ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

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IN THIS ISSUE

Fourth International Conference on Plants & Environmental Pollution (ICPEP-4)

8-11 December 2010
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National Botanical Research Institute (NBRI), Lucknow, India and International Society of Environmental Botanists (ISEB)

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Ministry of Environment & Forests, Govt. of India, New Delhi

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Information urgently needed from foreign delegates participating in Fourth International Conference on Plants & Environmental Pollution (ICPEP-4)

1. Full name, 2. Male/Female, 3. Father / Husband's name, 4. Designation, if any, 5. Official/Permanent address, 6. Date & Place of birth, 7. Phone/fax/e-mail, 8. Nationality, 9. Passport no. 10. Date & Place of issue of passport, 11. Date of expiry of passport

LETTERS

After working with the Government of Canada for more than 42 years. I have retired on April 28, 2010. My email address will be: yashpk1@hotmail.com (http://intranet.nrcan.gc.ca/archives/features/2010/04/14/soil-science.

Dr. Yash Pal Kalra
yashpk1@hotmail.com

I acknowledge with profound thanks the receipt of the latest copy of ENVIRO NEWS. It appears to be a fine publication which has given me news of some old friends, which has reached me through your kind compliments. I would be happy to subscribe it although with my advancing age I cannot do much. I am still editing and publishing GEOBIOS, which is in its 37th year of publication. Your old Institution is a subscriber. I thank you once again and wish you all the best.

David N. Sen,
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I am amazed by the consistency of the publication of the Environews by the Society. It is because of your incessant hard work for the betterment of the Society.

I wish to inform you that my address has changed and hence request you to kindly incorporate my new address which is as follow:

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Fourth International Conference on Plants & Environmental Pollution (ICPEP-4)

Registration fee payable for various categories of delegates

Category	Indian/SAARC Nationals*		Foreign Nationals/NRIs	
	Up to 30.09.2010	After 30.09.2010	Up to 30.09.2010	After 30.09.2010
Members of ISEB	Rs. 2500	Rs. 3500	US $ 350	US $ 400
Non Members	Rs. 3000	Rs. 4000	US $ 400	US $ 450
** Students	Rs. 1500	Rs. 2500	US $ 150	US $ 200
Accompanying Person	Rs. 1500	Rs. 2500	US $ 175	US $ 225

*Delegates from SAARC countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka) can pay either in Indian currency or US $.

**Post-Docs, RAs, SRFs, JRFs, Project Fellows, Project Assistants, and those in employment, are not eligible for student category.

WELCOME NEW MEMBERS

Patron Member

Mr. B.V. Chaubal, Chief General Manager, State Bank of India, Local Head Office, Lucknow.
E-mail: cgm.lholuc@sbi.co.in

Institutional Member

Ankleshwar Environmental Preservation Society, Ankleshwar, Gujarat.
E-mail: aepseducentre@yahoo.com

LIFE MEMBERS

Dr. Ashok Kumar Awasthi is working as a Reader, in the Department of Botany, Brahmanand College (CSJM University), Kanpur. He has over 25 years of research and over 20 years of teaching experience.

Dr. Awasthi has carried out the ethnobotanical studies on the Negrito Islanders of Andaman Islands: The great Andamanese and the Onges.

At present he is Principal Investigator of a major research project entitled "Algal Flora of Ganga at Kanpur: Pollution purification and the resource recovery" sponsored by UGC.
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Dr. Mrs. Premlata Singariya is "Dr. D.S. Kothari Post

Doctoral Fellow" at the University of Rajasthan, Jaipur.
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Dr. Lal Bihari Singha is an Assistant Professor, Department of Forestry in North Eastern Regional Institute of Science & Technology (Deemed University), Nirjuli, Arunachal Pradesh.
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Dr. Shekhar Salunke is Professor at the Centre for Enviroment (Protection training, Education and Researc), Solapur, Maharastra.
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NEWS FLASH

Dr R K Roy Scientist E-II, Botanic Garden, National Botanical Research Institute, Lucknow, and a Life Member of International Society of Environmental Botanists was awarded "Dr. B.P. Pal Award-2010" by Bougainvillea Society of India & International Centre of Registration Authority for Bougainvillea, IARI, New Delhi for his 'significant contribution towards maintaining a large collection of named varieties of Bougainvillea' during 'Bougainvillea Festival' organized in New Delhi on April 1-2, 2010.

Ms. Deepika Sharma, Member of International Society of Environmental Botanists has been nominated as a member of the Third World Organization for Women in Science (TWOWS, Trieste, Italy).

Science Outreach Campaign for Year of Biodiversity

Vigyan Prasar is a national institution for science and technology communication under the Department of Science and Technology. This institution is engaged in developing communication material for large campaigns. The objective is to enhance level of rational decision-making in the community.

Vigyan Prasar organized a Press Meet on International Biodiversity Day on May 22, 2010 at Press Club of India, New Delhi. This was well attended by representatives of various media houses, Science communicators, editors of the science magazines and scientists of Vigyan Prasar.

Prof. C. K. Varshney, eminent environmentalist & former Professor, Jawaharlal Nehru University, New Delhi was invited as key-note speaker. Ms. Arfa Khanum, Broadcaster & Film maker was invited as youth representative. She inaugurated the slogan of Vigyan Prasar for International Year of Biodiversity 2010 *"Samagra vikas kaise hoga, jaiv vividhta ke sanrakshan se hoga* (How will sustainable development take place, it will happen with the conservation of biodiversity)"

Er Anuj Sinha, Director, Vigyan Prasar announced the plan of action for "Science Outreach Campaign for Year of Biodiversity". Er Sinha said that Vigyan Prasar has produced interesting communication material on biodiversity conservation. This offers a rich resource for activists and media. It is now developing new training material – books, CD-Roms, activity kits, that over the next twelve months will be used extensively for training village leaders and sensitizing youth. The key message will be "Sustainable development critically depends on conservation of biodiversity".

We need to develop a tool for village centric environmental impact analysis that can support the process of decision-making by local elected bodies.

World Environment Day, June 5, 2010

On the invitation of Club of Lucknow

and Department of Environment, U.P. Govt., Dr. S.C. Sharma, Vice-President, International Society of Environmental Botanists, Lucknow organized an Exhibition on pollutant tolerant plant species for phyto-remediation of outside and inside pollution in the urban areas in the Directorate of Tourism Gomtinagar, Lucknow.

Shri Nakul Dube, Minister of Environment, Govt. of Uttar Pradesh visited the exhibition and showed keen interest in the activities of ISEB. Ms. Kanti Srivastava, Nupur, Shivani, Dr. Vinod Tomar and Shri Raju Chaurasia assisted in the organization of the Exhibition. The Message was well conveyed to a cross section of the society about the significance of plants for making the city clean and green.

Grantham Prize for the Author of 'Sea Sick'

Alanna Mitchell, the well known Canadian author has been awarded the 2010 Grantham Prize (US $ 75,000) for excellence in reporting on environment by the Metcalf Institute for Marine and Environmental Reporting.

The Grantham Prize honours outstanding coverage of the environment, and recognizes reporting that has the potential to bring about constructive change.

Alanna Mitchell is a Canadian journalist and author known for her ability to describe complex ideas. She is the author of the extraordinary book "Sea Sick: The Global Ocean in Crisis" which won worldwide acclaim and recognition in 2009. The book examines the current state of the world's oceans – describing an urgent yet little understood ecological crisis.

GLOBAL CLIMATE CHANGE AND SUSTAINABILITY OF FOOD SECURITY

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The climate of the earth, its chemical (e.g., carbon dioxide) and physical properties (e.g., air temperature), has been changing since the beginning of the20th century or since the onset of the industrial revolution. There is a great deal of concern about "global warming". However, global climate change and global warming are not one and the same. "Global climate change" includes three critical issues: (1) changes in trace or greenhouse gas (GHG) concentrations at the surface, (2) thinning of the beneficial ozone layer in the stratosphere (15-50 km above the surface) and (3) changes in air temperature (warming) and other physical parameters at the surface (according to the World Meteorological Organization [WMO], by 2025 availability of fresh water supply will be the single largest limiting factor affecting global population). All three issues are interrelated and represent an integrated atmospheric system and thus, should not be viewed individually.

Clearly the chemical climate of the earth has been changing. GHG concentrations have increased. As a result, at least in the last 50 years, while the daytime temperatures in the United States have declined, nighttime temperatures have increased. Similarly spring and fall seasons have become warmer. Overall, these processes can prolong the crop growth season, induce rapid growth and maturity and reduce flowering and seed filling, for example in cereals. Any increases in air temperature will need to be coupled to the availability of moisture (frequency of drought).

As an independent phenomenon, as opposed to the thinning of the beneficial stratospheric ozone layer (filters harmful ultraviolet radiation from reaching the surface), increasing ozone levels at the ground (part of the smog) is the most important phytotoxic compound worldwide.

There is evidence that the beneficial effects of the rising carbon dioxide levels on crops are likely to be offset by the increasing ozone levels. Further, increasing nitrogen in the atmosphere is a part of global climate change and its deposition is expected to result in changes in the community composition of perennial plant populations and biodiversity. Nevertheless, virtually all our knowledge of the effects of global climate change on crop production and yield is based on studies that involve the impact of one variable at a time, although that has little resemblance to the real world conditions. Nevertheless, with world population rapidly increasing toward nine billion by the mid-21st century, there is a need for doubling the level of current food production by 2030. Clearly that is a daunting challenge in sustaining global food security into the future.

Introduction

Life on earth has evolved under a naturally produced ozone layer that exists between 15-50 km above the surface (the stratosphere). That beneficial ozone layer filters significant levels of biologically harmful solar ultraviolet radiation from reaching the surface, and transforms that energy into heat and wind. At the surface, climate is the result of the interactions between its chemical (e.g., water vapor, carbon dioxide) and physical (e.g., radiation, temperature) parameters. The incoming solar radiation is absorbed by all surfaces (living, e.g., forests and non-living, e.g., buildings), those objects retain certain portion of the heat and the remaining energy is re-emitted into the

atmosphere. The dynamics of the incoming shorter wavelength and the outgoing longer wavelength radiations are regulated by the presence of certain trace gases (e.g., water vapor, carbon dioxide, methane). These trace gases trap the outgoing heat, thus warming the atmosphere (the surface air temperature).

This is a natural heating process that supports life on earth.

The physical mechanism of the heating of the ambient atmosphere is similar to the heating of the air inside a greenhouse where all surfaces absorb the radiation and that portion of the outgoing heat is trapped by the roof of the greenhouse, the *"greenhouse effect"*. As a similarity, the trace gases in the ambient atmosphere that trap or block the outgoing radiation (serving like the roof of a greenhouse) are known as *"greenhouse gases"* (GHGs). Table 1 provides a summary of the contributions of various greenhouses gases to the *"natural greenhouse effect"*. It is very important to note that water vapor is the single largest contributor (62%) to the natural greenhouse effect and carbon dioxide contributes to only 22%.

Table 1. Contribution of greenhouse gases to the natural greenhouse effect at 33°C

Greenhouse gas	Contribution	
	°C	Percentage
Carbon dioxide	7.2	22
Methane	0.8	2.4
Nitrous oxide	1.4	4.2
Ozone	2.5	7.3
Water vapor	20.6	62

Modified from: German Bundestag, Protecting the Earth's Atmosphere 1991 (www.Google)

In addition to their role in the greenhouse effect, trace gases such as chlorofluorocarbons (CFCs), organo-bromines (OBs) and nitrous oxide participate in reactions driven by the sunlight leading to the destruction of ozone in the stratosphere and the thinning of the beneficial ozone layer there and consequently increased penetration of the harmful ultraviolet radiation to the surface (therefore, possible increases in the incidence of skin cancer?).

In the popular media, terms such as "Global climate change", "Greenhouse effect" and "Global warming" have been used interchangeably. Great emphasis has been placed on global warming. That is certainly justified. *However, it is very important to note that global climate change and global warming are not the same.* Global warming is only a part of global climate change that is composed of a system of atmospheric processes and their products (Table 2). Both the atmospheric processes and their products have an impact on the environment and thus, global warming should be considered as only one of the critical issues within the overall climate change scenario.

2. Is the global climate changing?

"Global climate change" includes three critical issues: (1) changes in trace or greenhouse gas (GHG) concentrations at the surface, (2) thinning of the beneficial ozone layer in the stratosphere and (3) changes in air temperature and other physical parameters at the surface. *It is important to note that all three issues are interrelated and represent an integrated atmospheric system and thus, should not be viewed individually.*

A. Is there a change in the global chemical climate?

Clearly the chemical climate of the earth has been changing (Table 3). The air concentrations of GHGs have been increasing since: (1) the onset of industrial revolution, (2) rapid growth in populations and (3) increases in the number of urban centers across the world, for example mega cities with populations of >10 million (grew from 6 to some 38 in the last 50 years). The primary basis for the increases in the concentrations of carbon dioxide and surface level ozone from the past to the present is increased fossil fuel combustion. In contrast, increases in other GHGs are due to changes in: rice cultivation (methane), agriculture/nitrogen fertilizer use (nitrous oxide) and industrial processes including the use of refrigerants (CFCs). While carbon dioxide occurs at ppm (parts per million, 10^{-6}) levels, others such as methane occur at ppb (parts per billion, 10^{-9}) and still others such as the CFCs occur at ppt (parts per trillion, 10^{-12}) levels. *More importantly, all trace gases do not have the same heating effect or global warming potential (GWP).* For example, although nitrous oxide concentrations (320 ppb) are orders of magnitude lower than carbon dioxide

Table 2. Global climate change: A system of atmospheric processes and their products

Processes	Products
Thinning of the stratospheric ozone layer	Increases in harmful solar ultraviolet radiation at the surface
Increases in trace gas concentrations at the surface	(1) Thinning of the stratospheric ozone layer (2) Changes in air temperature, precipitation patterns, radiation, evaporation, winds
Increases in ultraviolet radiation at the surface	Decreases in ozone levels at the surface

(384 ppm), it is ~300 times more potent than carbon dioxide in heating the atmosphere (Table 3). Note that although water vapor contributes to about 60% of the natural greenhouse effect, no data are available in relation to other trace gases included in Table 3. One would readily conclude that the water vapor in the atmosphere is due to evaporation and evapo-transpiration. *However, it should be remembered that water vapor is also produced by chemical reactions in the atmosphere that are driven by sunlight. In fact, global warming will largely enhance that process*.

Table 3. Past (19th Century), present (21st Century) and the rate of change in some ambient greenhouse gas concentrations

Greenhouse gas	**Concentration**		**% Change/ Year**	**Lifetime (Years)**	**GWP***
	Past	Present			
Carbon dioxide, ppm (10^{-6})	280	384	0.6	~100	1
Methane, ppb (10^{-9})	700	1860	0.9	12	25
Nitrous oxide, ppb	270	320	0.3	114	298
CFC-11, ppt (10^{-12})**	0	246	n.a**	45	4750
CFC-12, ppt **	0	541	n.a**	100	10,900
Ozone, ppb	25	40	0.5-2.0	Hrs-Days	n.a***

*Global Warming Potential ** Chlorofluorocarbon, no longer produced
*** Not applicable, because of the short life time Modified from: Report of the Intergovernmental Panel on Climate Change (IPCC), 2007 (www.Google)

B. Is there an increase in the harmful solar ultraviolet radiation at the surface?

As noted previously, the thinning of the beneficial stratospheric (15-50 km above the surface) ozone layer will lead to increases in the harmful ultraviolet radiation (an average of 2% increase in radiation for every 1% loss in ozone) at the surface. Because of the angle of the rotation of the earth (the Coriolus), the jet stream in the northern hemisphere moves from west to east and in the southern hemisphere from east to west. These two general circulation patterns collide over the poles creating a polar vortex (vórtice). Because of that, pollutants transported to the stratosphere accumulate over the poles and thus the observed ozone hole due to its destruction by nitrous oxide, CFCs etc. Atmospheric models predict the thinning of the beneficial stratospheric ozone layer across all latitudes. However, *beyond the polar locations, there are no spectrally resolved data (because of the complexity and cost associated with its measurement) to demonstrate increases in ultraviolet radiation across all latitudes,* except at the southern tip of South America, New Zealand and Southern Australia. In as much as stratospheric ozone filters the ultraviolet radiation, so does the ozone produced at the surface by urban activity, as in Mexico City. Background surface ozone concentrations are increasing globally and combined with particulate matter, it acts as a limited radiation filter. However, the overall concern regarding the ultraviolet radiation is very valid at the global scale.

C. Is there a global warming?

There is a continuing debate regarding the question of global warming. While global warming is of great international concern, some believe that it is a product of natural phenomena such as sunspots or solar flares. Nevertheless, as the famous atmospheric scientist, James P. Lodge once stated: Most researchers believe that the climate will simply become warmer worldwide. While this may be true on a global mean basis, this is by no means necessarily true for a given spot on the earth or even for a given nation or continent. Instead, sizable areas may well become warmer, cooler, drier or wetter or remain unchanged, in so far as annual means are concerned. Probably any modification of the climate will manifest itself through changes not in mean values, but in the deviations from those means and in the frequency of severe weather conditions such as high winds, thunderstorms and blizzards.

Climate models predict an increase in air temperature of 0.5 to 4.5 C with the doubling of the carbon dioxide concentrations. Independent of the problems associated with the use of average values and the uncertainties associated with modeling, the air temperature appears to have increased by 0.7 C in the last 150 years. At non-urban or rural sites in the United States, the difference between day and night temperatures has declined since about 1950. *While the daytime temperatures have declined, nighttime temperatures have increased. Similarly spring and fall seasons have become warmer.*

D. Is atmospheric nitrogen deposition, a part of global climate change?

Clearly excess additions of nitrogen into the environment and their adverse effects on life are of major concern. A classic example is the flow of excess nitrogen from the Midwest down the Mississippi River into the Gulf of

Mexico resulting in hypoxia. Hypoxia is a phenomenon where sea life such as fish and shrimp are starved of oxygen and die, because algal blooms or growth stimulated by the excess nitrogen supply exhaust the normal oxygen availability in the waters. However, the issue here is nitrogen in the atmosphere as opposed to surface waters.

Leaving aside nitrous oxide (a greenhouse gas), other major nitrogen species in the atmosphere consist of nitric oxide and nitrogen dioxide (known together as the *oxides of nitrogen, these are not greenhouse gases),* nitrates and ammonia (although there are other species such as nitric acid, organic nitrogen molecules, they are not considered to be the main components). Oxides of nitrogen are mainly produced during fossil fuel combustion (particularly transportation) and serve as the building blocks for the formation of ozone (part of smog as in Mexico City) at the surface. *As opposed to the beneficial stratospheric ozone layer, ozone at the ground level, in addition to its negative impacts on human health, is the most important phytotoxic compound worldwide.*

Ammonia is a cooling gas and is a product of agriculture, particularly Concentrated Animal Feed Operations (CAFOs) and nitrate is produced by chemical reactions in the atmosphere. *Clearly total nitrogen deposition has increased over the years; in some parts of Europe it's input is as high as 70 kg/hectare/year.* In comparison, in the United States nitrogen fertilizer is applied at the rate of ~100 kg/ hectare/ year to grow corn. *Increasing nitrogen in the atmosphere is a part of global climate change.* The consequences of excess atmospheric nitrogen deposition on the terrestrial ecosystems are discussed in the section to follow.

Is food security sustainable under global climate change?

Since roughly 2000, the world has been consuming more food than it has been producing. After years of drawing from stockpiles, in 2007 the reserves fell to 61 days of global consumption, the second lowest on record. According to the great 18th century British scholar, Robert Malthus, while human population increases at a geometric rate, doubling about every 25 years if unchecked, agricultural production increases arithmetically, much more slowly. In 1943 as many as four million people died in the "Malthusian correction" known as the Bengal Famine. For the following two decades, India had to import millions of tons of grain to feed its people.

Consequently a group of international agricultural research centers helped to produce more than double the world's average yields of corn, rice, and wheat between the mid-1950s and the mid-1990s, an achievement called "the green revolution". It is very important to note that the "green revolution" could out-produce the prior wheat cultivars as long as there was plenty of water and synthetic fertilizer and minimal impacts from diseases and insects and competition from weeds. To that end, for example, the Indian government subsidized canals, fertilizer availability, and the drilling of tube wells for irrigation and gave farmers free electricity to pump the water. *Today, the miracle of the green revolution is over in northern India: yield has essentially flattened since the mid-1990s*. Over-irrigation has led to steep drops in the water table, now tapped by 1.3 million tube wells, while thousands of hectares of productive land have been lost due to salinity and water-logging. Forty years of intensive irrigation, fertilization, and pesticides have not been kind to the loamy gray fields of Punjab, India, nor, in some cases, to the people themselves. Still there are some that believe that these problems are due to the abuse of the land management practices for gaining increased crop yields. *Nevertheless, with world population rapidly increasing toward nine billion by the mid-21st century, there is a need for doubling the level of current food production by 2030.*

Virtually all our knowledge of the effects of global climate change on crop production and yield is based on studies that involve the impact of one variable at a time, although that has little resemblance to the real world conditions as described in the previous section (#2). In principle, increases in atmospheric carbon dioxide concentrations will stimulate plant biomass production and yield, particularly in *C3 plants (mostly vegetation from the temperate climate, e.g., wheat)*. For decades artificial exposure to elevated levels of carbon dioxide has been used to produce intensively managed high yielding horticultural crops in greenhouses. Plant uptake of increasing levels of carbon dioxide is dependent on the availability of more nitrogen. The impact of excess nitrogen on surface waters and hypoxia has been mentioned previously. *In addition excess atmospheric deposition of nitrogen is known to change native, perennial plant community structure and biodiversity by favoring nitrogen-loving species and suppressing others*.

Where carbohydrate to protein ratio is not balanced, the excess carbon assimilated by the plant will be converted to unwanted starch. That has implications in disease and pest incidence. For example, insects will have to feed on more foliage to obtain the required protein levels or migrate to new species that do not accumulate starch**,** *C4 plants (mostly vegetation from the tropical climate, e.g., corn,* that do not respond to elevated carbon dioxide levels, as much as the C3 plants do).

While increasing carbon dioxide concentrations can stimulate crop production, it should be remembered that any increases in the levels of surface ultraviolet radiation and ozone would counteract that beneficial effect. *A predominant number of studies show that the negative effects of elevated surface level ozone offset the stimulatory effect of carbon dioxide.*

In addition to the direct effects of trace gases on crops, greenhouse gas-induced increases in air temperatures will have a significant effect. *There is evidence to show that night-time increases in temperature has an impact on flowering and seed filling in cereals* and on blast disease incidence in rice. Increases in air temperature will affect precipitation patterns. C4 (tropical plant species) are adapted for heat and water limitation (drought). Thus, the soybean growing regions of the Midwestern United states might shift to the cultivation of sorghum. Similarly**,** *warmer spring and fall will prolong the growth season, but induce rapid crop growth and early maturity, thus resulting in decreased yields.*

Two billion people (one third the global population) already live in the driest parts of the globe, and climate change is projected to slash yields in these regions even further. No matter how great their yield potential, plants still need water to grow. And in the not too distant future, every year could be a drought year for much of the world. *According to the World Meteorological Organization (WMO), by 2025 availability of fresh water supply will be the single largest limiting factor affecting global population.*

Conclusions

In the final analysis, global climate change is much more complicated than simply global warming. The interactive effects of the multiple climate variables and their impacts on crop production preclude deterministic or definitive predictions. The associated uncertainties are too large and must be assessed at local scales.

More recently, due to the demand for alternative sources of energy, the use of cropping systems has been diverted from food to the production of bio-fuels such as ethanol. As more grain has been diverted to the production of bio-fuels for vehicles, annual worldwide consumption of grain has risen from 815 million metric tons in 1960 to 2.16 billion in 2008. Since 2005, the mad rush to bio-fuels alone has pushed the growth of grain consumption from about 20 million tons annually to 50 million tons, according to the Earth Policy Institute.

Recent climate studies show that extreme heat waves are very likely to become common in the tropics and subtropics by the end of the century. Himalayan glaciers that now provide water for hundreds of millions of people, livestock, and farmland in China and India are melting faster than expected. In the worst-case scenario, yields for some grain crops could decline by 10 to 15% in South Asia by 2030. Projections for southern Africa are worse. In a region already racked by water scarcity and food insecurity, the all-important corn harvest could drop by 30 to 47%. Meanwhile the population clock keeps going, with 2.5 more children being born every second (National Geographic, December 2009; www.Google).

THE GANGA: A POLLUTED PURIFIER

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Ganga : Mystical Powers Of the Ganga

Ganga has always been more than an ordinary river. For millions of Indians she is a goddess. Yet the river is exploited as much as she is worshipped. Ganga is in danger of dying - but if the river dies, will the goddess die too?The question took Julian on an extraordinary journey from the Himalayas to the Bay of Bengal.

The Ganga River (Ganga in Indian language , Ganges is Latin form) is the largest and very important river basin of the country. It has been a symbol of purity, but today it is grossly polluted. It has long history of reverence in India and it is often called Holy Ganga. It originated from Bhagirathi from the Gangotri Glacier in the Uttaranchal. The total length of river is about 2,510 Km. One of the of the largest group of human population belts on earth is built around the Ganga.

The basin drains eight states, H.P., Punjab, Haryana, U.P., Rajasthan, M.P., Bihar, West Bengal and Delhi.

It is in flood throughout the summer months when the snow on the Himalayas melt. Since it is a fast-flowing it's water is always muddy.

The Ganga River has been considered as the most sacred river of India in Puranas. It is called as Ganga Maa (or mother Ganga) or Ganga ji (or reverend Ganga). People of India believe that a bath in the holy waters of Ganga washes all the past sins of a person. Numerous pilgrimages centres such as Allahabad, Rishikesh, Haridwar, Varanasi and Patna are present all along the river. Water from the Ganga is used to cleanse any place or object for ritual purposes. The word Ganga is considered as a synonym of pure and holy water. According to a mythological legend, Lord Brahma collected the sweat of Lord Vishnu's feet and created Ganga. Being touched by two members of the Trimurti (Brahma, Vishnu, and Mahesh), Ganga became very holy.

Highly productive irrigated agriculture

is practiced in fertile soils of Ganga basin since time immemorial and recent rapid industrialization has generated large demands for water and hydropower. The domestic water demand in high-population density urban areas scattered throughout the Ganga basin has outstripped the supplies.

Although there is a vast canal network in Upper Ganga basin, there are no large existing reservoirs except on Ramganga. After the Tehri dam is completed in near future, Ganga River will be partly regulated. Tehri will also help in irrigating new areas of about 3 lakh ha besides stabilizing the existing system. Tehri will also supplement water supply to Delhi through the Upper Ganga Canal.

In the hilly reaches up to Rishikesh, Ganga water is quite clean except for sediments. From Rishikesh onwards, disposal of sewage into Ganga begins. Besides the municipal waste of Rishikesh and Haridwar, industrial units discharge partly treated effluents into the river. Haridwar City has a population of 1.5 lakh and nearly 60,000 people visit the city every day on an average. This number rises to a few lakh on important religious days and may go up to 15 lakh on the auspicious days during Kumbha Mela. Considerable lengths of sewer lines are clogged by silts that flow in from the adjoining hills. Further downstream from Haridwar, Ganga flows through Bijnor, Garhmukteshwar,Narora and Kannauj. Here, water is not much polluted as these towns do not have any large industry. Moving downstream, the situation changes for the worse at Kanpur from the quality point of view. Sewage from the city (population 2.7 million) coupled with untreated toxic waste discharge from about 150 industrial units results in severe damage to water quality.

The mean value of DO at 3 mg/l at Jajmau, near Kanpur, reflects the levels of pollution caused by discharge from 80 tanneries and other industries. At Allahabad with population of more than a million, municipal wastes are the major contributor to river pollution. Yamuna whose water is highly polluted joins Ganga at Sangam. Large volume of municipal and industrial waste is dumped in the river at Varanasi, a city with approximately 1.2 million population. The Varuna River, which joins the Ganga in the vicinity of Varanasi, receives waste from many drains. Besides, due to the religious belief that those who die in Varanasi are sure to go to heaven, on average, more than 40,000 dead bodies are cremated on the river bank and the ashes and remains are dumped in the river.

Entering Bihar, a number of industries (including fertilizer and oil refining) have come up along Ganga River. Patna is the most populous city whose wastes are dumped in the river. At Kolkota in West Bengal, the Hooghly (Ganga) river basin is highly populated as the waste from numerous industries as well as municipal sewage is dumped in the river.

In view of the magnitude of water quality problems in the Ganga basin, two action plans were launched by the government of India: the Ganga action plan and the Yamuna action plan.

Ganga Pollution: An Ever-increasing Problem:

The level of pollution on the Ganga river has reached an alarming proportion. Two types of points sources like, surface drains carrying municipal sewage or industrial effluents, pumping stations and sewage systems effluents from industries etc. are found. These point sources can be measured. Second is non point sources which can not be measured such as run-off from agricultural fields carrying chemicals and fertilizers, run-off from areas used for dumping of solid waste and open defecation, dumping of unburnt/ half burnt dead bodies and animal carcasses, dhobi ghats, cattle wallowing, mass bathing, floral offerings etc. According to a study nearly 89 milion litres of sewage is desposed into Ganga from the 12 municipal towns that fall along its route till Haridwar. Where the amount of the sewage disposed in the river increase during the Char Dham Yatra season when nearly 15 lacs pilgrims visit the state each year. Apart from sewage disposal of half burnt human body at Haridwar and hazardous medical waste from the base hospital at Srinagar due to absence of incinerator are also adding to the level of Ganga pollution. The major polluting source of Ganga is leather industries especially near Kanpur which release large amount of Chromium and other chemicals and heavy metals.

An emblem of India's rich culture and ecology.the Ganga is, unarguably one of the World's major river but the river is exploited and the result severe threat to the river ecology, water security and thereby to the lives of millions who are dependent on it.in Ganga there are three type of pollutant ,silt Biological and chemical.sedimentation may be reduced by rehabilitation of catchment area through tree plantation.

It is estimated that some 900 million litres of sewage is dumped into the Ganga every day; three-fourths of the pollution in the Ganga is from untreated municipal sewage. In particular the middle reach of the basin between Kanpur and Buxar is the most urbanized and industrialized, as also the most polluted segment of the basin. Municipal and industrial wastes with dangerous concentrations find entry into the watercourse in this segment and pose a grave threat to society.

However, industry is not the only source of pollution.An estimated 2,000,000 peoples ritually bath daily in the river, which is considered holy by Hindus.

Ganga Action plan: Where we stand now?

Ganga runs its course of over 2500 kms from Gangotri in the Himalayas to Ganga Sagar in the Bay of Bengal. Department of Environment, in

December 1984, prepared an action plan for reduction of pollution load on the river Ganga. The Cabinet approved the GAP (Ganga Action Plan)in April 1985 as a 100 per cent centrally sponsored scheme.

Under Ganga action plan Government of India constituted the CGA (Central Ganga Authority)in February 1985 and renamed it as the NRCA (National River Conservation Authority)in September 1995, under the chairmanship of the Prime Minister. The GAP-I envisaged to intercept, divert and treat 882 mld (Million litres per day) out of 1340 mld of wastewater, generated in 25 towns in 3 States of Uttar Pradesh, Bihar and West Bengal. The NRCD had scheduled the GAP-I for completion by March 1990, but extended it progressively up to March 2000. The GAP-I was still in progress, the CGA decided in February 1991 to take up the GAP-II.

Many operation have taken up in Ganga Action Plan like, Increase high capacity sewage treatment plant. The NRCD sanctioned 16 STPs of 433.31 mild capacity under GAP II in June 1994-99 but those sanctions also left about ¾ of the sewage uncovered.

How it Can be saved ?

Due to continuous pollution of Ganga, threat is not only to humans, but also to several other species living there. The river is home to more than 140 fish species, 90 amphibian species and endangered dolphin. We can save Maa Ganga by taking some prompt action. These are as follow:

Awareness among peoples of Rural Area

Until now Ganga was able to clean itself and mantain the rate of pollution because of the presence of certain bacteria's and plants but now because of the high value of the contaminants those plants are also dying. So ultimately we are not only polluting the river but also destroying the bacteria which help in controlling the pollution.

Time has come when efforts should be made to create awareness among masses. So that we can help the govt. in controlling the increasing pollution.

Increase the capacity of sewage treatment plant.

Sewage treatment, or domestic wastewater treatment, is the process of removing contaminants from wastewater and household sewage, both runoff (effluents) and domestic. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce a waste stream (or treated effluent) and a solid waste or sludge suitable for discharge or reuse back into the environment.

Sewage is created by residential, institutional, and commercial and industrial establishments and includes household waste liquid from toilets, baths, showers, kitchens, sinks etc that is disposed of via sewers. In many areas, sewage also includes liquid waste from industry and commerce.

The separation and draining of household waste into grey water and blackwater is becoming more common in the developed world, with grey water being permitted to be used for watering plants or recycled for flushing toilets. Most sewage also includes some surface water from roofs or hard-standing areas and may include storm water runoff.

Sewerage systems capable of handling storm water are known as combined systems or combined sewers. Such systems are usually avoided since they complicate and thereby reduce the efficiency of sewage treatment plants owing to their seasonality. The variability in flow also leads to often larger than necessary, and subsequently more expensive, treatment facilities. In addition, heavy storms that contribute more flows than the treatment plant can handle may overwhelm the sewage treatment system, causing a spill or overflow.

As rainfall travels over roofs and the ground, it may pick up various contaminants including soil particles and other sediment, heavy metals, organic compounds, animal waste, and oil and grease. Examples of treatment processes used for storm water include sedimentation basins, wetlands, buried concrete vaults with various kinds of filters, and vortex separators (to remove coarse solids). Separate sanitary sewers should not include any storm water. Sanitary sewers are much smaller than storm sewers, and they are not designed to transport storm water. In areas with basements, backups of raw sewage can occur if excessive storm water is allowed into a sanitary sewer system.

There is a need to develop a vegetation cover along the bank of river Ganga consisting of pollution resistant and abator having commercial and economic value for environmental management of pollution. The best green technology for remediating the Ganga pollution is development of constructed wetlands comprising of aquatic plants and algae for treatment of domestic waste and sewage emanating from major cities located along the bank of river.

Wetland: A Green Attempt

Wetland are natural purifier of water and rich in productivity ecosystem, it provide food and clean water. Wetlands are home to some of the richest biodiversity on earth. Wetland have vast capacity to absorb chemicals filter pollutants sediments and cleanse the life bearing water and capable of breaking down suspended solids and neutralizing harmful bacteria.

How Wetland Clean up Water?

A very important function of wetland is natural ability to filter the clean water. Water entering a wetland slows down as it moves through vegetation. Suspended particles begin to fall out or settle in to the soil at the bottom of a wetland or become trapped among the vegetation. various chemical pollutants e.g. fertilizers, pesticides, heavy metals and

other harmful compounds.

Wetland plants are able to take up waste water pollutant into their cells. The dead plants in the bottom of a wetland pond help and provide space and condition for important Microbes. Microbs also attach themselves to stem of living plants.

Various processes like decomposition, predation and neutralization, these microbes are able to transform contaminant into the less harmful forms. Microbes also convert various nitrogen compounds into nutrients that help plant grow.

Constructed wetland:

A constructed wetland is an artificial marsh or swamp, created for anthropogenic discharge such as waste water, storm water run-off or sewage treatment, and as a habitate for wild life, or for land reclamation after mining or other disturbance. Natural wetlands act as biofilter, removing sediments and pollutants such as heavy metals from the water, and constructed wetland can be designed to emulate these features. Constructed wetlands are built by humans. These constructed wetlands are primarily built to clean up waste water and create wild life habitat. Constructed wetlands naturally filter and treat waste water and are often less expensive than traditional treatment plants.

In an urban environment where land is scarce, a traditional treatment plant may produce more reclaimed water per acre but a wetland has numerous additional benefits. It provides valuable wild life habitat, supporting numerous species of birds, mammals, amphibians and reptiles. These wetlands also serve as a recreational and educational site for visitors and residents. Constructed wetland will have four parts-

1. The linear system will keep the wastewater and ground water out of contact in the system and it will be made from 30 mil. Poly vinyl chloride (pvc) material.

2. The distribution medium system at the inlet will usually be a coarse drain filed rock of ¾ to 2½ inches in diameter.

3. plant system growing in the wetland will be cattails, bulrushes, reeds, sedge and many other plants, which would grow and flourish in the system to operate at maximum efficiently and also useful for metal uptake.

4. The underdrain system at the end of wetland will be slotted with pipe.the underdrain moves the treated waste water out of the wetland.

Constructed wetlands are of two types: subsurface and surface flow wetland. Sub surface flow wetlands can be categorized as horizontal flow and vertical flow constructed wetlands. Subsurface-flow wetlands move effluent, agriculture run-off, tannery or meat processing wastes, waste water from sewage or storm drains through lavastone or sand medium on which plants are rooted, surface flow wetlands move effluent above the soil in a planted marsh or swamp, and can be supported by a wider variety of soil types including bay mud and other silty clay. In subsurface-flow systems, the effluent may move either horizontally, parallel to the surface, vertically, from the planted layer down through the substrate and out. Subsurface-flow systems have advantage of requiring less land area for water treatment, but are not suitable for wildlife habitat as are surface-flow constructed wetlands. The community found in wetland is called periphyton. Different species of aquatic plants have different rates of heavy metal uptake, a consideration for plant selection in a constructed wetland used for water treatment.

In constructed wetland many plant species planting of reed beds are popular in European plants such as, cattails, *Typha* Species , Sedge, Water Hyacinth, *Eicchornia crassipes* and *Pontederia*.

Buckbeans, *Menyanthes trifoliata* and Pendant grass (*Aretophila fulva*) are also useful for metal uptake. Wetland muck soils support immense population of microorganisms. Some of these microbes can use pesticides and other organic molecules as food. Wetlands reduce some pathogenic bacteria after only two hours of contact with wetland plants.

Physical, chemical, and biological processes combine in wetlands to remove pollutants from waste water. Treatment of waste water within a constructed wetland occurs as it passes through the wetland medium and plant rhizosphere. A thin aerobic film around each root hair is aerobicdue to the leakage of oxygen from the rhizomes, roots, and rootlets. Decomposition of organic matter is facilitated by aerobic and anaerobic micro-organism present. Microbial nitrification and subsequent denitrification releases nitrogen as gas to the atmosphere. Phosphorous is co-precipitated with iron, Aluminium, and Calcium compounds located in the root bed medium suspended solids are filtered out as they settle in the water in surface flow wetlands. Harmful baxcteria and viruses reduced by filteration and adsorption by biofilms on the rock media in sub surface flow and vertical flow system.

National Botanical Research Institute (CSIR) has planned to treat municipal sewage waste water with aquatic plants before allowing them to flow into the river as a low cost, eco-friendly and sustainable solution. The project entitled "plant based management of Ganga water pollution" was sanctioned to the institute by the National River Conservation Directorate, Ministry of Environment and Forests, Govt. of India. Under this project scientists plan to cover river banks at different spots, from Gangotri in Uttrakhand to Ganga Sagar in West Bengal.

DUAL NATURE OF REACTIVE OXYGEN SPECIES; AN ALLY OR ADVERSARY FOR PLANTS

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What are Reactive oxygen species (ROS)?

Palaeo-climatically, the introduction of molecular oxygen (O2) into our atmosphere by O2-evolving photosynthetic organisms 2.7 billion years ago, reactive oxygen species (ROS) have been the undesirable companion of aerobic life. Accordingly, the evolution of all aerobic organisms has been dependent on the development of efficient ROS-scavenging mechanisms. ROS are free radicals produced as by-products of oxidation-reduction (REDOX) reactions. ROS are produced as a consequence of electron transport processes in photosynthesis and aerobic respiration. The total reduction of oxygen produces water, however partial reduction produces ROS including superoxide anion (O2·-), hydrogen peroxide (H2O2) and the hydroxyl radical (OH·). ROS are generated at very high rates in plants. They are produced by organelles with a high oxidising metabolic activity or intense rate of electron flow, e.g. chloroplasts, mitochondria and microbodies, or by the oxidases, a large class of enzymes. Examples of ROS-producing oxidases include the plasma membrane NADPH oxidases, peroxidases, oxalate oxidases and amine oxidases. The mechanism of activation is by the stepwise monovalent reduction of oxygen to form superoxide (O2·-), hydrogen peroxide (H2O2), hydroxyl radical (OH·) and finally water according to the scheme. The first step in the reduction of oxygen forming superoxide is endothermic but subsequent reductions are exothermic. Superoxide can act as either an oxidant or a reductant; it can oxidise sulphur, ascorbic acid or NADPH; it can reduce cytochrome C and metal ions. A dismutation reaction leading to the formation of hydrogen peroxide and oxygen can occur spontaneously or is catalysed by the enzyme superoxide dismutase. In its protonated form (pKa = 4.8) superoxide forms the perhydroxyl radical (·OOH) which is a powerful oxidant (Gebicki and Bielski, 1981), but its biological relevance is probably minor because of its low concentration at physiological pH.

Reactive oxygen species as an Ally

According to the most of recent studies, a new task for ROS has been recognized in plants: the control and regulation of a group of essential biological processes, such as, hormone signaling, immune defense, growth and development, seed germination and the alleviation of seed dormancy, programmed cell death; and stress acclimation. At low levels, they are beneficial for plant and act as signaling molecules during local and systemic acquired resistance. In addition to sensing the environment and abiotic stresses, ROS also play an important role in plant defense responses to pathogens. They are involved in the hypersensitive response typical of plant-pathogen incompatible interactions. The hypersensitive response (HR), is an example of programmed cell death (PCD) characterized by cell death at the site of infection. One of the earliest events in HR is the rapid accumulation of ROS, which can be directly toxic to the pathogen, but recent evidence suggests that the ROS, in particular H_2O_2, are the signal molecules that trigger HR and other defense mechanisms such as systemic acquired resistance (SAR) and activation of defense genes. The production of ROS occurs in two distinct phases: an initial, non-specific phase probably originates from an NADPH-dependent oxidase follows within minutes of pathogen addition, and a secondary phase, dependent on recognition of incompatible pathogens by the host begins 1–3 h after the initial burst .The produced $O_2^{\cdot-}$ is dismutated by SOD to H_2O_2 and will activate benzoic acid 2-hydroxylase leading to salicylic acid (SA) accumulation. This rise in SA, in combination with H_2O_2, is necessary for inducing defense gene expression. The second, longer-lasting burst is involved in activating defense responses, even if thought to be NAD(P)H dependent. H_2O_2 and $O_2^{\cdot-}$ can induce different genes, in combination or separately, thereby giving more flexibility to the ROS signaling function. ROS are also produced in response to many hormones such as auxin, abscisic acid and salicylic acid. It is no surprise therefore that ROS are important not only in sensing and responding to environmental changes, but also in orchestrating plant movement (stomatal closure and tropism) responses and in development. Liam Dolan and his colleagues at John Innes Centre (UK) have demonstrated a role for ROS in the development of root hairs. The production of the ROS signal for root growth is highly ordered and tightly coordinated to ensure the production of a single root hair. Redox signaling events are also involved in plant responses to temperature stresses. Here the ROS appear to play a more direct role in the induction of heat shock proteins, but this does not rule out other indirect mechanisms. It would appear that stress sensors in the photosynthetic and respiratory electron transport chains

activate redox-sensitive transcription factors that in turn up-regulate the expression of genes that encode HSPs and related proteins, ROS-scavenging enzymes and factors involved in the amplification of the ROS signal by activation of NADPH oxidases. According to beyond depiction it will be able to predict that at minimum concentration ROS may act as an ally or defender for plant.

Reactive oxygen species as an Adversary

Nevertheless, the effects of ROS are dose dependent and high levels of ROS production lead to a process that is often referred to as 'oxidative stress' on the cell, and call up reflective changes in gene expression. The adverse effects of ROS have been coupled with aging, carcinogenesis and atherosclerosis in humans. These oxygen radicals are highly reactive, forming hydroperoxides with enes and dienes. Furthermore, specific amino acids, such as histidine, methionine, and tryptophan can be oxidized by $O_2^{\cdot-}$. In the cellular environment, $O_2^{\cdot-}$ will also cause lipid peroxidation, thereby weakening cell membranes. The following O_2 reduction produces hydrogen peroxide (H_2O_2), a quite long-lasting molecule (1 μs) that can diffuse some distance from its site of production. The biological toxicity of H_2O_2 through oxidation of SH groups has long been recognized and it can be enhanced in the presence of metal catalysts through Haber-Weiss or Fenton-type reactions. Likewise, $O_2^{\cdot-}$ may react with other molecules such as lipid peroxides. It can also react with nitric oxide, leading to the formation of peroxynitrite, a species considered less reactive than peroxides. These reactions depend on concentration and on the preferential scavenging capacity of the cell. The plant may favor formation of one or the other species by preferentially scavenging H_2O_2 with antioxidants or, in contrast, accumulate H_2O_2 by activating superoxide dismutase (SOD). In addition, H_2O_2 accumulation may itself lead to higher ROS production. The H_2O_2 disruption of photosynthesis, as well as the probable direct role of H_2O_2 in the activation of an NAD(P)H-dependent oxidase , suggests that H_2O_2 itself can stimulate ROS accumulation. The various sites of oxygen activation in the plant cell are highly controlled and firmly coupled to avoid release of intermediate products. Under stress situations, it is probable that this control or coupling breaks down and the process "dysfunctions" leaking activated oxygen. This is probably a common occurrence in plants especially when we consider that a plant has minimal mobility and control of its environment. These uncoupling events are not unfavorable that they are short in duration and that the oxygen scavenging systems are able to detoxify the various forms of activated oxygen. If the production of activated oxygen exceeds the plant's capacity to detoxify it, deleterious degenerative reactions occur, the typical symptoms being loss of osmotic responsiveness, wilting, and necrosis. At the sub cellular level, disintegration of membranes and aggregation of proteins are typical symptoms. Under abiotic stress, such as heavy metal stress condition, a large quantity of ROS generates in the cell and degrades chlorophyll, protein, nucleic acid molecules and causes lipid peroxidation. The degree of lipid peroxidation is measured by MDA(manoldialdehyde), the end product of the reaction. Therefore the undesirable product of ROS action in the cell under abiotic stress illustrates the adverse nature of reactive oxygen species.

Efficient management of steady state level of ROS

According to dual nature of ROS, it acts as both a defender and as a destroyer to plant. How this dual role is controlled in plants is a little bit mysterious. Although there has been rapid progress in recent years, there are still many uncertainties and gaps in our understanding of how ROS affect the stress response of plants. Nonetheless, it is obvious that the steady-state level of ROS in cells needs to be strongly regulated. Thus, the plant's dilemma is not how to eliminate the activation of oxygen, but how to control and manage the potential reactions of activated oxygen. Complex systems of scavenging activated oxygen therefore exist in plant cells with complimentary and interdependent strategies. Some components such as the carotenoids prevent the formation of activated oxygen by competing for the energy leaked from the photosystems. Other components are lipid soluble and reside in the membrane bilayer to terminate the lipid peroxidation chain reactions. Still others, ascorbate and glutathione, are aqueous scavenger that detoxify activated oxygen directly or serve to recycle other protective components back to their reduced state. The enzymes that catalyse the synthesis, degradation and recycling of these antioxidants are essential to viability. Consequently they are highly conserved among plants, and exist in multiple forms in different subcellular compartments and different tissues to allow precise regulation. For ROS to be effective in these roles Graham Noctor of the University of Paris, notes that "the production and concentration of ROS requires effective regulation by a powerful antioxidant system". The plant antioxidative system is continuously processing ROS, by acting as electron donors the antioxidants are themselves oxidised in the process of neutralizing the ROS. The omnipresence of O_2 in the environment and the various cellular locations where ROS are produced render oxidant scavengers necessary for plant growth and survival. The capacity for ROS to serve as signals adds to the importance of antioxidants to specifically regulate different ROS in various cellular locations. Plants have several antioxidant enzymes and metabolites located in different plant cell compartments, the main ones being SODs, a family of metalloenzymes catalyzing the dismutation of $O_2^{\cdot-}$ to H_2O_2, catalases (CATs), which are heme proteins that catalyze the removal of H_2O_2, and the enzymes and metabolites of the ascorbate-glutathione cycle that are involved in the removal of H_2O_2. The majority of enzymes of the ascorbate-glutathione cycle [ascorbate peroxidase (APX), glutathione reductase (GR), and dehydroascorbate reductase (DHAR)] have been found in chloroplasts,

cytosol, mitochondria, and peroxisomes (Figure 2). Catalase and the ascorbate-glutathione cycle are important in H_2O_2 scavenging. Although their properties and requirements are different, they function effectively in parallel. Catalase does not require reducing power and has a high reaction rate but a low affinity for H_2O_2, thereby only removing the bulk of H_2O_2. In contrast, APX requires a reductant (ascorbate) and has a higher affinity for H_2O_2, allowing for the scavenging of small amounts of H_2O_2 in more specific locations. Non-enzymatic antioxidant include redox buffers such as glutathione, ascorbate, tocopherol, flavonoids, carotenoids and alkaloids vis-à-vis ROS detoxification. Antioxidant capacity is very much dependent on the severity of the stress as well as the species and its developmental stage (Apel & Hirt, 2004).

A highly dynamic and redundant network of more than 150 genes is implicated in **Arabidopsis**(a model plant for genomics, proteomics and stress related physiology) for managing the concentration of ROS and also encodes ROS-scavenging and ROS-producing proteins. Recent studies have unraveled some of the key players in the network, but many questions related to its mode of regulation, its protective roles and its modulation of signaling networks that control growth, development and stress response remain unanswered. The hunt for ROS receptors in plants is still open. It has been proposed that plant cells sense ROS by at least three different mechanisms: (i) unidentified receptor proteins; (ii) redox-sensitive transcription factors, such as NPR1 or Heat Shock Factors; and (iii) direct inhibition of phosphatases by ROS. Multiple efforts involving genomics, proteomics and metabolomics and other coming up technologies are likely to provide a better picture of the networks involved in different ROS-related plant processes (http://www.scitopics.com/Reactive_Oxygen_Species_in_Plants.html). Since active oxygen species contribute a regulatory function in plants response and adaptation to both biotic and abiotic stress conditions, new insights into the ROS gene network might also allow the identification of genes that can eventually be exploited to modulate ROS-related plant processes that direct the development of better performing yield plants through detoxification of excess ROS at subcellular level. Therefore it is essential to sustain the balance between the production and the scavenging of activated oxygen that is critical to the maintenance of active growth and metabolism of the plant and overall environmental stress tolerance.

NEWS AND VIEWS

Common Plants Can Eliminate Indoor Air Pollutants

Pot plants are not simply decorative, they are functional too. Now, if we could only get them to grow out doors, they might soak up such problematic pollutants as carbon dioxide. Yang *et. al* (Hort. Science 44: 1377-1381, 2009) tested 28 plants, and identified five including *Hedera helix* and *Asparagus densifolrus* as 'super ornamentals' – those with the highest rates of contaminant removal. To determine the plants' atmospheric clean-up ability, they were exposed to a range of common household volatile organic compounds (VOCs), including aromatic hydrocarbons (benzene and toluene, an aliphatic hydrocarbon (octane) and a halogenated hydrocarbon (trichloroethylene). These VOCs are widely present indoors and are derived from everyday items such as furnishings, carpets, plastics, cleaning products, paint, solvents and adhesives. The plants differed in their abilities to remove the VOCs and it is suggested that a mix of plants should be used in any air purifying role, the exact composition tailored to the VOC signature of the intended location

Source: Annals of Botany Vol. 105 No.2: Feb. 2010.

Sasakawa Prize for "Trees, Water and People"

Trees, water and people (TWP), the winner of prestigious Sasakawa Prize have succeeded in showcasing the importance of Green Economy at the grass roots level.

Nearly half the world's 6.8 billion people rely on smoky open fires to cook their daily meals. Thie traditional practice cause, deadly indoor air pollution which kills 1.6 million women and children annually. TWP collaborates with local NGOs to distribute fuel-efficient cook stoves to communities in South America. TWP offers a variety of stove modes to meet the needs of different communities while conserving trees and decreasing emissions from deforestation. The Justa Stove burns 70% less wood, saving families between US $ 1-85 per day. They also decrease harmful carbon emissions by 1 tonne CO_2 equivalent per year for commercial users.

In order to supplement the trees used in the fuel-efficient stoves, the project also includes reforestation efforts to sequester carbon and counter the effects of deforestation. TWP has assisted in the creation of 16 community-run nurseries that produce 650,000 trees each year. TWP's reforestation efforts have led to the planting of three million trees to date throughout Latin America.

Source: www.treeswaterpeople.org

Cooling Effect of Shade Trees with different Characteristics

Scientists from National Taiwan University have recently carried out a study on the effect of shade trees on the ore and surface-soil temperature reduction under the canopy in a park in Taipei city.

Ten species of tree and two species of bamboo, which resembled these trees in shape were chosen for the study. Leaf and canopy characteristics of each species was studied. The microclimate conditions under the tree canopies and an unshaded open space were measured repeatedly at mid days without precipitation. In comparison with the nearby unshaded open space, air temperatures under the cabioues were 0.64 to 2.52 °C lower, whereas the surface-soil temperatures were 3.28 to 8.07 °C lower. The researchers concluded that foliage density had the greatest contribution to surface-soil cooling followed by leaf thickness, leaf texture and leaf colour lightness in that order.

Pollution Kills the Heart

Polluted air causes hardening and blockage of the arteries

Direct evidence of deleterious effects of pollution on human health is often difficult to prove except in cases of acute intoxication. There are several examples in which sadly the most famous being the "Great Smog of London" in December 1952, that resulted in 3000 deaths in one week. A total of 12,000 deaths were attributed to this smog during the following year.

These intoxication's, like many others of the same kind, had the effect of encouraging researchers to study and examine the effect's of air pollution on health, at a lower dose, but over longer period of times. The action of burning fossil fuels fill's the ambient air with fine particle whose effect on the health of the heart begins to be understood. Inhaling fumes from exhaust pipes increases blood clotting and oxidative stress in arteries, decreases circulation in the vessels of the heart muscle, an increases arterial pressure, and arythmics of thrombosis.

By these effects, several studies show that pollution induced atherosclerosis in hardening and blockage of arteries that can eventually lead to a lack of blood to tissues and organs. A 2007 study by a German scientists has shown that people living closer than 50 meters from a busy highway had 63 percent higher coronary calcification than those living farther than 200 meters from the same highway.

Indeed, studies from China to Taiwan, Portugal, Finland and in nine major American cities demonstrated that a higher rate of fine particles in ambient air leads to an increase in mortality from cerebral vascular accident. Also as a result of episodes of atmospheric pollution in Boston, we noticed an increase of 48 percent of acute infactus within two hours and 69 percent within 24 hours after the peak. This also explains why the hospitals emergencies become so crouded during high episodes of smog.

Conversely, the beneficial effect's of antipollution standards can also be measured: A decrease of 10 ug/m3 of fine ambient air particles results in a longer life span amelioration of 0.6 year of life. So, measures to improve the air quality would have a similar effect as anti-smoking measures in place in public spaces and that leads to lowering of hospitalizations for acute infactus.

By Rodolphe Cote

Uranium in groundwater

Recently reports have appeared about the high pre value of cancer cases in the Bathinda district of Punjab. In the case of village jaijal the level of uranium in ground water has been found to be 63 parts per billion. The village use to get filtered canal water but that has been badly contaminated by industrial effluent discharged by the Budha nallah of Ludhiana and non contains contaminants like arsenic, selenium, mercury and chromium which can not be removed by the filtration process employed earlier. The water availability in the neighboring villages carry the uranium concentrations varying between 100 ppm to 145 ppb. The USEPA Health standards for clean water fit for drinking purposes has fixed the limit at 30 ppb.

A part from the naturally occurring radionuclide materials in the earth's surface, the leaching of fly ash gets accelerated when pH value of leaching water risk to a value ground water it travels alkaline state. Once the uranium enters ground water it travels fast from location to another depending upon the water gradient. Unless adequate precautions are taken e.g. fast disposal of fly ash for use by the cement and brick manufacturing, the piling of the ash will only end up polluting the water in the surrounding regions.

The safe level of uranium is drinking water needs to the carefully fixed so as not to endanger the health of the people. Additionally safeguards need to be built into our existing and proposed thermal power plants to reduce the risks of uranium contamination of the ground water resources.

By Dr. G.S. Dhillion

Cheap and Green Stove

Ramesh Singh, an ex-Lecturer from Delhi University has developed a bio-stove fuelled by dry rice husk, which can cook a full meal at a very cheap cost. The stove has been designed that merely 250 gms of rice husk for cooking one meal. The stove could go a long way in curbing carbon emissions and help check deforestation as poor villager would not need to fell trees for fuel. They could get rice husk cheaply from rice mills.

All that one has to do is to fill the iron tray in the stove with the dry husk, which then gets trapped in the burner. It is ignited with a small piece of paper and soon gives out flame, enabling users to cook a meal for five to six persons within 30 to 50 minutes.

In places with scarcity of rice husk, other dry bio-waste, including dry sugarcane waste, wheat husk, mustard husk, gram husk and even small chopped dry leaves can be used as fuel.

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Contact: Conference Secretariat
Irene Moreno Millan
Wessex Institute of Technology
Ashurst Lodge, Ashurst, Southampton, SO40 7AA
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Contact: Conference Secretariat
Claire Shiell
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Ashurst Lodge, Ashurst
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