005/coastal2005/4.html>

### **ECOSUD 2005**

Fifth International Conference on Ecosystems and Sustainable Development

3-5 May 2005, Cadiz, Spain

**Contact:** <http://www.wessex.ac.uk/conference/2005/eco2005/4html>

### **Air Pollution 2005**

Thirteenth International Conference on Modelling, Monitoring and Management of Air Pollution

16 - 18 May 2005, Cordoba, Spain

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<http://www.wessex.ac.uk/conferences/2005/air2005/4.html>

### **Acid Rain 2005**

12-17 June 2005 Prague, Czech Republic  
Information: [www.acidrain2005.cz](http://www.acidrain2005.cz)

### **RIVER BASIN MANAGEMENT 2005 Third International Conference on River Basin Management including all aspects of Hydrology, Ecology, Environmental Management, Flood Plains and Wetlands**

6 - 8 September 2005, Bologna, Italy

**Contact:** Rachel Green Senior Conference  
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**Fax:** +44 (0) 238 029 2853

<http://www.wessex.ac.uk/conferences/2005/rm2005/2.html>

### **7th International CO<sub>2</sub> Conference**

26-30 September 2005, Boulder CO, U.S.A.

**Contact:** pep.canadell@csiro.au

### **6th Open Meeting of the Global Environmental Change Research Community**

9-13 October, 2005 BONN, t34MQNY,  
Germany

**Contact:** mullin.ihdp@uni-bonn.de

**Website:** <http://www.ihdp.org>

### **1st DIVERSITAS International Conference on Biodiversity. Integrating Biodiversity Science for Human Well-being**

9-12 November 2005 Oaxaca, Mexico

**Contact:** <http://www.diversitas-osc1.org>

### **Third International Conference on Plants and Environmental Pollution (ICPEP-3)**

29 November – 2 December 2005

Lucknow, India

Organized by International Society of Environmental Botanists & National Botanical Research Institute, Lucknow, India

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