



ENVIRONEWS

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Newsletter

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THIRD INTERNATIONAL CONFERENCE ON PLANTS & 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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FREE PRE-REGISTRATION OPEN NOW

Only those individuals/organizations who pre-register themselves will receive Conference Circular, Registration form and other details by mail/email. **There is no pre-registration fee.**

For free pre-registration following details should be furnished by mail/e-mail to the Organizing Secretaries ICPEP-3.

Title (Dr./Prof./Mr./Ms./Mrs./Miss); First Name; Middle Name; Last/Surname; Designation; Organization; Address; City, State, Postal code; Country; Phone with full dialing code; FAX with full dialing code; E-mail

- Informative news, views and popular articles/write-ups on current environmental researches/issues are invited for publication in ENVIRONEWS.
- 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 :** isebnbrillko@satyam.net.in ● **Website :** <http://www.geocities.com/isebindia/index.html>



LETTERS

I continue to have a sincere regard for the ISEB and its objectives. I have retired but continue to work in various ways. I do still teach plant anatomy and about a year and a half ago I published with Andrey Vassilyev a complete work on the subject in electronic (CD) form. This year we have a couple of publications on low-level pollution impacts on lichens from the Pacific Northwest, and I am working at the City University of New York for the next few weeks where we are looking into the encapsulation of several species of algae into alginate beads for the purposes of heavy metal containment.

I feel that the use of pdf files for the Environews is a very good thing. The Society should also have an interactive Web site, and the news can be effectively handled in this manner. I would suggest that approved minutes of the executive meetings of ISEB be made available to the members as well. Again, with sincere apologies for any inconvenience in contacting me, I wish to emphasize that I continue to have a strong interest in ISEB and its goals.

Prof. Richard F.E. Crang
Formerly, Professor of Plant Biology
University Illinois, Urbana, Illinois, U.S.A.

We are delighted to enclose for your attention the First Announcement and Call for Papers of the JGSEE and Kyoto University Joint International Conference on “**Sustainable Energy and Environment**” (SEE). The Conference incorporates the 3rd Regional Conference on Energy Technology towards a Clean Environment (3rd RCETCE) organized by the Joint Graduate School of Energy and Environment (JGSEE) and the 2nd Kyoto University 21 COE Symposium on Sustainable Energy System organized by Kyoto University, which will be held during 1-3 December 2004 at Hilton Hua Hin Resort – Hua-Hin, the beautiful beach in western coast of the Gulf of Thailand.

The Joint International Conference ‘SEE’ focuses on current advances in sustainable energy and related technologies contributing to improving the environment of the Asia-Pacific region. Potential participants from academia, research organizations, governmental agencies and private sectors are encouraged to submit abstracts for consideration for presentations at the Joint International Conference ‘SEE’.

The ‘SEE’ venue will be in Hua-Hin, a beautiful western coast beach resort, just 2 hours drive along the Gulf of Thailand, its natural beauty and related activities always surprise visitors with unforgettable experiences.

Potential participants of the Joint International Conference ‘SEE’ are invited to complete the “Expression of Interest” form and return to us as soon as possible. For further information on the Conference, please visit our website: <http://www.jgsee.kmutt.ac.th/see.html>

Dr. Bundit Fungtammasan
Associate Professor &
Chairperson of the Organizing Committee
The Joint International Conference ‘SEE’, Thailand
E-mail : see@jgsee.kmutt.ac.th, Fax : +662 872 9805

At the moment, I am off to Beijing for a series of seminars and lectures. After I have returned, I will schedule some time to complete my agreement with you to provide an article for ENVIRONNEWS.

Prof. William J. Manning
Department of Microbiology
University of Massachusetts
Amherst, MA 01003-9298, U.S.A.

Thank you for informing me about new ENVIRONNEWS issue. The contents look interesting to me. I was thinking that I may permanently contribute in work of the Journal’s Editorial Board, taking care of the issue of phytoremediation of contaminated soils. I hold a Ph.D. in plant physiology, and have 20 years’ research experience in the related subjects. A few years ago I gave a seminar in your Institute at Lucknow concerning phytoremediation.

Dr. Aleksandra Sas-Nowosielska
Land Management Department
Institute for Ecology of Industrial Areas
Katowice, Poland
sas@ietu.katowice.pl

We greatly appreciate being on your mailing list and to know of your activities. As you know that I am involved in supervising the activities of our International Society “**Aquatic Ecosystem Health and Management-AEHMS**” its journal “**Aquatic Ecosystem Health and Management-AEHM**” and book series “**Ecovision World Monograph Series (EWMS)**”. Please find attached brochures of the AEHMS and EWMS for your information. We would greatly appreciate if you could forward the attached brochures to the ISEB members. We would also reciprocate any request from you to forward advertisements to our members.

By the way I will be visiting India (New Delhi) in early December and it would be nice to meet you if possible to discuss future activities of AEHMS in Asia-India and possible collaboration with ISEB.

I visited your website and you should be complimented for doing an excellent job!

You are also invited to visit our website: www.aehms.org

Dr. M. Munawar, Ph.D.
Research Scientist
Great Lakes Laboratory for Fisheries &
Aquatic Sciences, Fisheries & Oceans, Canada
munawarm@dfm-mpo.gc.ca

I am glad to see your mail on the website of the ISEB. I left Delhi in July 2002 (three years before I completed my full term in the University by declining the reappointment after retirement). I have joined Ashoka Trust for Research in Ecology and the Environment (ATREE) at Bangalore as a INSA Senior Scientist. I am having a DBT project on Reproductive ecology of some endemic, endangered and economically important species with the main aim of identifying reproductive constraints for their

reproduction/regeneration and to develop methods to mitigate them. There is lot of scope and need to do such type of work around here. I hope to spend a few more years in active research before I retire completely from Botany.

I am going to USA on 16th August on a private visit for about 6 weeks.

KR Shivanna

(Formerly Professor & Head, Department of Botany Delhi University) INSA Senior Scientist
Ashoka Trust for Research in Ecology & the Environment
(ATREE)
Bangalore, **India**

I am very much impressed to see the website of International Society of Environmental Botanists (ISEB) and I am keen to join this Society. I would appreciate to receive a hard copy of the publication of ISEB soon for our Programme in Biotechnology at Tribhuvan University. It will be a separate department from the next year. I have keen interest in ISEB and want to become Life Member of ISEB.

Prof. Braj Nandan Prasad

Coordinator, Programme in Biotechnology
Central Department of Botany, Tribhuvan University
P.O.Box 9782, Kathmandu, **Nepal**

We arrived here almost a month back and are now settled. Besides the previous friends in the lab we also have met some of the Indian friends whom we knew in 2002.

I work here with a group headed by Norman Huner. This group has been known for their contributions on the responses of plants and algae subjected to different excitation pressures. My previous visit in 2002 to this place was in connection with the work on this topic. Using the technique of thermoluminescence that was set up by Prof Zeinalov of Bulgaria and me with the help of Alex Ivanov from Prof. Huner's group in 2002, a new concept of reaction center quenching to deal with excess excitation pressure is emerging. Our earlier work from Prof. Gunnar Oquist's lab in Sweden introduced this concept of reaction center quenching occurring through changes in the redox potentials of the two quinone acceptors QA and QB in photosynthetic organisms including algae during acclimation/stress. You will agree that this is environmental botany being studied with non-invasive techniques. We monitor changes in the redox characteristics of

the membrane located components in the intact leaf or algal cells with this technique. This is the beauty of the technique.

Prof Huner has been successful in attracting major funding from the Canadian Govt. to set up a National Biotron facility on this campus. When established, Biotron will provide facilities for researchers to study effects of different environmental conditions (related to climate change also) on plants. It appeared to me that our Environews could carry a write up on this Biotron initiative. I have asked Prof. Huner if he would like to provide us a write up on the Biotron project for publishing in Environews. He has gladly accepted to do this and I will send you the write up for our next Environews. I have also requested him to consider becoming a member of our Society and be associated with it. Please send me by e-mail the membership form and information about the society that I could give him. I will request him to become a life member. His association with the Society could be an asset for the Society.

Dr. P.V. Sane

Formerly Director NBRI & President ISEB
C/o Prof. Norman Huner
Department of Plant Sciences,
The University of Western Ontario London, **Canada** N6A 5B7
saneraj@rediffmail.com

This is to bring to your kind attention that with effect from September 2004 my new mailing address will be as under: Prof. C.K. Varshney 88, Vaishali, Pitampura, Delhi-110 034.

Prof. C.K. Varshney

School of Environmental Sciences
Jawaharlal Nehru University, New Delhi-110067, **India**

I am regularly receiving *Environews*. I have a request to you. I want to know about the latest developments regarding commercial cultivation of *Eurayle ferox* in India. I learnt about it in TV news. Can you give me the details and/or the e-mail address of the contact person. Further, I want to know in detail the economic potential of the plant. Do you think that Economic Botany Information Service of NBRI, Lucknow can help me? If so, please do provide the e-mail address of the concerned official.

Dr. Sabrina Naz

(Life Member, ISEB)
Associate Professor, Department of Botany,
University of Rajshahi, Rajshahi, **Bangladesh.**

Dr. S.C. Sharma, Vice President ISEB and former Head Botanic Garden, Floriculture & Bioaesthetics Division NBRI has been awarded a project by the Department of Science & Technology, Government of India, New Delhi for writing a monograph entitled "**Lotus (*Nelumbo nucifera*), the National Flower of India**". The two year project, will operate under the aegis of International Society of Environmental Botanists, National Botanical Research Institute, Lucknow.

Dr. M.R. Suseela, Scientist and Head, Algology Section, NBRI, and Life Member of ISEB, attended the 18th International Diatom Symposium at the University of Szczecin, Miedzyzdroje, Poland during 2-7 September 2004, in which she presented a research paper entitled "Diatom diversity at Corbett Tiger Reserve, India".

She also delivered an invited lecture on "Conservation of fresh water algal diversity" at the University of Madras, Chennai on 9th September 2004

NEWS FLASH



Dr. S.C. Sharma, Vice-President ISEB has been elected as President of the Indian Horticultural Society. The Society aims at the transfer of technologies for the promotion of horticulture and income generation for the weaker section.

Dr. Ms. Shashi Dhawan, a member of Executive Committee of ISEB has been elected as Secretary, International Council of Biodeterioration of Cultural Property. Dr. Dhawan is a Senior Scientist

at the National Research Laboratory for Conservation of Cultural Property, Lucknow.

The National Institute of Ecology has honoured Professor Muhammad Iqbal, Head of Botany Department at Jamia Hamdard, New Delhi with the prestigious Fellowship (FNIE) of the Institute in recognition of his contribution in the field of plant ecology and environmental botany. Prof. Iqbal is a Councillor of ISEB.

NBRI Celebrates Golden Jubilee

National Botanical Research Institute, Lucknow, a premier plant science research institute of India under the aegis of Council of Scientific & Industrial Research (CSIR), government of India celebrated its Golden Jubilee on 30 August 2004. Laid out in 1800 A.D. as a small garden by Nawab Saadat Ali Khan, the then ruler of Avadh, the garden was taken over by CSIR on 13th April 1953 and developed as the National Botanic Gardens as a combination of a Botanic Garden and an applied Botanical Research Laboratory on the lines of world famous Royal Botanic Gardens Kew, England. NBG was re-designated as National Botanical Research Institute (NBRI) in 1978.

The year long Golden Jubilee celebrations culminated with a valedictory function on 30th August. While Dr. R.A. Mashelkar, FRS, director General of the CSIR was the Chief Guest, Prof. V.L. Chopra, Member Planning Commission and Chairman, NBRI Research Council presided over the function. Dr. Mashelkar in his thought provoking address emphasized the need for a grand research strategy to utilize the immense pool of available herbal resources for developing sustainable products. Dr. Chopra in his address, remarked that NBRI over the years, has evolved into a great center of learning.

Dr. P. Pushpangadan, Director of NBRI & President ISEB, while welcoming the guests, highlighted the achievements of the Institute and presented a plan of action for its future development. Dr. H.M. Behl, Deputy Director of NBRI and Executive Editor of *EnviroNews* highlighted the activities of the Institute in the area of business development. On this occasion, Dr. S. Kumar, Senior Scientist of NBRI and a Life member of ISEB organized the release of some publications of the Institute and also presented a vote of thanks.

The function was attended by a distinguished gathering of scientists and academicians from prestigious teaching and research institutes of Lucknow.

WELCOME NEW LIFE MEMBERS

The following persons have joined as Life members of International society of Environmental Botanists during July-September 2004.

***Ms. Seema Mishra**, Senior Research Fellow in Ecotoxicology & Bioremediation Group, NBRI, Lucknow did her M.Sc. in Chemistry from Gorakhpur University Gorakhpur in 1999. She is working on Phytoremediation of heavy metal pollution in aquatic system and investigating various metal induced biochemical changes in selected plants (*Bacopa monnieri* and *Ceratophyllum demersum*) with respect to tolerance, detoxification and accumulation of heavy metals.

Mr. Sudhakar Srivastava did his M.Sc. in Botany from Lucknow University, in 2002. He is presently working as Junior Research Fellow in Ecotoxicology & Bioremediation Group, NBRI, Lucknow. His Ph.D. work is focussed on assessing the metal phytoremediation potential of selected plants and studying various biochemical mechanisms involved in plants under metal stress.

Ms. Preeti, Lecturer in Environmental Science, V.B.S. University, Jaunpur (U.P.) did her M.Sc. in Environmental Science from B.B.A. University, Lucknow in 2001. She has carried out some research work in the area of clinical nutrition at Department of Mycology & Plant Pathology at Banaras Hindu University under the guidance of Dr. U.P. Singh, before joining her current assignment in Jaunpur.

Mr. Arun Kumar Singh did his M.Sc. in Information Sciences from B.B.A. University, Lucknow in 2000 followed by Masters in Computer Application from the same University. Presently he is working as a Trainee in Max Health Centre, NOIDA (U.P.).

Dr. P.B. Khare is Scientist & Head, Pteridology Laboratory at the National Botanical Research Institute Lucknow, India. He has made extensive research contributions on Pteridophytes, Reproductive biology, Conservation and Phytoremediation. He is the recipient of Prof. S.S. Bir Gold Medal of Indian Fern Society, Certificate of Merit by the Indian Fern Society and Young Scientist Award by the Indian Science Congress Association.

His current areas of interest are: Biodiversity and biosystematic studies of heavy metal accumulating species of *Equisetum* and genetic diversity and conservation of threatened and economically important ferns.

*Ms. Mishra is the hundredth Life Member of ISEB.

Humanity is on the march, earth itself is left behind

- David Ehrenfeld

Man is a complex being, he makes deserts bloom – and lakes die

- Gil Stern

THE UWO-GUELPH BIOTRON

NORMAN HUNER

The Biotron is a multi-staged, interdisciplinary research facility located on the campus of the University of Western Ontario and dedicated to the elucidation of the impact of climate change and extreme environments on plants and micro-organisms. The major contributors to this initiative include the University of Guelph and Agriculture and Agri-Food Canada, London, Canada.

The Biotron will be constructed in three phases with the CFI program being central to the success of the overall project. The first phase has already been completed through support from Round 1 of the CFI, with the construction of the CSA and CRESTech supported Controlled Environment Systems Research Facility (CESRF) dedicated to the evaluation of plant-based life support systems for space travel and related terrestrial applications located on the Campus of the University of Guelph. The second phase for CFI round 4 complements phase 1 by focussing on Earth-based ecosystems through the creation of controlled mini-ecosystems for climate change research and environmental risk assessment. The final phase of the project, in CFI round 5, will integrate the knowledge gained and facilities constructed in phases 1 and 2 with a final proposal to develop robotic, controlled environments for both Earth and space-based ecosystems.

Phase 2 of the Biotron (CFI round 4) is a two component international environment and climate change research and biotechnology development facility. The Biotron includes the construction of a series of laboratory and controlled environment plant growth facilities in the UWO North Campus Building and the construction of a new four floor multidisciplinary research facility to be built contiguous with the existing Biology and Geological Sciences Building on the campus of UWO.

The primary goal of this facility is to provide the research infrastructure necessary to generate a blueprint for sustainable long-term, ecosystem health in conjunction with sustainable economic growth in the medical, agricultural and forestry sectors of the Canadian economy. This goal will be accomplished in two ways: (1) through the integration of research in environmental biology, medicine and agriculture and (2) by providing unprecedented experimental scale and flexibility with respect to controlled environment research on organisms as diverse as microbes, plants and insects in terrestrial and aquatic ecosystems. To our knowledge, no other facility in Canada, exhibits the scale, flexibility and interdisciplinary scope encompassed by the Biotron which integrates research in ecology, basic

environmental biology and earth sciences with medicine and agriculture. The three primary missions of the research programs enabled by this facility are, first, to accelerate our understanding of the responses to and consequences of global climate change on terrestrial and aquatic ecosystems; second, to provide the research infrastructure to support and stimulate the shift of growth markets towards biology based industries, that is a "bioeconomy", in the areas of medicine and agriculture and finally to assess and quantify the potential environmental benefits and risks associated with emerging biotechnologies on biodiversity and general ecosystem health. This facility will allow world-leading scientists not only to elucidate the mechanisms by which organisms as diverse as plants, aquatic algae and cyanobacteria, soil microbes and insects sense and respond to environmental change at the community, organismal, and molecular levels but also assess the impact of climate change on the interaction of these organisms within controlled mesocosms or mini-ecosystems.

Prof. Norman Huner is at the Department of Plant Sciences, The University of Western Ontario London, Canada N6A 5B7.

CHROMIUM ACCUMULATION AND TOXICITY IN AQUATIC VASCULAR PLANTS

PRAKASH CHANDRA & KAMLA KULSHRESHTHA

The indiscriminate discharge of spent waste of chromium based industries has become a serious global concern as it has created an acute scarcity of safe drinking water in many countries including India. The problem of chromium poisoning among leather tanners has long been known. The workers suffer from ulcers, allergic dermatitis, lung cancer and liver necrosis due to prolonged contact with chromium salts.

Aquatic vascular plants play an important role in the uptake, storage and recycling of metals. The uptake of metals

depends on the chemical form present in the system and on the life form of the macrophytes (floating, rooted or rootless). While submerged species showed higher chromium accumulation, emergent species also showed moderate accumulation.

At biochemical level, chromium toxicity caused reduction in the rate of photosynthesis and decrease in chlorophyll pigments. Chromium induced morphological and ultra-structural changes reported in several vascular plants (*Lemna minor*, *Ceratophyllum*

demersum, *Limnanthemum cristatum*) are quite characteristic and may serve as indicators of chromium pollution.

(For more details see: *Botanical Review* vol. 70, No. 3, pp. 313-327, 2004)

Dr. Prakash Chandra is a former Scientist & Head, Aquatic Botany Laboratory, National Botanical Research Institute, Lucknow, India;
Dr. Kamla Kulshreshtha is Scientist & Head, Eco-education Division at NBRI.

VANISHING TERTIARY GENETIC HERITAGE IN THE EAST MEDITERRANEAN, *LIQUIDAMBER ORIENTALIS* MILL.

M. OZTURK¹, C. R. PARKS², F. COSKUN³, G. GORK⁴, O. SECMEN¹

Very few people comprehend the importance and meaning of biodiversity; a common buzzword of these days. Habitat loss and genetic erosion are mainly responsible for the loss of our biodiversity leading towards species extinction. Most of the interpretations make a mention of this term as species diversity, including a plethora of living organisms and their habitats. However, ecologically it is an attribute of three other levels of biological organization namely; genetic diversity, community diversity and landscape diversity. In any case whenever we think of the quantitative side of this theme we start with number of species. Turkey with a population of 67 million inhabitants embodies more than 9000 taxa of pteridophytes and spermatophytes, including over 3000 endemics. This makes it one of the important plant diversity hotspots in the Mediterranean basin as well as Europe. The medicinal, agricultural and consumptive use values of this diversity together with their involvement in biogeochemical cycles, prevention of soil erosion, ecotourism, and regulation of climate provide the very basis of a country's socio-economic development. We are losing 24-100 species a day due to habitat loss, introduction of alien species, pollution and over exploitation. The species extinction is proceeding at such a high rate that coming generations can face serious consequences. *Liquidambar orientalis* an east Mediterranean element with a boreal tertiary origin is one among such species facing a threat of extinction.

The oriental sweetgum, *Liquidambar orientalis* Mill. is a tertiary period relict endemic taxon of the East Mediterranean, distributed naturally only in the South and West Anatolian parts of Turkey, mainly on sandy soils, with a high pH. The monoecious trees form dense forests confined to floodplains, valleys and along streams and in a few dry habitats. In Turkish it is called "gunluk" due to the fragrance of the trees or "sigla" because

of the gum like exudates, which has been used for more than seven hundred years as an all purpose drug, in particular as the most effective cure for stomach ulcers.

The name *Liquidambar* is said to have been given by Monardes in the 16th century as the name of the resin obtained in Mexico from the American species, now *L. styraciflua*.

The balsamic resin is collected from March till September every year from the trunks of about 10 years old trees with a girth of 15 cm. In Turkish it is called gunluk due to the fragrance of the trees or sigla because of the gum like exudate which develops in response to injury, being thus more a pathological than physiological response. The balsam contains α -pinene, β -pinene, myrcene, camphene, limonene, 1,8-cineol, p-cymene, terpinolene, linalool, 4-terpinenol, α -terpineol, dihydrocoumarone, cinnamic aldehyde, trans-methyl cinnamate, 1-benzoyl-3-phenylpropyne, β -phenylpropionic acid, benzoic acid, palmitic acid, and linoleic acid (12,37). The residual bark left after the extraction has been named as cortex thymiamatis, cortex thuris and storax bark. The resin is soft, viscid semi-liquid, grayish to grayish brown in color, semi-opaque, with a honey like consistence, balsamic odor, and pungent, aromatic, burning taste. It has been confined with a similar product obtained from a typical Mediterranean macchia element *Styrax officinalis* in earlier times. Later on term styrax was used for the resin of *Liquidambar* and storax for that of *Styrax officinalis*.

The early history of the resin is a little mixed up, but it surely goes back to Theophrastus and Herodotus (Hus 1949). An authenticated record clearly gives its use somewhere in 629 A. D., which refers to Chinese sources as well as to the name zygia (12,26). In the 7th century Su Kung has written about the drug named as su ho hiang which is a kind of styrax coming from western Asia (38). Chinese have mentioned about *Liquidambar* exudate as

an excrement of lions as well as a symbol of tranquility and perfume to expel evil spirits. The wood of *Liquidambar* has been used to make tea chests in China. It also has been used to make idols due to the waving of branches and fluttering of leaves in the wind which led Chinese to a belief that this tree is inhabited by spirits. Due to its incense characteristics, it is used even now in mosques and churches in several countries. According to Kang Mu (26) styrax was considered as a cure-all drug in the Chinese medicine, to treat ulcers, hemorrhage, toothache, scales, swellings, some of the cancerous outgrowths, improvement of circulation and healing of wounds as well as cuts. A similar use has been put forth for root and leaf preparations. Other medical sources of 16th century however, have not been referring to all these cures. Styrax of course has served as an important drug for seven hundred years. It has been used as an expectorant in asthma, bronchitis, and lung infections, in fumigatories, incenses, perfumes and skin diseases. The bark is said to have been used to cure colds, diabetes, dysentery, cholera and dropsy (38). Chinese literature also cites the preparations from the fruits to cure back-aches, spasms, eye clearing and prevention of plague. Out of this large list of cures the only one left behind today is treatment of ulcers under the name storaxol (26) and its use in compound tincture benzoin. It is also used in adhesives and tobacco industry. The resin which develops in response to injury, more a pathological response than physiological one, is consumed directly even now in Turkey to treat ulcer. It is sold at the market in Marmaris area. One teaspoon of the resin is mixed up with one teaspoon of honey and taken directly with empty stomach daily in the mornings for 10 days. The residue left after resin pressing is used as an incense in mosques. Lately the production of the resin in Turkey has however, diminished tremendously from 180 to 1 ton due to its less use and destruction of these relict forests.

Threats to extinction: The forests of *L. orientalis* have been severely destroyed during the last 200 years. This disappearance has started the chain of events leading to an extinction of many other species. Unfortunately, the landscape is becoming increasingly fragmented leading towards a loss of too many species, which means a psychological and spiritual loss too. There is an urgent need for sustained maintenance of these forests for scientific, utilitarian, and ethical purposes. The fragrant aromatic balsamic resin appears to keep the insects and fungi away from the healthy populations of oriental sweetgum. In fact these forests have suffered much from the anthropogenic pressures than insect attacks. Major factors involved in the destruction of this important genetic heritage are cutting and felling for field openings and settlements. This practice has continued for over 200 years. Earlier, Egyptian experts living around Nile delta were despatched to this region during Ottoman Empire to drain these swampy areas in view of their know-how in this field. During last few decades the trees are first cut followed by planting fast growing *Eucalyptus globules*, which dries up these areas. Latter plantations are felled then and citrus orchards established. These orchards are maintained whence they are taken over by land speculators for constructing summer residential quarters, since a major part of these forests lies near to the coast on the Aegean and Mediterranean Sea. In addition, use of these forests as grazing grounds because of the rich herbaceous undercover as well as inflicting injuries through deep and long cuts for the procurance of resin add to the major destructive activity cited above. The trees used for the exudates production live for 30 years but untouched trees live for more than 100 years.

Bark Pollution: The bark of trees growing along roadsides was observed to be darker in colour than those away from the highways. The thickness of bark of the trees in unpolluted sites in the states of Antalya, Isparta, Denizli, Aydin and Datca was recorded as 0.9 -1.1 cm and bark pH at these sites varied between 4.3–6.6, whereas thickness in medium polluted sites like Yatagan, Milas and Marmaris in the state of Mugla was 1.3-1.4 cm and pH of the bark samples was 3.3-4.7. In the highly polluted samples collected from the trees alongside the highway passing through Koycegiz bark thickness was 1.5 cm and pH varied between 2.8-3.7. In the latter area very low epiphytic and ground plant cover was observed in the forests along the highway. This can be attributed to the pollution due to leaded gasoline originating from the heavy traffic.

Conclusions: The area of this taxon has got reduced from 7000 to 1657.80 ha during the last 200 years. Major anthropogenic impacts involved in the decline of this important genetic heritage are habitat destruction due to cutting and felling for wood, followed by a change of the land use, grazing, resin extraction and urban development pressures. The loss of this precious genetic resource has been increasingly more in the recent past mainly due to degradation and shrinking habitat and often their complete loss due to cutting, summer house constructions, tourism and land acquisition for agricultural purposes. This problem is acute in the Mediterranean, due to increasing chunk of area being used for tourism. There is an urgent need for its in situ conservation. Although some protected areas have been earmarked but the preservation and restoration of these open spaces is insufficient to maintain and rebuild biodiversity. There is an urgent need for an international support as well

for maintenance of this area as an in situ conservation site as well as a world heritage site. This will help us to re-establish biological continuums in the *L.orientalis* distributional zone. In Europe national and regional maps defining the networks of ecological corridors are expected to be set up until 2005. Like Europe the ecological network is the backbone of the biodiversity strategy for ecology and landscapes in the Mediterranean basin too. But the countries bordering the Mediterranean are dragging their feet, as is often the case where protection of biodiversity is concerned. The species is shown as vulnerable (degree of threat) in the plants of Europe threatened tree Project. There is an immediate need for a protection of the forests of this plant species through in-situ conservation. In situ conservation of special, vulnerable ecosystems is essential. These include all habitats with emphasis on mountains, wetlands and deserts. Many of their representative areas are now protected. According to IUCN report these protected areas numbering 9800 cover 92,63,49,000 ha area of earth surface. Immense possibilities exist for insitu conservation of *L. orientalis*. Since it is a common property resource, active involvement of local people in their management will always be a prerequisite for their better management and conservation.

¹**M. Ozturk and O. Secmen**, Botany Department, Ege University, Bornova - Izmir, Turkey

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⁴**G. Gork**, Biology Department, Mugla University, Mugla, Turkey

Modern technology – owes ecology – an apology

- Alan M. Eddison

They kill good trees to put out bad news papers

- James G. Watt in Newsweek

Let us permit nature to take her own way; she better understands her own affairs than we.

- Montaigne

NEWS AND VIEWS



GLOBAL WARMING REDUCES RICE YIELD

Global warming affects the productivity of rice crops, threatening future harvests of the grain according to the field studies carried out by International Rice Research Institute (IRRI) Manila, Philippines. This is attributed to increased night temperatures associated with global warming, caused largely by emissions of gases like carbon dioxide from fossil fuels in cars and factories.

Researchers speculate that increased temperature at night forces the plant to divert more energy to maintain metabolic functions instead of producing greater biomass and grain yield. Rice yields were found to decrease by 10 per cent for each one degree Celsius increase in minimum night time temperature. But as the increase in night temperature was threefold greater than the increase in day time temperature, rice yield declined by 15 per cent for every degree Celsius increase in mean daily temperature. Harvest shortfalls induced by global warming would likely be much more widespread and persistent than previous projections.

These findings are important for predicting the effects of global warming on food security because rice is the food for about one-half of the human population.

Clean Energy News, Nepal.

BIODIESEL: SUSTAINABLE AND EARTH-FRIENDLY

Energy is not something that exists only in fossil fuels. Embodied energy exists in many things besides fossil fuel products. Petroleum and other fossil products are stored energy from plants and animals from millions of years ago. When they are burned, the carbon from the formerly living material is released into the atmosphere in the form of carbon dioxide. We will not have an ample supply of petroleum products for ever. It took us 150 years to use up half of the supply. It will

take fewer than 50 years to use up the rest.

It is clear that we need a sustainable solution to our energy needs. There is a solution – Biodiesel. Biodiesel is a fuel made from any kind of oil or fat. It is the embodied energy of vegetable oil – grown this season, not millions of years ago. Biodiesel is a fully renewable resource and in U.S.A. it is made from soybean, canola and other vegetable oils.

Besides aiding the domestic economy, biodiesel can help reduce pollution as well. The main component of acid rain, sulphur dioxide, is completely eliminated in biodiesel. Net carbon dioxide released is also eliminated. The plants that are grown to make the oil for biodiesel typically absorb three times the carbon that is released from tailpipe of vehicles. In addition, soot, aromatics, hydrocarbons and carbon monoxide are all significantly reduced in biodiesel emissions.

Noam J. Gundle

(Source: Clean Energy News, Nepal)

U.S. EXPORTING POLLUTION TO EUROPE?

Air borne chemicals from 8,000 km away across the Atlantic Ocean are being dumped in the U.K. and Western Europe and may be blamed for a rise in lung diseases according to scientists from York University in England. A team of about 50 scientists from seven U.K. universities are investigating how a cocktail of chemicals, emitted from vehicle exhausts and power stations in the U.S. react together in the air on their way to Europe, while U.S. scientists will test the air as it leaves the eastern coast of America.

According to the York scientists, it is highly likely that air leaving U.S.A. contains nitrogen oxides and hydrocarbons, which are emitted from vehicle exhausts and power stations. Scientists want to know how these will react together on the way to Europe and notably whether they will form ozone and particles, both of which can be harmful to humans. During last year's heat wave,

in which there were 800 extra deaths across Britain, levels of ozone and particles had soared. Although it is known that some of this pollution was produced locally in the U.K., contribution from other countries has not been evaluated. The more we look at ozone the more we understand that it is a global pollutant.

The U.S. consumes 25% of world's fossil fuels – mostly oil – and it is predominantly the consumption of fossil fuels that create pollution. It is perfectly plausible that they were exporting air pollution to Europe. The predominant wind is from the South West.

(Clean Energy News, Nepal)

WOOD STOVE HAZARDS

Traditional wood stoves used in many rural kitchens are health hazards. The U.S. Environmental Protection Agency estimates that wood smoke can be 12 times more carcinogenic than tobacco smoke and it attacks body cells 40 times higher than tobacco smoke. A fireplace operating for an hour burning 4 kg of wood during that time, generates 4,300 times more carcinogenic particles than 30 cigarettes. A wood stove is about 500 times more polluting than an oil burner and about 1000 times dirtier than heating with gas.

Down to Earth, New Delhi

CLIMATE RISK TO U.K. ORCHARDS

U.K. Climate Impact Programme showed that there would be some frost-free winters during this century. A study on the possible implications for commercial fruit growers of warmer winters has been commissioned by the Department of Environment, Food and Rural Affairs. Warmer winter would fail to provide the chill that some plants need if they are to produce flowers and fruits. There will be significant drops in yields of several summer fruits like pears and cherries. Apples are important crops and it will become harder to get a decent crop

in the South of England but apples may head northwards to find a cooler place to grow.

There is also a strong possibility that climate change may encourage some exotic weeds to become problematic invaders. 'Giant hogweed' has already gone haywire and other invaders may follow. These weeds out-compete the native flora and fauna and affect the ecology of that place.

Alex Kirby

(BBC News – Online Environment Correspondent)

ENVIRONMENTAL HAZARDS OF BURNING DRY LEAVES

It is a common sight to see smouldering heaps of leaves in urban areas by gardeners, municipal sweepers and house owners. Leaf burning leads to severe air pollution and health problems. Burning of leaves produces particulate matter and hydrocarbons, which contain a number of toxic, irritant and cancer-causing compounds. Burning a ton of leaves produces about 117 pounds of carbon monoxide, 41 pounds of particulates and some highly carcinogenic polycyclic aromatic hydrocarbons. When inhaled, these microscopic particles can remain in the lungs for months or even years and increases the chances of respiratory infection, reduces the volume of air inhaled and impairs the ability of the lungs to make use of that air.

Particulate matter can also trigger asthma attacks and aggravate heart and lung diseases. Nitrogen and phosphorus released in the form of particulate matter washes into lakes damaging all our water resources. Leaf burning can also reduce visibility and create safety hazards. A substantial portion of the hydrocarbons in leaf smoke consists of polynuclear aromatic hydrocarbon (PAH), such as Benzo-a-pyrene, which is a major factor for lung cancer. Aldehydes and ketones cause irritation of the eyes, nose, throat and lungs.

As the pollution caused by leaf burning is emitted at the ground level, it is poorly dispersed and remains trapped in the stagnant air near the ground during early evening, night and early morning hours.

Leaves are a rich natural resource, which can be used as mulch or compost. Composting is a safe and environmentally sound method of managing fallen leaves.

Mrs. Maneka Gandhi (former Minister of Environment, Government of India)

(Extracted from her article in the Pioneer, August 13, 2004)

CARCINOGENS IN DIESEL EXHAUST

A study by Sweden based Ecotrafic shows that, in India, the cancer potency of diesel exhaust is more than twice that of petrol cars. But if only particulate emissions are considered, the carcinogenic effects of one new diesel car is equivalent to 24 new petrol cars and 84 new CNG cars on road.

According to a WHO study, compared to petrol, diesel vehicles emit 6.5 times more benzo[a]pyrene – a toxic Polycyclic Aromatic Hydrocarbon (PAH), Japanese scientists have found the strongest-known human carcinogens in diesel exhaust.

(Clean Energy Nepal)

POPS

Persistent organic pollutants (PoPs) are a set of chemicals that are toxic, persist in the environment for long periods of time, and biomagnify as they move up through the food chain. PoPs have been linked to adverse effects on human health and animals, such as cancer, damage to the nervous system, reproductive disorders, and disruption of the immune system. Because they circulate globally via the atmosphere, oceans, and other pathways, PoPs released in one part of the world can travel to regions far from their source of origin.

Clean Energy News

WARNING OF CLIMATE CHANGE RISKS

Rajendra Pachauri, an Indian expert on global warming and chairman of the Intergovernmental Panel on Climate Change (IPCC) has warned the international community that water is leading a crisis level in several developing countries, and it is feared that things will get much worse with climate change.

According to him water supply in the Indian subcontinent is mainly dependent on the melting of snow in the Himalayan range and in the past several decades the glaciers that provide water are receding very rapidly. So we may get floods in the initial period but after a while, when the size of the glaciers has shrunk, then the water flow might actually decrease. The danger is that we might have floods as well as droughts taking place in future.

According to Pachauri, the world's climate is a very delicate one that has been kept in balance for thousands of years but as we are now influencing that balance, the things can go wrong suddenly. Even if we take some serious and very ambitious measures, climate change will continue for centuries. The concentration of greenhouse gases will remain high for a long period of time.

Tadayoshi Sakaguchi

(Source: Clean Energy News, Nepal)

PLASTIC RECYCLING AT ROOM TEMPERATURE

Scientists at Massachusetts Institute of Technology have devised a new class of plastics that can be recycled at room temperature and reshaped at standard manufacturing pressures, providing a potential breakthrough for one of the biggest environmental problems of present day. Conventional plastics need to be heated to 200°C or more to be softened enough for remoulding. This is expensive in energy, carries environmental costs and weakens the material's microscopic polymer chains, eventually sapping its strength and making it un-recyclable.

M.I.T. researchers found a substitute in a mixture of polystyrene, which is rigid, and a soft plastic called polybutyl acetate. Under 340 times atmospheric pressure and at room temperature the mix softened into a clear plastic that could be moulded into a range of hard plastic casings. The casings are shredded and remoulded into new shapes up to 10 times, but remained as strong as ever. If the substance is proved on an industrial scale, it would be a major step towards easing the problem of dumped plastic, a substance that takes decades to biodegrade. However, it is not a substitute for all plastic materials which means that discarded plastic has to be sorted by hand so that the same types are batched together.

(Nature, U.K.)

SANSHUI'S LOTUS WORLD

Sanshui's 'Lotus World' is the largest lotus ecological park in the world, which has exclusively integrated buildings, sculpture and lotus culture. The facility was founded by the Xinan town government of Sanshui under the guidance of the China Lotus Research Center. At present, there are over 300 varieties of lotus planted within, including "Space Lotus" cultivated from air space and "Ancient Lotus" cultivated from Liaoning province. Visitors can enjoy the park by bus or on foot, or canoe among the lotuses and pick flowers and roots. One can enjoy a lotus dinner of fresh lotus leaves, seeds and roots and take in the daily song and dance drama, "Lotus Fairy", which tells of an old but beautiful lotus fairy and a lotus root boy who loved each other and jointly fought against devils. 'Lotus World' has farmhouse-like villas.

Aquaphyte (U.S.A.)

ENVIRONMENT-FRIENDLY PAPER PRODUCTION

Planet's wood supplies are being used faster than forests can replenish themselves. At the same time, agricultural residues, such as straw, are largely unused when they could be quite easily turned into pulp for paper. Wheat straw makes excellent paper. In China non-wood mills represent 7% of world's paper capacity but such activities are now diminishing as small non-wood plants close in the wake of stricter environmental controls. In obtaining white pulp from the brown fibre, a residue of "black liquor" effluent is left which contains caustic substances, which are harmful to environment. Machinery needed to recover it, operates on too large a scale for small plants to install it.

Ms. Sue Riddlestone, Director of the BioRegional MiniMills in U.K. is one of the prime saviours of our forests. She is making paper from straw pulp combining innovative technology, local employment and environmental benefits in a visionary

new approach to Sustainable paper production. MiniMill developed a technology that produces a quality paper pulp suitable for printing and writing paper but using only half the energy and fewer chemicals than in traditional systems.

Ms. Riddlestone, who a former nurse by profession, became actively involved in the environmental field following a stint of voluntary work for the eco-lobby group Greenpeace and co-founded BioRegional as an environmental charity.

James Sinclair

London Press Service

(Source: Spectrum magazine)

RECYCLED WATER IS A HEALTH HAZARD

Using recycled water at home can pose serious health risks according to Australian researchers. People turning to rainwater, storm water, gray water and treated sewage, to save water, may unwittingly expose themselves to pathogens or chemical contaminants.

More than half of household water is used to water the garden, flush the toilet or wash cloths. Because of the drought and long-term climate change we are looking at different alternative sources of drinking water. Faecal contamination is also a problem in the recycled gray water, which comes from washing machines and showers. Faecal matter can form a breeding ground for pathogenic bacteria and together with soaps and body fats washed off in showers can form a scum that makes it smelly and a health hazard.

(Source: ANI)

'BHINDI' – FORTIFIED PAPER

Textile technologists at Indian Institute of Technology, New Delhi have produced paper laminates with excellent strand fibres extracted from the stem of lady's finger ('bhindi') plant. Its stem, which is 6-10 ft long is mostly wasted or burned as fuel. The sturdy laminates have been made by sandwiching the fibres between two sheets of packaging grade

paper bonded by hot pressing. The resulting fibre reinforced paper laminates are very tough and show excellent properties. This can easily replace expensive paper corrugated component currently used by packing industry.

Pollution affects Unborn Mice

Researchers at the McMaster University found that genetic mutations known to be caused by some pollutants in mice can be passed to their offsprings. The studies carried out by the scientists indicated that airborne particulate matter as contributor to heritable mutation induction in mice. The scientists, in their experiment, put caged mice downward of steel mills in Ontario, Canada. Some got filtered air and others got what the wind brought. Mice exposed to filtered air at the urban-industrial site had 53% lower paternal mutation rates. Presumably, the same thing could happen to human beings.

Reuters News Service/Clean Energy, Nepal

HOLLYWOOD FILM BASED ON CLIMATE CHANGE

20th Century Fox's 125 million dollar latest movie "The Day After Tomorrow" highlights the perils of climate change. The story of the film depicts how global warming caused by man's insatiable desire to keep burning oil, gas and coal, melts the polar ice caps and neutralizes warm ocean currents to trigger and Ice Age.

New York is flooded by a tidal wave and then frozen solid in a giant ice storm. Americans flee South to the Mexican border.

It is hoped that the film would bring the real debate on climate change to people who would not otherwise consider it. Ronald Emmerich, the director of the movie has donated U.S. \$ 200,000 to a reforestation project in the Himalayas and energy saving projects for poor families in U.S.A. to offset the carbon energy used during filming.

Source: Reuters News Service

In an underdeveloped country, don't drink the water; in a developed country don't breath the air

- Changing Times Magazine.

USE OF BIOMASS COULD REDUCE CO₂ EMISSIONS

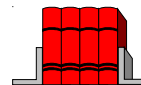
According to a report by the World Wide Fund for Nature (WWF) and European Biomass Industry Association, the production of biomass would create hundreds of thousands of jobs while helping to reduce carbon dioxide emissions by about 1,000 million tons each year. Biomass currently provides one per cent of industrialized countries' power needs but could provide 15% by 2020. A renewable energy source, biomass is made from agricultural and forest products such as animal waste, straw or sugar cane.

BENEFITS OF VEGETABLE-BASED FUEL FOR DIESEL ENGINES

- It is created from soybean or other vegetable oil or from used cooking oil (more than 4 billion gallons of waste cooking oil produced annually in U.S.A.)
- Reduces carbon monoxide, carbon dioxide, hydrocarbons, benzene and particulate matter.
- Can safely be blended with petroleum diesel
- Can be used in any diesel engine with little or no modification to the engine
- Is safer to use than petroleum diesel—it has a flash point of 300^o F (vs .125^o F for diesel)
- Is biodegradable
- Would create new jobs and increased income for farmers
- Smells like French fries or popcorn when burned.



BOOKS



The impact of Carbon dioxide and other Green house Gases on Forest Ecosystems

Edited by Karnosky, D.F., Ceulemans, R.R., Scarascia-Mugnozza, G.E. & Innes, J.L.
2001
IUFRO Research Series 8
CABI Publishing, Wallingford & New York
Price £ 55.00

Ecological Management of Agricultural Weeds

By Liefman, M., Mahler, C.L. & Staven, C.P.
2001
Cambridge University press
Price US \$ 120.00

Environmental Urban Noise

Edited by A. Garcia
2001
ISBN: 1-85312-752-3 Price US \$ 136.00
132.00
Series: Advances in Ecological Sciences

World Atlas of Biodiversity

Earth's Living Resources in the 21st Century
By Brian Groombridge & Martin D. Jenkins
2002

UNEP-WCMC

University of California Press
ISBN: 0-520-23668-8 Price \$ 54.95

Evoluion and Adaptation of Cereal Crops

Edited by V.L. Chopra & S. Prakash
2002
Enfield (NH): Science Publishers, Inc.
Price US \$ 89.50

The Biology of Seeds: Recent Research Advances

By G. Nicolas, K.J. Bradfors, D. Come & H.W. Pritchard
2003
CABI Publishing Wallingford, U.K.
ISBN: 0-851 99-53-1 Price US \$ 175.00

Air Pollution XI

Edited by F. Patania & C.A. Brebbia
2003
ISBN; 1-85312-982-8 Price US \$ 349.00
328.50
Series: Advances in Air Pollution Vol. 13
www.witpress.com

Water Pollution VII

Modelling, Measuring and Prediction
Edited by C.A. Brebbia, D. Almorza & D. Sales
2003
ISBN:1-85312-976-3 Price US \$ 249 237
Series: Progress in Water Resources Vol. 9

Invasive Plant Species of the World: A Reference Guide to Environmental Weeds 2003

CABI Publishing Cambridge MA, U.S.A.
ISBN: 0-85199-695-7 Price US \$ 75.00

Bioterrorism and Food Safety

By Barbara A. Rasco & Gleyen E. Bledsoe
2004

CRC Press

ISBN: 08493-2787-3 Price US \$ 99.95
Urban Transport and the Environment
Edited by the World Conference on Transport Research Society & the Institute for Transport Policy Studies
2004
ISBN: 0-08-044512-8 Price US \$ 88.00

Air Pollution XII

Edited by C.A. Brebbia
2004
ISBN: 1-85312-722-1 Price US \$ 184 172
Series: Advances in Air Pollution Vol. 14

Waste Management and the Environment II

Edited by C.A. Brebbia, S. Kungolos, V. Popov & H. Itoh
2004
ISBN:1-85312-738-8 Price US \$ 288.00
270

Urban Air Pollution, Bioindication and Environmental Awareness

(This volume contains lectures, poster presentations and discussions of the EuroBionet 2002 Conference on urban air pollution, bioindication and environmental awareness organized at the University of Hohenheim on 5-6 November 2002)
Edited by Andreas Klumpp, Wolfgang Ansel, Gabriele Klumpp
2004
ISBN: 3-86537-078-0

CONFERENCES

National Seminar on Eco-degradation due to Air Pollution

October 16, 2004, Baroda, India
Contract: Dr. Arun Arya

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Baroda, Vadodara, India

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National Seminar on Bioresources, Awareness and Management of Urban Waste

October 30-31, 2004, Jhansi, India

Contact: Dr. M.C. Kanchan
Head, Department of Botany
& Industrial Microbiology
Bipin Bihari Post-graduate
College, Jhansi-284001
(U.P.), India.

Conference on Indoor Air Quality

November 10-12, 2004, Padua, Italy
Information: <http://www.isac.cnr.it>

Healthy Trees, Healthy Cities, Healthy People

November 17-19, 2004, Atlanta, Georgia (U.S.A.)

Contact: Racey Ratterre, Macon, Georgia

E-mail: gufc@comcast.net
Internet: <http://www.gufc.org/newGUF2004>

National Symposium on Biodiversity, Biotechnology & Environmental Toxicology

November 24-26, 2004, Institute of Science, Mumbai

Contact: Dr. Prakash D. Raut
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Madam Cama Road,
Mumbai-400032, India

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aeb1@rediffmail.com /
kgdubey@hotmail.com

International Conference on Development of Herbal Drugs – Regulatory Requirements and Future Tasks

November 26-29, 2004, Lucknow, India

Contact: Mr. G.V. Shridhar /
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E-mail: gvshridhar@hotmail.com
nnjeevan@sancharnet.in
herbaltech_vision2004@yahoo.com

'5th Annual, Indoor Air Quality Tools for Schools' National Symposium

December 2-4, 2004, Washington D.C. (U.S.A.)

Contact:
E-mail : info@iaqsymposium.com
Internet : <http://www.iaqsymposium.com>

International Conference on Education for a Sustainable Future

18-20 Jan. 2005, Ahmedabad, India

Contact : esf@ceeindia.org
www.ceeindia.org/esf

Third International Conference on River Basin Management.

September 6-8, 2005, Bologna, ITALY

Contact: Rachel Green
SR. Conf. Co-ordinator
River Basin Management
2005, WESSEX Institute of
Technology
Ashurst Lodge, Ashurst,
Southampton, SO 40 7AA,
UK

Email : rgreen@wessex.ac.uk

Third International Conference on Impact of Environmental Factors on Health

September 14 - 16, 2005, Bologna, ITALY

Contact: Katie Banham
Conf. Secretariat,
Environmental Health Risk
2005, WESSEX Institute of
Technology, Ashurst Lodge,
Ashurst, Southampton,
SO 40 7AA, UK

Email : kbanham@wessex.ac.uk

First International Conference on Environmental Exposure & Health (EEH - 2005)

October 5 - 7, 2005, Atlanta, USA

Contact E-mail:
enquiries@wessex.ac.uk

6th International Conference on Biodeterioration of Cultural Property (ICBCP-6)

2005 (venue and dates to be announced later)

Contact: The Editor/The Secretary
ICBCP, Lucknow, India

Email: iccins@sancharnet.in

International Solanaceae Conference and Poster Photocompetition

July 23-27, 2006, Madison, Wisconsin (U.S.A.)

Contact: David M. Spooner
E-mail : dspoone@sisc.edu

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