ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

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IN THIS ISSUE

High Rises – A Solution for Urban Pollution

Po-pollution is the pollution caused by increasing population. In all developing countries, it is the basic cause of all environmental pollution. Urban India has seen a phenomenal growth during the past decade. As our metro cities have already reached a saturation point and are bursting at the seams, the population pressure is now shifting to medium class cities and towns, where infra-structural facilities are on the verge of collapse.

Metros have already become vast, concrete jungles due to poor planning. Restrictions are now being imposed on the vertical growth of other fast growing cities. These cities are growing horizontally in all directions. Colonies after colonies are being developed on the peripheries of these cities where green farms, fields, orchards and ponds once existed. As the farmers are elbowed out to make room for the upcoming posh colonies, they have no option but to move towards forested areas for their sustenance. Trees are cut and dense forests are denuded to make way for agriculture and horticulture. Nobody knows where this horizontal movement will lead us.

Rapid horizontal growth of cities is also causing severe strain on our transport system. A person often has to travel 20-30 km from his residence to his place of work. This has resulted in manifold increase in the number of vehicles, galloping rise in fuel consumption and a phenomenal increase in environmental pollution. If the distance covered daily by thousands of commuters could be reducedy, say 50-60%, then there will be a corresponding decrease in the fuel bill, reduced pollution and save precious man hours, which are wasted in commuting long distances.

Civic and urban authorities should put a check on unrestricted horizontal growth of these cities and allow well planned high-rise multi-storeyed buildings to come up with full encouragement and incentives. However, in order to avoid the creation of 'concrete jungles', high rise buildings should be allowed to come up only along very wide, tree-lined roads. While half of the ground floor of such buildings should have parking facilities, the remaining half should be converted into indoor gardens of potted house plants. In Delhi such indoor gardens have recently come up under the flyovers with very pleasing and soothing effect.

K.J. Ahmad

(Secretary, ISEB).

- 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, Rana Pratap Marg, Lucknow-226 001 (India).
- **E-mail** : isebnbrilko@satyam.net.in ● **Website:** http://www.geocities.com/isebindia/index.html

LETTERS

Please see the attached check for US $200. This is a personal gift to ISEB. I had intended to send this to you since last December. I regret the delay. Every time I thought about it, I seemed to have been side tracked. Nevertheless, I am glad that I could arrange for it now.

Although you may consider it, please note that I do not wish to have my name announced in the EnviroNews, as a donor. I would appreciate your cooperation in this matter.

"A well wisher of I.S.E.B"
(U.S.A.)

Many thanks for sending the valuable *Environews* April 2004. It is an excellent publication. I will be highly grateful, if you could send me the April 2003 issue of ***Environews***, as it contains a paper jointly authored by Lisa Emberson, Prof. Agrawal, and myself. You may recall that you had sent this paper to Prof. Nigel Bell last year, and he had promised to send it to me. Now I again requested Prof. Nigel Bell to send it to me but he said that he is not finding it in his office.

If possible, then please send it to me as an attachment, for which I will be obliged.

Dr. Abdul Wahid
Botany Department,
Government College, University of Lahore, ***Pakistan.***

Just now I went through the ISEB newsletter sent to me as e-mail ms. Thanks a lot for the same. I would like to contribute an aarticle in the ***Environews***. Could you kindly mail to me the rules for the preparation of an article? Moreover, we are organizing an "International Conference on "**Biosaline Agriculture and High Salinity Tolerance**" here in Turkey. Unfortunately, I could not trace the names of scientists from India in this field. Will it be possible for you to help me in this connection? The announcement is attached herewith for your perusal.

Dr. Munir Ozturk
Professor Emeritus, Ecology & Environmental Sciences,
Department of Botany, Ege University, Bornova-Izmir, ***Turkey***

Through the columns of your esteemed newsletter, I feel pleasure in informing the scientists, academicians, scholars and student community in India that Jamia Hamdard (Hamdard University) has recently set up two prestigious facilities namely, Scholars' House and Convention Centre for their benefit within its sprawling campus in New Delhi.

Scholars' House has modern and clean boarding and lodging facilities for 60 delegates and the charges are quite moderate.

Hamdard Convention Centre has a state-of-the-art centrally air-conditioned auditorium with a seating capacity for 250 persons. A Conference Hall with a seating capacity of 60 persons and a seminar room to accommodate, 24 persons has also been constructed adjacent to the main hall. Convention Centre is fully equipped with all modern gadgets, including excellent projection and light systems. A well-designed lobby, central recording, typing, xeroxing and slide and movie projection facilities and a press gallery are also provided under the same roof.

Through the medium of ***Environews***, I appeal to the scientists and academicians of the country to avail the facilities of Scholars' House and Convention Centre provided by us for organizing national/international conferences, seminars and symposia.

Dr. Javed Ahmad
Senior Reader, Department of Botany
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Congratulations for launching the website of ISEB. It was very much needed for quick transmission of information. Special care has been taken to keep it simple, possibly to enable it to open quickly.

However, I would like to inform you that I could not open the ***Environews*** page. Either there is some problem with the page or some fault at my terminal.

Dr. Mohammad Ahmad
Former Professor & Head, Department of Cardiology &
Director Cardiology Institute,
Aligarh Muslim University, Aligarh, ***India.***

I was sure of the grand success of the last Conference. I was really unlucky in missing this important Conference. I will be obliged to have a copy of the Abstracts and the Proceedings of the Conference. I sincerely want to be a member of ISEB. Please send the application form and other details for the purpose.

Prof. Subrata Maity, Ph.D.
Head, Dept. of Seed Sci. & Technology,Faculty of Agriculture
Bidhan Chandra Krishi Viswavidyalaya,
Mohanpur, West Bengal - 741252, ***India***

Thank you for sending me the electronic version of ***Environews***, which I really liked. I was able to pen one attachment only, and hence will be reading that one. I am sure it will be very useful for **Earthwatch** and also for my own knowledge. I look forward to receiving more of these.

Bharati Chaturvedi
Earthwatch**,** *New Delhi,* ***India***

We are going to organize an one day National Workshop on Aquatic Weeds. The title of the said programme is "AQUATIC WEEDS -THREAT TO THE ENVIRONMENT OR BOON IN DISGUISE". It will be held on Sept.4, 2004 at College of Technology and Engineering, Udaipur (Rajasthan). I will request you to disseminate this information through the channels of International Society of Environmental Botanists and its newsletter, ***Environews.*** Please send me the list of the names of the concerned scientists along with their postal and e-mail addresses so that I could send the workshop announcement to all of them. Your cooperation and guidance will lead us to make this programme a success.

Dr. S.M.Mathur
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NEWS FLASH

2nd World Botanic Gardens Congress was held at Barcelona, Spain during 17-22 April 2004. The main objective of this Congress was to provide a forum for the botanic gardens of the world to review the implementation of the International Agenda for Botanic Gardens in Conservation and to consider matters of mutual interest relating to the development and implementation of common policies, programmes, and shared priorities.

The Congress reaffirmed the commitment of botanic gardens to plant conservation, environmental education and sustainable development.

From India, Dr. P. Pushpangadan (Director, National Botanical Research Institute, Lucknow & President ISEB), Dr. H.M. Behl (Head, Biomass Biology, NBRI & Executive Editor, ***Environews***), Dr. S. Kumar (Head, Bioinformatics, NBRI & Life Member of ISEB) and Dr. Kamla Kulshreshtha (Head, Eco-education, NBRI & Joint Secretary ISEB), participated in the Conference and made their presentations on National Plant Data Base, Action plan for Indian Botanic Gardens, ex situ conservation in Botanic Gardens and Establishment of Model Home Garden for Women.

TRAINING PROGRAMME ON BIORESOURCES FOR SCHOOL CHILDREN

A four week "Vacation Training Programme on Bioresources for School Children" was organized by the Eco-education Division of the National Botanical Research Institute, Lucknow from May 17 to June 11, 2004. Dr. Kamla Kulshreshtha, Scientist & Head of the Division and Course Director, planned and conducted the programme under the guidance of Dr. P. Pushpangadan, the Director of the Institute and President ISEB.

The entire curriculum of this programme was designed with a view to provide an opportunity to young participants to learn about their local biodiversity, starting from the microbial world to the vast realm of gigantic gymnosperms, angiosperms and animal world. It was emphasised that the application of various techniques of biotechnology could be utilized successfully to derive economic benefits from these bioresources. The conservation of biodiversity for providing a sustainable livelihood is another aspect, which was highlighted in this programme. To provide practical experience to the children, visits to protected and reserved areas and laboratories were also organized. The hand on activities ended with the closing session of the programme.

The main objectives of the training programme were:

- to inculcate among students an appreciation of the biological resources of the country, their use and management;
- to create opportunities for hands – on experiences in the field;
- to understand locally available bioresources, their sustainable use and conservation;
- to interact with leading experts in the field including core and visiting faculty at the organizations.

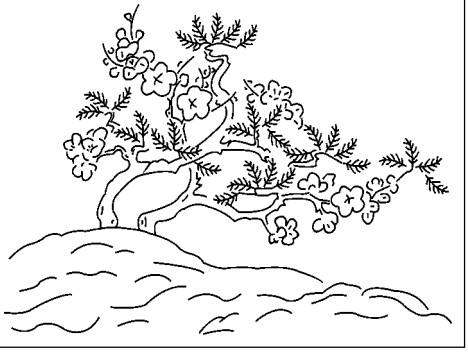
The porgramme covered various aspects of country's biodiversity and bioresources such as their values, distribution, ethnic knowledge bases, threats to bioresources, intellectual property rights and scope/avenues in the field of biotechnology and biodiversity.

The programme, which was inaugurated by H.E. Prof. Vishnu Kant Shastri, the Governor of Uttar Pradesh was sponsored by National Bioresource Development Board (NBDB), Department of Biotechnology, Government of India, New Delhi. Dr. S. Natesh, Advisor DBT was the Chief Guest at the inaugural function. Well known Indian environmental activitist and Director of the Centre for Science & Environment, New Delhi, Ms. Sunita Narain was the Chief Guest at the valedictory function held on 10th June 2004.

WELCOME NEW LIFE MEMBERS

Prof. P.K. Seth, Scientist-in-Director's Grade, Industrial Toxicology Research Centre and Chief Executive Officer, Biotechnology Park, has joined International Society of Environmental Botanists as a Life Member. An internationally renowned Biochemical Toxicologist /Neuro-toxicologist and Biotechnologist, Prof. Seth headed CSIR's Industrial Toxicology Research Centre as its Director, prior to his current assignment. Dr. Seth aims to make Biotechnology Park as the hub of R & D activities in the field of Biotechnology, and Lucknow, as the Biotech City of India.

Dr. Ms. Sabrina Naz, Associate Professor, Department of Botany, Rajshahi University, **Bangladesh,** has joined as a Life Member of ISEB. Dr. Naz has done extensive researches in the field of Limnology.



ENVIRONMENTAL IMPACT OF GENETICALLY ENGINEERED CROPS

C.R. BHATIA

Cultivation of food crops began ten thousand years back when humans discovered that the cereal grains they have been collecting from natural stands could be grown in their own backyards. Since then, contemporary knowledge and tools have been used to select the plant types most suited to the human needs. Selection of easily threshing wheat, non-shattering rice, cobs of maize, and fruits with large edible parts are some of the well-known examples. Genetic modification of crops continues even in the most primitive tribal populations. They select the best cobs of maize, and ears of sorghum and millets, and hang them at the entrance of their houses. Domestication brought about large changes in morphological, physiological and biochemical characters by indirectly selecting them, though the process was slow. Rediscovery of the Mendel's laws of inheritance in 1900, and the birth of the science of Genetics, provided knowledge based plant improvement, and the rate of change accelerated. Hybridization to combine the desired characters from different accessions, exploitation of hybrid vigor, development of polyploids, and amphiploids, induction of mutations, chromosomal translocations using radiations and chemical mutagens added new tools, and further hastened the pace of change. However, in all these methods the genetic manipulations were made at the cell level, and selection was based on the phenotype. In the mid 1970's it was discovered that the isolated genetic material (DNA) can be cut at defined sites using specific restriction enzymes, cloned, and the desired DNA sequences (genes) can be introduced into the resident genomes, and expressed. This process of precisely manipulating the genetic material at molecular level is known as the recombinant DNA (r-DNA) technology, or as genetic engineering. The new techniques also made it possible to directly select for the presence or absence of the gene(s) and not on the phenotype as in the past.

First such plants expressing a bacterial antibiotic resistance gene were produced in 1983. Since then, a large variety of plants expressing genes from microbes, reproductively isolated plants, animals, and even human genes have been developed. Thus the gene pool available for the improvement of crop plants has been enlarged to include the genes available in the entire biodiversity. Further, the existing genes can be modified at molecular level or new genes can be synthesized. Such plants are popularly referred as Genetically Modified Organisms (GMO's). Crop plants developed using classical methods of selection, hybridization and mutations are all genetically modified, and hence, the terms Genetically Engineered Organisms (GEO's) clearly differentiates them on the basis of the technique used for their development.

Soon after the development of GE plants, and the possibilities of their large-scale cultivation, the scientific community expressed different viewpoints illustrated by the following quotes:

"Genetic Engineering represents a radical break from evolutionary history." - Rissler and Mellon (1993)

"Molecular biologists are making an end run around nature's restrictions, mixing genes from many distantly related species of organisms to provide progeny that nature would never allow" – Giampietro (1994)

"Crops modified by molecular and cellular methods pose risk no different from those modified by classical genetic methods for similar traits" – NRC (1989)

"Genetic Engineering is nothing more than a simple extension of traditional plant breeding" - OECD (1993)

It is pertinent to recall that:

- Most people are apprehensive of things that are new, not experienced by them earlier – the fear of the unknown.
- New technologies have always been controversial – vaccination introduced by Edward Jenner, and pasteurization of milk are the classical examples.
- All technologies have some adverse effect on environment. Even food gathering, and hunting, practiced by humans before the dawn of agriculture, was detrimental to the environment and biodiversity.
- Growing of crops, and animal husbandry was possible only after clearing the natural vegetation from large areas of land, and consequent loss of biodiversity.
- All technologies have certain risks, and benefits. Humans have learned to minimize, and control risks, and to maximize the benefits.
- The real risk, and human perception of risk varies. Most people believe that flying has a higher risk than travelling by road, but the statistics show that it is the other way.

ENVIRONMENTAL RISKS FROM GE CROPS

Environmental risks perceived from large-scale cultivation of GE crops are:

- Increased invasiveness.
- Development of new, more virulent strains of viruses on transgenic virus resistant plants.
- Effect of toxic, transgenic products from insect, and pathogen resistant plants on non-target organisms.
- Overcoming the resistance mechanism of the transgenes by insect pests leading to more virulent insect biotypes.
- Transfer of antibiotic resistance genes, used as selectable markers in the process of developing transgenics, to other organisms.
- Safety of food items obtained from transgenic crops – allergic reactions.
- Gene flow to other crop cultivars, traditional varieties, land races, wild, weedy related species leading to the loss of biodiversity.
- Long term effects.
- Non-foreseeable effects on ecosystems.

The possibilities of the above-

mentioned risks cannot be ruled out on the basis of scientific knowledge. The risk-benefit analyses consider the probability of the occurrence of risk, and the overall benefits of the technology. Out of the above, except the gene flow, the probabilities of their occurrence are extremely low. Moreover, if any transformation events lead to such adverse changes they will be identified in early generation testing, and during biosafety evaluation. While the GE crops were widely accepted in US, the environmental groups in Europe started determined campaigns against the GE crops. Believers in the God's creation of life say that "humans have no right to tinker with the genetic material which is the creation of God", and "GE is against nature". These ideas found wide support in public. At the same time green political parties gained considerable clout in Europe and became part of the ruling coalition Governments. Socio-political and commercial issues underlying the resistance to GE crops in Europe are very different. Human populations are stable or declining in many countries, crop productivity is high with excess production of most farm products, produced by their heavily subsidized farmers. In contrast, population is growing in India, and most developing countries of the world, and average purchasing capacity is low. Additional land can be brought under cultivation only after clearing the already low forest cover, and hence, increased production must come through enhancing the productivity of the existing farmland. GE crops though grown in 18 countries over an area of 67.7 million ha in 2003 is one of the most controversial, and hotly debated issue. People opposing globalization, privatization, multinational companies and new technologies view GE crops as a symbol of all the above, and a means of exploiting the farmers in poor countries.

BIOSAFETY REGULATIONS

Biosafety regulations were first brought out in the USA to find science-based answers to the possible risks. Since then a large number of countries have evolved their own regulatory mechanisms for conducting experiments with GE plants, their field evaluation and commercial cultivation. In India, rules for the manufacture, use, import, export, and storage of GEO's, the Ministry of Environment and Forests framed cells and plants under the Environment Protection Act in 1989. Based on the recommendations of the Recombinant DNA Advisory Committee, the r-DNA safety guidelines were issued in 1989 by the Department of Biotechnology. They were revised in 1994, and more detailed guidelines for transgenic crops were issued in 1999.

Three level of approvals is followed, first the Institutional Biosafety Committee (IBSC) that approves and oversees the GE research within the Institute / Company. At the second level is the Review Committee on Genetic Manipulation (RCGM) that permits and oversees contained as well as small plot (one acre) field experiments. The design and layout of the field experiments is approved by RCGM that also appoints Monitoring and Evaluation Committees (MEC) to visit each of the field experimental sites and report to RCGM. At the third level Genetic Engineering Approval Committee (GEAC) functions under the Ministry of Environment and Forests Large-scale field experiments, and final approval for commercial production are authorized by the GEAC. Besides the above, there are State Biotechnology Coordination Committees for each state, and District Level Committees (DLC) in each district (county), mainly to ensure implementation of the biosafety guidelines.

GENERAL CONSENSUS AMONG SCIENTISTS

Some common issues in safety evaluation have emerged for which there is widespread agreement in the scientific community. The Ecological Society of America has also included them in their position paper on GEOs in 2004.

- The environmental benefits and risks associated with GE crops should be evaluated with appropriate baseline – GE versus conventional crop.
- The risk is dependent on the trait, and not on the method used for developing such cultivars.
- Each crop-gene combination, and transformation event, should be evaluated independently.

Leading Science Academies of India, China, Brazil, Mexico U. S. National Science Academy, the Royal Society, London, and the Third World Academy of Science after considerable deliberations brought out their common report on GE crops. Others have also considered the ethical, and socially sensitive issues such as transfer of animal, and human genes into plants the public acceptability for which would vary in different societies. The food safety issues were also extensively examined among others by the British Medical Association, their 2004 statement says that the safety concerns for GE foods apply equally to other conventional foods.

GENES VERSUS GENOMES

Out crossing is ubiquitous even in highly self-pollinated plants. Occasional out crossing and consequent gene flow is a means of enlarging the genetic diversity of the species. Out crossing between cultivars of the same species, cultivars to wild, weedy relatives and *vice versa* happen all the time when they grow nearby (Sympatric populations). It has been a matter of concern in the seed production programs, and appropriate measures have been evolved to minimize the pollen flow into seed production plots. GE crops do not differ from the traditional crops in this respect. However, some environmental scientists have projected scenarios to scare the public, even going to the extent that GE crops will destroy biodiversity, and the land races will be lost forever. Gene flow can only enhance biodiversity by enlarging the gene pool, it cannot destroy it. Genomes (complete set of genes) are constantly changing even in nature due to mutations and recombination. In the past, the whole genomes with about 30,000 genes each, as per the recent estimates, have been introduced as food, fruit or ornamental crops with no apparent damage to local biodiversity. Potato, tomato, tobacco, chillies, groundnut, maize, tetraploid cotton, soybean, rubber are introduced crops extensively grown in the country. Similarly many introduced species of fruit and agro-forestry trees, and ornamentals (*Bougainvillea*) are grown all over the country. Botanical gardens claim with pride the new exotic species they have introduced. All such introductions of new genomes have not caused any appreciable harm to the local biodiversity, how the introduction of few genes can destroy biodiversity? Of course, precautions are necessary in dealing with herbicide resistance – natural or engineered, and other such characters for which there is

no previous experience. Identification, management and plans for mitigation of environmental risks should be well thought out and investigated in parallel with the development of GE crops.

CONCLUSIONS

GE crops, approved for cultivation by the regulatory agencies, are as safe as any other conventionally bred cultivars for human consumption, as well as for the environment. Occasionally they may transfer their genes into other cultivars in the neighboring fields or wild related species through out crossing, like other cultivars. Cross-pollination, even in highly self-pollinated species, is part of the nature to enhance biodiversity. It occurs in the natural stands of the ancestral species of the crops, and has been going on between the cultivated and their related wild species since domestication.

Dr. C. R. Bhatia *is former Secretary, Department of Biotechnology, Government of India, New Delhi and Former Director, Bio-Medical Group , Bhabha Atomic Research Center, Mumbai.*
e-mail: ***neil@bom7.vsnl.net.in***
The first transgenic plants in India were developed at BARC.

EVERGREEN PLANT SURFACES AS TARGETS UNDER CHANGING CLIMATE

SATU HUTTUNEN

All botanists know how variable the aerial green surfaces are. Surface structures (cuticles) vary from thin films to thick waxy surfaces. The protective features are not related to thickness of the cuticle, but mainly to the chemistry and morphology of the aerial surfaces. Some surfaces are water-repellent and some others are easily wettable.

Epicuticular wax chemistry and morphology has attracted scientists as early as microscopes of sufficient magnifications were available to see few microns ultrastructures. Simultaneously, the complicated stomatal structures with special epicuticular wax structures have been of interest to researchers. The observation, that environmental signal on developing waxes, affects the development of stomata, is quite recent.

Many leaves and needles are evergreen with a considerably long life span. Evergreen plant surfaces and leaves have considerable morphological, ultrastructural and chemical diversity, and variation in their responses to environmental factors. Wax morphology and chemistry are important in plant systematics, but waxes respond to environment in quality and quantity.

Increasing spring and early summer UV-radiation, fluctuating temperatures, drought or wetness as part of the climate change and air-borne pollutants represent a risk for plants. Wintertime accumulation of air-borne pollutants on evergreen surfaces and into leaves under subarctic conditions was observed in 1970s. Late winter and early spring at high-altitude ecosystems are characterized by high radiation levels and fluctuations between freezing and thawing temperatures. Many evergreens are important key species in arctic and alpine ecosystems. In subarctic or alpine ecosystems, the UV dose received by evergreens in the late winter and early spring is high due to reflectance from the long-lasting snow cover.

Are there especially sensitive or inert wax surfaces in plants? A chemical definition of a wax is the ester of a long-chain acid and a long-chain alcohol. Waxes constitute a large array of different chemical class hydrocarbons, wax esters, ketones, aldehydes and sterols. The second feature is that the chain length ranges from C2 to C 62.

FUTURE CLIMATE IN SUBARCTIC

Most climate models predict that the maximum temperature increase due to the future change in climate will occur at the high altitudes, and that the relative elevation of tropospheric ozone levels will also be remarkable. A new evaluation of the responses in the Arctic tundra and subarctic forest ecosystems will be available later this year in the form of an ACIA Scientific Report (Meeting in Reykjavik).

The relative ozone depletion and the relative increase in UV-B radiation are now greater in the subarctic than at lower altitudes), and this may be more important than the absolute radiation levels. The most marked increases in UV radiation occur in the springtime, and the warming-related declines in snow and ice cover increase exposure. The total impact is greater than the sum of its parts, such as chemical contaminants, UV and climate warming.

In the arctic tundra and subarctic ecosystems, the snow cover normally persists long into the spring even after air temperatures and light have increased to levels suitable for photosynthesis. Bryophytes and lichens photosynthesise under snow, and so do also evergreen vascular plants. The probable result during spring conditions there will be a prolonged snow-free period, which will affect the early active evergreens.

RESPONSES IN SURFACE STRUCTURE AND CHEMISTRY

Outdoor UV-B supplementation studies of higher plants involving modulated lamp banks have revealed some significant responses, but plant responses to UV-B generally seem to be more subtle than those based on exclusion studies. The most consistent response in higher plants was an increase in the concentrations of soluble leaf UV-B-absorbing compounds. Phenylpropanoids, e.g. hydroxycinnamic acid, cinnamoyl esters, and flavonoids, including flavones and flavonols, and anthocyanins provide a UV-A and UV-B screen in higher plants. The flavonoids responsible for UV screening vary from species to species, and most plants synthesize a range of compounds to provide more effective screening. So far, most of the studies have been made with summer-green species.

The studies with evergreens have shown that, in warm years, the production of soluble phenolics is higher compared to cold years. UV-B radiation and altitude

alter the foliar flavonoid composition in forest tree species, such as Scots and ponderosa pine. The responses may be transient or long-lasting. Phenolics increase with needle age in Scots pine, black pine and ponderosa pine Enhanced UV-B radiation increased Scots pine needle cutinization and wall-bound phenolics as well as flavonoids, , which are important during the late winter and early spring.

The natural UV-screening mechanisms in evergreens have been shown to include UV light screening via reflectance of UV/violet light by the epidermis, UV light screening via reduction of transmission by special anatomical arrangement of epidermal cells as well as light-reflecting hyaline hypodermal cells, conversion of UV light via fluorescence and UV light screening by UV-screening substances in cell walls and on surfaces. In higher plants, anthocyanins and flavones increase in response to high visible light levels, and UV irradiation induces flavonoids, sinapate esters, isoflavonoids and psoralens, and in evergreens, diacylated flavonol monoglycoside induction, for example, has been detected and p-coumaric acid, ferulic acid and astragalins have been identified as UV-B-absorbing substances.

There is a growing body of evidence to suggest that plants respond to biotic and abiotic stress factors by increasing their capacity to scavenge reactive oxygen species via the phenylpropanoid pathway, and that the production of epicuticular waxes increases , and changes in wax biosynthesis and chemistry occur. On the other hand, harsh climatic factors (winter abrasion) and air-borne particles and pollutants erode epicuticular waxes. Signal transfer from plant surfaces has indicated the role of cuticular waxes in the environmental control of stomatal development, and environmental factors may further affect the function of plant leaves. Surface structures and epicuticular waxes differ in their composition, water repellency, wettability and structural climatic factors, including snow cover and pollution. Also, evergreen shrub responses to elevated temperatures have been studied, but only a few studies have so far been conducted on activity aspects related to enhanced UV and the effects of lengthened spring.

Anthocyanins have been reported to occur in the mesophyll layers of some evergreen species, e.g. *Mahonia, Viburnum* and *Rhododendron*. Prenylpropanoid and flavonoid compounds usually accumulate in the central vacuoles of guard cells and epidermal cells as well as the sub epidermal cells of leaves and shoots. Furthermore, some compounds seem to be covalently linked to plant cell walls. In red mosses, anthocyanins are so firmly wall-bound that they have been recommended for use as cytological stains, but their importance for the species is not fully understood. The changes in light climate and hydrology may affect the spectral behaviour of peatland canopies and further complicate the interpretation of spectral images.

Anthocyanins absorb blue light and reflect red wavelengths, and theoretically, anthocyanins in the upper epidermis or mesophyll of leaves could compete with light harvesting by chlorophyll and carotenoids. Neill and Gould from New Zealand observed that anthocyanin production enhanced the absorbance of green-yellow wavelengths in proportion to the pigment concentration. The reflectance of red light was independent of the leaf anthocyanin content.

Photoinduction of anthocyanin biosynthesis by wavelengths in the UV, visible and far-red regions, cold temperature and osmotic induction are the best-known cases of anthocyanin appearance. Other induction factors, e.g. nutrient deficiency and plant hormonal relations, have also been discovered.

New approaches on the study of evergreen plant surfaces will provide basic functional and structural knowledge of the responsiveness and acclimation of subarctic plants. It will also add to our knowledge of cuticular and wax evolution in extant plants and thus provide an important link with plant evolution. Protective structural features, e.g. epicuticular waxes and light screening compounds, both surface- and cell wall-associated, and their correlations with function and species diversity have not been studied earlier e.g. in subarctic or arctic mosses.

New studies will give new information on the diversity of the light and climate responses of arctic and subarctic evergreens and help to predict the long-term responses in key species and to understand the subtle changes due to microclimate or season. Reconstructive methods (herbarium specimens, environmental specimen banks) may be useful in the evaluation of future trends.

Prof. Satu Huttunen *is Professor in Plant Ecophysiology, Botany Division, Department of Biology, University of Oulu,* ***Finland.***

LAND DEGRADATION PROBLEMS IN THE EUPHRATES BASIN, TURKEY

M. OZTURK[1], H. OZCELIK[2], S. SAKCALI[3], A.GUVENSEN[1]

The Euphrates-Tigris basin is a historically important watershed area in the world and plays an extremely important role in the water availability of Middle East. The river is the longest of all the rivers in SW Asia, formed by the confluence of the Karasu and the Murat rivers, which start in the highlands of eastern Turkey. It is 2740 km. long with nearly 2000 km. lying in Turkey. The actual annual volume of water is 35.9 billion cubic meters, 98% of which is contributed by Turkey. The river flows generally South through Turkey into Syria, then southeast through Iraq joining Tigris to form the Shatt al Arab. In its upper course, the Euphrates flows rapidly through deep canyons and narrow gorges. The middle Euphrates traverses a wide floodplain in Syria, where it is used extensively for irrigation. In Syria and Iraq, it loses velocity and becomes a slow running stream. The modern waterworks along the Euphrates do not equal in scope those of ancient times when Babylon and other civilisations flourished on the banks of Euphrates. Mesopotamia, birthplace of many great civilisations, gave

life to millions of inhabitants who depended on the waters of the Euphrates and the Tigris for survival. Irrigation and agriculture played an important role in the area. However, as the maintenance of irrigation and drainage networks was neglected, the siltation of canals and the salinization of fields eventually made the land unsuitable for agriculture. The same situation is expected to arise in the Euphrates and Tigris basins in Turkey in near future if steps are not taken. Since nearly 2000 km. of the Euphrates lie within the borders of Turkey, this paper enlightens the land degradation situation in the Turkish side in particular upper parts of the Euphrates basin and its environs, which covers most of the East Anatolian geographical region. Harsh climatic conditions in the region result in higher mechanical weathering of parent material than chemical one, as such soils are pebbly in nature. Main soil types met within the area are; alluvial, colluvial, chestnut, brown, regosols, basaltic, organic, and arid soils. The area investigated during the present survey exists at a place where different types of climates inter-cross and mix up, but in general climate is characterised by long and harsh cold winters. From north to south and east to west temperatures increase gradually. Summer rains are excessive than winter ones particularly in the northeast around the states of Erzurum and Kars. Hottest month here is August with a mean maximum temperature of 24-28 ^{o}C and in the coolest month mean minimum varies between -16 to -17 ^{o}C. Highest rainfall is observed in Tunceli (1003.8 mm) and lowest in Erzincan (359.6 mm). Extremely cold temperatures of - 45.6 ^{o}C have been recorded around Agri, whereas around Malatya and Elazig summer temperatures reach 42 ^{o}C.

Demographic Developments: Human activities are the determining factor at all stages of degradation. The causes, mechanisms of deterioration, and the impacts, underlying this phenomenon originate from demographic developments.The population problem in Turkey started after first world war and national war of liberation. The demographic developments followed an increasing trend all through Turkey between 1927 (13.65 million) and 2000 (70 million). The population density in the Upper Euphrates and environs also went above the average,with highest growth observed in Erzurum.

Land Use: The region is rough topographically, plateaus being very high in particular around Erzurum, Agri, Van and Hakkari, where high altitude mountains are gathered together. Grasslands cover large areas around these states due to the topography. They have an area of 8.900.000 ha, which is 41% of the total grasslands of Turkey. Agricultural land is found mostly around the state of Malatya, Agri and Erzurum. Cattle raising, in particular sheep, is thus very important in this region. Most of the grasslands are moved for winter fodder. Others are used for grazing in summer. Agricultural products sown are mainly cereals, namely; wheat, barley, rye, lentils and chickpea. Eastern parts mainly sow fodder crops and legumes. Industrial plant cultivation is also common in the area together with tuberous plants. Out of fruit trees we commonly get apples, pear, plum, walnut and prune. Plum is one of the major exported products from Turkey and its centre lies in Malatya. Tobacco cultivation is dominant in Malatya, Elazig, Bitlis, parts of Van and sunflower in Mus.

Land Degradation: Industrialisation and demographic explosion have been important driving forces in the heavy urbanisation. Study area experienced greatest constructional activities during the last decade loosing 16.000 ha. of prime quality land. The soil surface including the top layer of the soil at the interface between earth and atmosphere is the place where atmospheric attack is maximum. The processes of soil degradation are accelerated when the vegetation is destroyed by human activities. The first recorded civilisation of the Sumerians was thriving in the southern Tigris-Euphrates Valley by the 4th millennium B.C. Over the course of years, Sumerian irrigation practices destroyed the pedosphere in such a way that this civilisation collapsed. However even today vast areas of Iraq look like snow covered fields. Latest trend in our study area has been use of best quality arable lands for urbanisation districts, highway construction, touristic establishments, sports complexes, universities, air-ports and other activities. Uptill now 60 percent of land has been used for this purpose and it belongs to the most productive class in the soil grouping system of Turkey. In all 129.709 ha have been used for urbanisation and have got lost in this way and millions of hectares of land are awaiting planning due to wrong use or over use. An increase in the land for construction on monetary basis results in decrease in the productive value of cultivated area. The brick and tile factories also are using large areas of the productive land. In the upper parts of the Euphrates nearly 188.000 ha have enough drainage, 91.000 ha suffer from bad and 3.400 ha high drainage. In all 2.1 million ha. area is facing very strong, 5.2 million ha. strong and 3.7 million ha. medium erosion. More than 108 million tons of soil is transported by the Euphrates annually. Biological degradation is the reduction in the quantity of organic matter and living organisms in particular plant cover decomposition, whereas chemical degradation includes salinity, alkalinity, or acidity. A high concentration of salts in the soil gives rise to saline or alkaline soils. This is often the result of irrigation without adequate drainage. Soil and salinity problems are more widespread and acute in arid than in temperate areas. About 900 million ha.of land are presently affected by excessive salts in the world, one of these being Nile valley where 1.2 million ha. of land has got exposed to salinization and water logging. Salt-affected soils are especially common in irrigated regions of Asia, Australia, and Western USA. The accumulation of the soluble salts of Na ions (salinization) produces soil degradation over the entire profile, resulting in such harmful effects as: changes in compactness, porosity and permeability, organic matter content, soil pH, plant cover characteristics, soil-plant-water balance. The man-made share of these salinity problems arises principally from raising of the water table through continuous passage of large amounts of H_2O through unsuitable canals, thus converting large productive areas from a renewable resource to a non-renewable one. According to recent estimates, over 220 mill. ha. of land are irrigated worldwide. Approximately 25 to 40% of that land is affected by salinization. In the fertile crescent Tigris-Euphrates rivers salted up 5-2 millennia ago and resulting in the collapse of the civilisation. Even today flooding and over irrigation have started creating serious problems of soil salinization in Syria and Iraq. A similar situation is observed in this area in Turkey as well. The Euphrates, Tigris and Van basins are presenting an alarming situation with over 75.000 ha facing salinity-alkalinity problems.

Plant Diversity: Forest vegetation in

the Euphrates Basin and its environs has been very dense but with time has become very poor due to years of degradation activities. Human impact has resulted in a decline in the habitat as well as plant diversity. Nearly 50 percent of the forests have been heavily destroyed. On an average every year timber in Turkey is harvested at a rate of around 7 million m^3 and upper Euphrates basin and its environs have a major contribution in it. The firewood production lies around 35 million m^3 in Turkey, most of which is used in the area under question. Forests are present at the edge of plains in tectonic depression. Dry forests are found at high elevation,being sparse and poor due to aridity as well as heavy biotic pressures. Tree line occurs at 2700 m. *Quercus* forests extend from the natural steppe to the subalpine belt. The South-eastern Taurus mountains are characterised by oak forests. Over exploitation has resulted in a decrease in the genetic diversity existing previously in these forest ecosystems. The situation of plant diversity in general is threatening. Nearly 50 species have been recorded to be under a threat of extinction. In particular endemics are facing a greater threat. This area shows an endemic ratio of 20-25%.

Turkey is regarded as one of the eight major gene centres on earth, due to the presence of wild relatives of many domesticated plants in the country. For example, wild progenitors of such cultivated plants as lentil, chickpea, wheat, peach, almond, and pistachio are native to Turkey. The Euphrates basin in particular is home for many of these species. As such soil degradation will lead to not only the loss of plant but also genetic diversity.

Conclusions: The spread of technology and culture together with a rapid growth of human population has spread the desertification process to every continent. Degradation is a problem with ancient roots. Cutting of forests, overgrazing, and salt accumulation in irrigated lands led to desertification in Mesopotamia, and the lands bordering the Mediterranean more than 2000 years ago. Archaeologists have clearly shown that more than climate change we the humans have changed once rich and populous areas to desolation and poverty. Many ancient civilisations once enjoying a golden age crumbled in ruins and lie buried in debris, because of destructive treatment of the lands on which they were dependent for their living. The occupation of man has been so devastating that with a few exceptions, a desert condition is often associated with his long habitation of a region. In the first place, semi-arid to semi-humid regions proved the most favourable sites for the early development of human culture followed by their degradation through processes of soil erosion, accelerated by the exposure of soil surfaces protected by a dense plant cover. If we are to escape similar fate of induced impoverishment and the desiccation of land, it would be more plausible to start taking measures now through well organised ecological land use planning. The degradation cannot be arrested by physical or technical means alone. There is a large body of evidence available regarding the fact that these types of short time treatments have accentuated the problem quite seriously. In the valleys of Khorezm and Zeravshan there was formerly a flourishing strip of oasis which is now a desert, the reason being social and political dynamics of degradation. Following measures will prove more helpful in the long run: creating environmental awareness through environmental education at all levels, women should be given a pivotal role in decreasing population growth rate, socio-economic status of rural areas should be upgraded, land tenure systems and size of land holdings need be well planned, species with high potential for food, fibre and energy should be grown using ecological farming systems and marginal land for cultivation and grazing, cultural and religious hinderances should be evaluated together with prevailing political trends as these can interfere with the implementation of a programme.

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NEWS AND VIEWS

COFFEE HUSK – A SOURCE OF ENERGY

Bioflame, based in England, is a high technology company with state-of-the-art environmental solutions, specializing in equipment that uses waste products to generate energy. It has installed a coffee burner for a Costa Rica coffee producer that uses coffee husk as its energy source. This equipment will dramatically reduce the need for cutting down trees to supply wood for coffee burners. The Bioflame coffee burner is environment friendly, smoke-free and runs entirely on waste products. It also gives a higher quality of coffee beans through a total control of drying temperature during processing.

Since Bioflame's burners and gasifiers can consume waste products, they not only leave no pollutants or dioxins but provide energy that can be used for a number of applications in the manufacturing processes.

Bioflame turns waste material into electric power by using Bioflame gasifiers efficiently to create gas that is cooled and cleaned, and then passed through a gas engine generator. Fuels suitable for gasification include vehicle tyres, wood and wood by-products, coal, straw, peat, corncobs, rice husks, coffee husks/pulp, coconut shells and sugarcane stalks. It also uses sewage sludge cake, industrial sludge cake and refuse-derived from animal litter.

Kofi Akumanyi
London Press Service

TRADING IN CARBON DIOXIDE EMISSIONS

In the European Union's single market, there will be a new commodity for sale: greenhouse gas emissions from next year. Although it is the first large scale system of its kind, the principle is simple: a company or plant is assigned a carbon dioxide emission limit, typically based on its historical emissions average. If a firm lowers its emissions below the allocated limit – by using renewable energy, switching from one fuel to another, or through geological carbon sequestration – it can sell its remaining allowance to another company that is set to breach its quota. The Brussels scheme envisions 12,000 industrial sites trading emission levels by 8% before 2012.

When the trading system does get going next year, the E.U. may well have found a novel way to make environmental care profitable.

Adam Smith
(TIME Magazine, U.S.A.)

U.N. BANS DIRTY DOZEN CHEMICALS

A dirty dozen of industrial chemicals blamed for cancer and damage to the nervous, reproductive, and immune systems have been recently outlawed by a UN pact.

The 2001 Stockholm Convention on 12 persistent organic pollutants(POPs) comes into force after ratification by 50 states, banning a range of pesticides, dioxins and polychlorinated biphenyls (PCBs). Banning the production and use of some of the most toxic chemicals known to humankind will save lives and protect the natural environment. Even so it will take years for POPs, which are used in everyday items like plastics or paints as well as pesticides, to break down. And everyone on the planet has traces of POPs in their bodies.

But many experts say the dirty dozen list is too short. For example, the levels of new products like brominated flame retardants are increasing. Flame retardants are used in sofas, clothing and television sets etc. and are an environment hazard.

POPs like the pesticides DDT aldrin or dieldrin have been long banned in many nations. Even so, anyone scrapping off old paint from a window frame, for instance, may release PCBs. Global warming could exacerbates the POPs problem: higher temperatures might wash out chemicals that have been locked in glaciers or flooding might release buried POPs.

The U.N.'s ban covers the following chemicals: aldrin, chlordane, DDT, dieldrin, dioxins, endrin, furans, heptachlor, hexachlorobenzene, mirex, PCBs and toxaphene.

Alister Doyle
(Reuters)

PLASTIC FIBRE – A MAJOR POLLUTANT

Tiny pieces of plastic and man-made fibres are causing contamination of the world's oceans and beaches. Even remote and apparently pristine layers of sand and mud are now composed partly of this microscopic rubbish, broken down from discarded waste.

A team of scientists from the Universities of Plymouth and South Hampton took samples from 17 beaches and estuaries around the U.K. and analyzed particles, which did not appear to be natural. They found that most samples included evidence of a range of plastics and polymers, including nylon, polyester and acrylic. A major concern is that toxic chemicals could attach themselves to the particles, which would then help to spread them up the food chain.

This study suggests that practically everything really is made of plastic. These days – even the Oceans.

Tim Hirsch
BBC Environment Correspondent

TREES POLLUTE DURING HEAT WAVES

Trees are supposed to be nature's greatest defences against pollution, but new data suggests they can sometimes have the opposite effect. Experts at York University in U.K. have found that when temperatures exceed a threshold, trees and other plants emit chemicals that encourage toxic ozone production. They found that when temperatures rose above 35ºC, deciduous trees began emitting greatly increased amounts of the compound isoprene. At 25ºC, the amount of isoprene emissions from the average U.K. deciduous tree is pretty low. But as the temperature increases, the emission rate increases almost exponentially. Isoprene takes part in reactions that convert nitrogen oxide from car exhaust emissions into ozone. The more isoprene there is, the more ozone is produced from smaller amounts of nitrogen oxide. Last summer U.K. had very high temperatures and in the future extreme heat waves are expected to be more frequent.

Evergreen trees also produce terpenes, which have similar but lesser effects to isoprene. The increased isoprene and terpene levels were contributing 30% to ozone levels at the height of the heat wave.

European laws dictate that governments need to warn the public when hourly concentrations of ozone rise above 180 microgrammes per cubic metre. On 6 August 2003, ozone level in London rose to 300.

Source: *BBC/Clean Energy, Nepal*

A MILLION SPECIES THREATENED BY CLIMATE CHANGE

Climate change may cause a quarter of our land animals and plants to become extinct according to a report published in the journal 'Nature'. Contrary to previous projections, climate warming is likely to be the greatest threat in many if not most regions. The only thing that could stop the extinctions is drastic reduction in emissions of greenhouse gases that are causing climate change.

Using data of the Intergovernmental Panel on Climate Change (IPCC), the study examined six biodiversity-rich regions around the world, representing 20% of the planet's land area. According to the IPCC, the global average surface temperature inceased over the 20th century by about 0.6 ^{O} Celsius. And the warming is speeded up – the 1990s was the warmest decade on record. The study found that 15 to 37%

of all species in the regions considered could become extinct because of the climate change that is likely to occur by 2050. The study makes it clear that climate change is the biggest new extinction threat.

A large number of unique species are described in the study as being under threat in South Africa's Cape Floristic Region that is considered as one of the world's biodiversity hotspot areas. In Latin America, the Brazilian Cerrado, is home to about 10,000 plant species. A study of 163 tree species predicted that 39-48% of them may become extinct. At risk also are many birds and butterflies. In Australia, where more than 400 species of butterflies are found, as many as 54% of species may eventually become extinct as a result of global warming.

According to Professor Sir Ghillean Prance, former Director of the Royal Botanic Gardens at Kew, England **(and a Life member of ISEB)**, "We are heading for a massive wave of extinction comparable to the one that wiped out the dinosaurs.

The rise in global temperature is due to human-induced activities that have altered the chemical composition of the atmosphere. An immediate and progressive switch over to technologies that produce little or no new greenhouse gases combined with active removal of carbon dioxide from the atmosphere could save a million or more species from extinction.

John Madeley

London Press Service

*(Source: **Spectrum** magazine)*

C.N.G. – IDEAL FUEL

C.N.G., a mixture of hydrocarbons, especially methane, which is compressed to 80 atmospheric, is a cost-effective fuel. It is cleaner than petrol and diesel, which play a major role in air pollution. It also costs 70 and 30% less than petrol and diesel respectively. C.N.G. is free from toxic pollutants like sulphur, benzene, lead and polycylic aromatic hydrocarbons.

On energy basis also, vehicles running on C.N.G. emit 90% less carbon monoxide, 60% less hydrocarbons and 50% less nitrous oxide as compared to traditional fuel. Petrol and diesel exhausts contain high level of particulate matter. Emissions of diesel and petrol exhaust are a major cause of heart and lung diseases and they also contain carcinogens.

C.N.G. has an excellent anti-knocking property, which results in better fuel efficiency. As C.N.G. vapours are lighter than air, they can easily dissipate into atmosphere in the case of an accidental leakage and thus the risk of catching fire is minimal. C.N.G. cannot be adulterated and its siphoning from vehicles is not possible.

Asit Srivastava

(in Hindustan Times).

TURMERIC ALLEVIATES CYSTIC FIBROSIS

Researches carried out by scientists at Yale University, New Haven, Connecticut in U.S.A. in mice indicate that low doses of a component of turmeric can help control cystic fibrosis.

People develop cystic fibrosis when they inherit two copies of a defective gene, CFTR, which leaves an important protein misfolded. The misshapen protein, though functional, is prevented by the cell's quality control agents from taking its rightful place at the cell surface and is mislead trapped inside. Without the protein at the surface salt has trouble moving in and out of cells. The end result is that mucous in the airways and digestive tract becomes very thick and sticky. Bacteria get trapped and cannot be expelled through the nose and mouth, and nutrients cannot be absorbed in the gut. People with CF live only on an average 32 years.

Lab work at the University of Toronto, Canada, has recently shown that curcumin, a component of turmeric makes it possible for the protein to escape to the surface by starving the inspector proteins of calcium.

Cystic fibrosis is just the latest disease that research has shown might be alleviated by turmeric. Others include inflammatory bowel disease, cancer, alcohol-related liver disease and most recently, Alzheimer's disease.

Reuters News Service/Clean Energy,

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E-mail: <namstct@vsnl.com>, <apknam@yahoo.co.in>
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Contact: Prof.Dr. Guven GORK,
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Biology Department.,
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11 – 13 April 2005 Algarve, Portugal
Contact: <enquiries@wessex.ac.uk>
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3-5 May 2005 Cadiz, Spain
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29 September – 1 October 2005
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