ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

ISEB SILVER JUBILEE ISSUE

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IN THIS ISSUE

ISEB Presidents

Name	Year
Dr. Prafullachandra Vishnu Sane	1984-1997
Dr. Palpu Pushpangadan	1999-2006
Dr. Rakesh Tuli	2006-2010
Dr. Kailash Chand Gupta	2010
Dr. Chandra Shekhar Nautiyal	2010-2016
Prof. Saroj Kanta Barik	2016- to date

ISEB: JOURENEY OF TWENTY-FIVE YEARS

A group of 28 odd plant scientists, environmentalists, academicians, nature lovers and NGOs met on 3rd December 1994 at National Botanical Research Institute, Lucknow, India under the chairmanship of Dr. P. V. Sane, the then director of the Institute, to discuss the ways and means of protecting our environment from the onslaught of atmosphere pollution caused by increasing population, rapidly growing urbanization and industrialization and fast depleting natural resources.

This meeting after detailed discussions and deliberations resolved to establish a society to promote the cause of environmental protection, biodiversity conservation, sustainable development and pollution mitigation, focusing and highlighting the role of plants in attaining the aforementioned objective. The meeting adopted a blue print of the constitution of the Society, which was named as "International Society of Environmental Botanists (ISEB)". It was decided to locate the office of the Society at National Botanical Research Institute, Lucknow (NBRI), which is a national laboratory under the aegis of Council of Scientific & Industrial Research, New Delhi.

The ISEB is registered with the Registrar of Societies, Govt. of Uttar Pradesh, Lucknow under the Societies Registration Act No. XXI of 1860, (Regd. No. 1818) and it is governed by a duly elected Executive Committee. It is a non-governmental and not-for-profit Scientific Society which aims to promote the cause of environmental protection, biodiversity conservation, pollution abatement and sustainable development thorough research and outreach programmes. ISEB was unanimously selected as a scientific member of International Union of Biological Sciences (IUBS), Paris during its 28th General Assembly held in Cairo, Egypt on 18-22 January, 2004.

The objectives of ISEB are:

- To promote and coordinate research on plants in relation to environmental pollution.
- To encourage better interaction among researchers, teachers, and social activists.
- To create awareness, especially among governmental policy makers and industry leaders.

With a view to achieve these objectives, ISEB targets its activities to three sections namely, common man, including illiterate masses in rural and urban areas; students in educational institutions from primary school to university level; and global scientific community (research workers and academics in research institutes and universities) including NGOs.

Since its founding, ISEB has organized a wide spectrum of activities including scientific talks, environmental awareness activities, training programmes, community services, lectures, demonstrations, debates and poster competitions at rural community centers, schools and colleges. Besides organizing activities like lectures, seminars, debates, mass awareness, and educational programs, the Society has been regularly publishing a quarterly newsletter *EnviroNews* since January 1995. It has played a very significant role in carrying the message of the Society world-wide. A quarterly scientific journal, *International Journal of Plant and Environment* (IJPE) has been introduced since 2015. Now it is in its 6th year of publication and has 4 issues per year, and in a short span of 5 years it has gained international acclaim and recognition.

One of the objectives of ISEB is to recognize outstanding scientists in the field of ecology and environmental science through selecting them as Fellow of ISEB. Young scientists are recognized by awarding them with ISEB Young Scientist Medal.

ISEB and CSIR-NBRI jointly organize a series of International Conferences on Plants and Environmental Pollution (ICPEP) in Lucknow. Till date, six ICPEPs were organized in the years 1996, 2002, 2005, 2010, 2015 and 2018 in which leading scientists from more than 40 countries across the globe participated.

It is a matter of great pride and satisfaction that CSIR-NBRI based International Society of Environmental Botanist (ISEB) has completed 25 years of its existence. During this period, the membership of ISEB has grown from 28 to more than 550 covering several countries of the world. In the series of programmes planned to celebrate Silver Jubilee year a function was organized on 6thMarch, 2020. The highlight of the programme were the deliberation of two Silver Jubilee lectures by the Chief Guest of the function, Prof. L.S. Shashidhara, FNA, President, IUBS & Dean Ashoka University, and the Guest of Honour, Prof. Madhoolika Agrawal, FNA, Coordinator, Interdisciplinary School of Life Sciences at BHU. The lecture was attended by many ISEB members, distinguished scientists/academicians of Lucknow and around, research students and scientists/staff of CSIR-NBRI. On this occasion the ISEB Fellowship and Young Scientist Award 2019 were conferred on the awardees by the Director CSIR-NBRI and President ISEB.

'एक व्यक्ति-एक वृक्ष' पॉलिसी की जरूरत

एनबीआरआई में मनाया गया रजत जयंती वर्ष,जलवायु परिवर्तन पर की विशेषज्ञों ने चर्चा

लखनऊ (एसएनबी)। जलवायु परिवर्तन का सामना करने के लिए हमें 'एक व्यक्ति- एक वृक्ष' की पॉलिसी अपनाने की आवश्यकता है। यह बात शुक्रवार को राष्ट्रीय वनस्पति अनुसंधान संस्थान (एनबीआरआई) में आयोजित इंटरनेशनल सोसाइटी ऑफ एनवायर्नमेंटल बोटनिस्ट (आईएसईबी) के रजत जयंती वर्ष पर मुख्य अतिथि इंटरनेशनल यूनियन ऑफ बायोलॉजिकल साइंसेज के अध्यक्ष प्रो. एल.एस. शशिधारा ने कही। इस अवसर पर विशिष्ट अतिथि के रूप में बीएचयू, वाराणसी की प्रो. मधूलिका अग्रवाल उपस्थित थीं।

इस दौरान मुख्य अतिथि ने 'जलवायु परिवर्तन और पर्यावरण क्षरण : आज कैसे सामना किया जाए, कल को कैसे रोका जाए' विषय पर व्याख्यान देते हुए कहा कि आज के वैज्ञानिकों के लिए आवश्यक है कि वह जलवायु परिवर्तनों के विषय में युवाओं एवं आने वाली पीढ़ियों को जागरूक करें। उन्होंने जलवायु परिवर्तन पर आधारित अध्ययनों के लिए वैकल्पिक ऊर्जा संसाधनों जैसे सोलर पैनलो एवं आर्टिफीसियल इंटेलिजेंस का प्रयोग करने के विषय में भी चर्चा की।

विशिष्ट अतिथि प्रो. मधुलिका अग्रवाल ने अपने अध्यक्षीय संबोधन में ओजोन प्रदूषक के विषय में जानकारी दी तथा पर्यावरण पर इसके प्रतिकूल प्रभावों के विषय पर चर्चा की। उन्होंने अपने शोध कार्य के आधार पर बताया कि ओजोन एक शहरी प्रदूषक ना होकर एक ग्रामीण प्रदूषक है जैसा कि इन क्षेत्रों में इसके अधिक मापन से ज्ञात हुआ है। उन्होंने यह भी बताया कि गेहूं के पौधों पर आधारित शोध में पाया गया कि पौधों के दैहिक वृद्धि काल की तुलना में प्रजनन काल के दौरान अधिक ओजोन सांद्रता देखी गयी है। उन्होंने कहा कि अन्य प्रदूषकों से मिल कर ओजोन पर्यावरण एवं पौधों के लिए काफी हानिकारक हो जाती है तथा पौधों में वृद्धि एवं उपज पर नकारात्मक प्रभाव डालती है।

कार्यक्रम के प्रारंभ में एनबीआरआई के निदेशक व आईएसईबी के अध्यक्ष प्रो. एस.के. बारिक अतिथियों का स्वागत करते हुए कहा कि एनबीआरआई आईएसईबी के साथ मिलकर भविष्य की पर्यावरणीय समस्याओं के समाधान खोजने के लिए हमेशा तत्पर है। इस दौरान एमेरिटस वैज्ञानिक व आईएसईबी के सचिव डा. आर.डी. त्रिपाठी ने संस्था द्वारा पिछले 25 वर्षों के दौरान पर्यावरण सुधार के लिए किये गये कार्यों के बारे में जानकारी दी तथा कहा कि यह संस्था पर्यावरण में पौधों की भूमिका को समझने एवं उनका प्रचार करने में लगी हुई है।

इस अवसर पर मुख्य अतिथि एवं विशिष्ट अतिथि द्वारा आईएसईबी यंग साइंटिस्ट पुरस्कार एनबीआरआई के डा. जी.के. मिश्रा को दिया गया, जबकि आईएसईबी फैलोशिप को नौ वैज्ञानिकों/शोधकर्ताओं को प्रदान किया गया। अंत में डा. विवेक पांडे द्वारा धन्यवाद प्रस्ताव के साथ समारोह का समापन हुआ। इस अवसर पर डा. विवेक पांडे, डा. नंदिता सिंह, डा. प्रमोद शिर्के आदि उपस्थित थे।

हर व्यक्ति लगाए एक पौधा : प्रो . शशिधारा

जागरण संवाददाता ● लखनऊ : जलवायु परिवर्तन से मुकाबला करना बहुत मुश्किल नहीं है। बस करना यह होगा कि एक व्यक्ति एक पौधा की नीति अपनानी होगी।

कार्यक्रम को संबोधित करते प्रो. एलएस शशिधारा ● जागरण

राष्ट्रीय वनस्पति अनुसंधान संस्थान (एनबीआरआइ) में शुक्रवार को इंटरनेशनल सोसाइटी ऑफ एनवायरनमेंटल बॉटनिस्ट (आइएसईबी) के रजत जयंती वर्ष समारोह को संबोधित करते हुए ये बातें इंटरनेशनल यूनियन ऑफ बायोलॉजिकल साइंसेज के अध्यक्ष प्रो. एलएस शशिधारा ने कहीं। प्रो. शशिधारा जलवायु परिवर्तन और पर्यावरण संरक्षण का कैसे सामना किया जाए पर व्याख्यान दे रहे थे। उन्होंने कहा कि वैज्ञानिकों के लिए आवश्यक है कि वह जलवायु परिवर्तनों के विषय में युवाओं एवं आने वाली पीढ़ियों को जागरूक करें। बीएचयू की प्रो. मधूलिका अग्रवाल ने ओजोन प्रदूषण के विषय में बताते हुए पर्यावरण पर इसके प्रतिकूल प्रभावों के विषय पर चर्चा की। एनबीआरआइ के निदेशक एवं आइएसईबी के अध्यक्ष प्रो. एसके बारिक ने कहा कि एनबीआरआइ व आइएसईबी साथ मिलकर भविष्य की पर्यावरणीय समस्याओं के समाधान खोजने के लिए तत्पर है। सचिव डॉ. आरडी त्रिपाठी ने संस्था द्वारा पिछले 25 वर्षों के दौरान पर्यावरण सुधार के लिए किए गए कार्यों के बारे में जानकारी दी। इस अवसर पर आइएसईबी यंग साइंटिस्ट पुरस्कार डॉ. जीके मिश्रा को दिया गया।

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एनबीआरआई में इंटरनेशनल सोसाइटी ऑफ एनवायर्नमेंटल बोटनिस्ट (आईएसईबी) ने शुक्रवार को संस्थान परिसर में अपना रजत जयंती वर्ष समारोह मनाया। जिसमें मुख्य अतिथि के रूप में प्रो. एलएस शशिधारा अध्यक्ष इंटरनेशनल यूनियन ऑफ बायोलॉजिकल साइंसेज व विशिष्ट अतिथि प्रो. मधूलिका अग्रवाल शामिल हुईं। इस मौके पर डॉ. जीके मिश्रा को आईएसईबी यंग साइंटिस्ट पुरस्कार से सम्मानित किया गया। वहीं, नौ वैज्ञानिकों व शोधकर्ताओं डॉ. नासिर अजीज अंजुम, प्रो. नवीन कुमार अरोड़ा, डॉ. राजीव प्रताप सिंह, डॉ. संजीव नायक, डॉ. अक्षुनी कुमार, डॉ. पेखा सुमसखा, प्रो. डेज़ी आर. बरौंध, प्रो. एसपीएस कुशवाह व डॉ. प्रभात कुमार राय को आईएसबी फैलोशिप प्रदान की गई।

'जलवायु परिवर्तन और पर्यावरण क्षरण विषयक व्याख्यान को संबोधित करते हुए प्रो. शशिधारा ने कहा कि जलवायु परिवर्तन का सामना करने के लिए 'एक व्यक्ति एक वृक्ष की पॉलिसी अपनाने की आवश्यकता है। उन्होंने जलवायु परिवर्तन पर आधारित अध्ययनों के लिए सोलर पैनलों व आर्टिफीशियल इंटेलिजेंस का प्रयोग करने के बारे में भी चर्चा की। प्रो. मधूलिका अग्रवाल ने ओजोन प्रदूषण के विषय में बताते हुए पर्यावरण पर इसके प्रतिकूल प्रभावों के विषय पर चर्चा की। उन्होंने बताया कि ओजोन एक शहरी प्रदूषक न होकर ग्रामीण प्रदूषक है। निदेशक प्रो. एसके बारिक ने कहा कि एनबीआरआई व आईएसईबी मिलकर भविष्य की पर्यावरणीय समस्याओं के समाधान खोजने के लिए हमेशा तत्पर हैं। सचिव एमेरिटस वैज्ञानिक डॉ. आरडी त्रिपाठी ने संस्था द्वारा बीते 25 वर्षों के दौरान पर्यावरण सुधार के लिए किए गए कार्यों के बारे में जानकारी दी।

डॉ. जीके मिश्र को यंग साइंटिस्ट पुरस्कार

लखनऊ। एनबीआरआई में इंटरनेशनल सोसाइटी ऑफ एनवायर्नमेंटल बोटनिस्ट (आईएसईबी) ने शुक्रवार को संस्थान परिसर में अपना रजत जयंती वर्ष समारोह मनाया। जिसमें मुख्य अतिथि के रूप में प्रो. एलएस शशिधारा अध्यक्ष इंटरनेशनल यूनियन ऑफ बायोलॉजिकल साइंसेज व विशिष्ट अतिथि प्रो. मधुलिका अग्रवाल शामिल हुईं। इस मौके पर डॉ. जीके मिश्रा को आईएसईबी यंग साइंटिस्ट पुरस्कार से सम्मानित किया गया। वहीं, नौ वैज्ञानिकों व शोधकर्ताओं को आईएसबी फैलोशिप प्रदान की गई।

'एक व्यक्ति, एक वृक्ष' की पॉलिसी अपनाने से सुधरेगा पर्यावरण

लखनऊ। पर्यावरण को अगर सुधारना है तो सभी को एक व्यक्ति एक वृक्ष की नीति को अपनाना होगा। इससे ही पर्यावरण सुरक्षित किया जा सकता है। यह बात शुक्रवार को एनबीआरआई के ऑडिटोरियम में आयोजित इंटरनेशनल सोसाइटी ऑफ एनवायरमेंटल साइंस (आईएसईबी) के कार्यक्रम में प्रमुख वैज्ञानिक प्रो. एसएल शशिधरा, अध्यक्ष इंटरनेशनल यूनियन ऑफ बायोलॉजिकल साइंसेज ने कही। डॉ. शशिधरा का कहना है कि वैज्ञानिकों को युवा पीढ़ी को जलवायु परिवर्तन को लेकर जागरूक करना चाहिए। वहीं, बीएचयू की प्रो. मधुलिका अग्रवाल ने ओजोन प्रदूषण व पर्यावरण पर पड़ने वाले दुष्प्रभाव के बारे में बताया। उनका कहना है कि इससे गेहूं की पैदावार पर असर पड़ रहा है। इस दौरान एनबीआरआई के निदेशक डॉ. एसके बारिक, एएमयू के डॉ. नासिर अजीज अंजुम, बीबीएयू के प्रो. नवीन कुमार अरोड़ा, बीएचयू के डॉ. राजीव प्रताप सिंह मौजूद रहे।

NEWS FLASH

Dr. P.K. Trivedi, FNA, FISEB, former Senior Principal Scientist of CSIR-NBRI and Life member of ISEB, has been appointed Director CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, on 14th February, 2020. The whole ISEB family congratulates him for the prestigious achievement.

Dr. Nandita Singh, FISEB, Additional Secretary ISEB, was 'Guest of Honour and Invited Speaker' on the occasion of National Science Day on 28th March, 2020 at School for Environmental Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow. She gave a talk on the theme "Women in Science".

ISEB and CSIR-NBRI members under the leadership of **Dr. Sanjay Dwivedi**, FISEB exhibited an educative stall in the flower show of Lucknow Nagar Nigam on 22-23 Feb, 2020 at E-park Mahanagar, under the theme 'Importance of plants in controling of environmental pollution'. The display was awarded 1st prize for best educative stall and was considered for the **Chal Baijanti Trophy**.

WELCOME NEW LIFE MEMBERS

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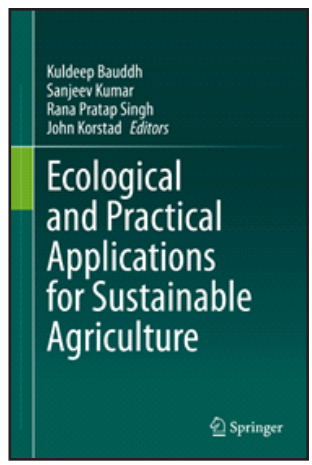
NEW BOOK RELEASE

Ecological and Practical Applications for Sustainable Agriculture

Edited by

Kuldeep Bauddh, Central University of Kharkhand, Ranchi, India; Sanjeev Kumar, Central University of Jharkhand, Ranchi, India; Rana Pratap Singh, Babasaheb Bhimrao Ambedkar University, Lucknow, India & John Korstad, Oral Roberts University, Tulsa, USA.



Rampant industrialization, urbanization, and population growth have resulted in increased global environmental contamination. Pollution of agricultural land is a major concern. The productivity of agricultural soil is drastically deteriorated and requires a high dose of fertilizers to cultivate crops. Heavy loads of chemical fertilizers not only degrade the quality of agricultural land but also pollute water and air. Excess fertiliser can accelerate release of greenhouse gases like nitrous oxide and methane. Farming practices globally in developed, developing, and under-developing countries should utilize and promote sustainable methods through viable combined environmental, social, and economic means that improve rather than harm future generations. This can include use of non-synthetic fertilizers like microbial compost, vermicompost, slow-release fertilizers, farmyard manures, crop rotations that include nitrogen-fixing legumes, and customized fertilizers.

The purpose of this book is to document the available alternatives of synthetic fertilizers, their mode of action, their efficiency, preparation methodology, practical suggestions for sustainable practices, and needed research focus. The book will cover major disciplines of sciences like plant science, environmental science, agricultural science, agricultural biotechnology and microbiology, horticulture, soil science, atmospheric science, agro-forestry, agronomy and ecology. It book is helpful for farmers, scientists, industrialists, research scholars, masters and graduate students, non-governmental organizations, financial advisers and policy makers.

Climate change and environmental degradation: how to face the onslaught today, how to prevent tomorrow?

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Reproduction of the First ISEB Silver Jubilee Seminar delivered on 6th March, 2020 at CSIR-NBRI, Lucknow

Before going straight to Climate Change let us ask the basic question, What is Science? The best definition which comes across is by Science Council. It defines, "*Science* is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence" (http://sciencecouncil.org/about-science/our-definition-of-science/). Further, to come up for a new hypothesis in science there is a long process of making observations – authenticate it and observe its reproducibility. Later, analyze the observation statistically for its significance and validate through experimental or mathematical extrapolation. The best example can be given about biodiversity. For thousands of years, many people including farmers, philosophers, scientists have wondered the origin and nature of biodiversity. Mendel tried to discover a unifying principle of inheritance among the diverse organisms and in the process also gave a clue on how variations are generated in the population. Darwin provided the explanation on the "why" question of biodiversity, in the process explained its origin and continued divergence. Then came the theories, on the common chemical (DNA, RNA, protein, cell and their functions) basis to explain the unity in this diversity. Every time we pass on genetic information to the next generation, some new variations are introduced.

Diversity is the key for survival. Sustenance of life on earth for the past 3.7 billion years has been possible due to the process in which each individual becomes different from the rest. This ensures that, at least, a group of individuals of a population survive in any given environment. More the genetic diversity of a population, more is the chances of its survival and continuance. Biodiversity is no longer only regarded as a passive feature of an ecosystem, but also as an option to positively affect the functioning of ecosystems and the services that flow from them. Very good examples are pollinators for our crops, predators for our crop pests and "so called unwanted rodents", which keep disease vectors and disease-causing microbes and viruses at bay, etc. All these together ensure nutritional diversity according to our genetic diversity, environmental diversity and physical and mental health. To summarise, our very existence is dependent on the sustenance of natural biodiversity.

ANTHROPOGENIC-Climate change

Climate Change is one of the most significant issues of our times. It will affect the sustainable and equitable development of all countries and their citizens. Understanding how natural populations will respond to rapid anthropogenic climate change is one of the greatest challenges for ecologists and evolutionary biologists.

A wealth of data now exists on biotic changes that occurred over the last one to two decades, but scientific understanding of the processes involved, the magnitude of the changes and their likely outcomes is still in its infancy, largely due to the lack of long-term baselines against which to compare these data. The **Integrative Climate Change Biology (iccbio.org)** is working to provide appropriate baselines by integrating data from long-term ecological studies and the even longer-term data provided by paleontology. A trait-based, community macroecology approach allows integration of data across the temporal and spatial scales at which climate change biologists, ecologists, and paleontologists work.

International Union of Biological Sciences (IUBS)

The mission of the **International Union of Biological Sciences (IUBS)** is **to Unify Biology Through Diversity**. The primary goal of the IUBS is basic research in all topics of Biology and its application to ensure sustainable management of the biosphere. To align its objectives and activities with the Sustainable Developmental Goals (SDGs) outlined by the United Nations and adopted by all member countries. IUBS actively supports international collaboration in research and education on biodiversity, climate change and its impact on agriculture, marine and terrestrial ecosystems, invasive species, spread of infectious diseases and many other such topics. The Biological Consequences of Global Change aims to assess the impact of global change on invasion of alien species, outbreaks of diseases, insects and rodent pests, on community structure and biodiversity of different ecosystems.

While impact of Climate Change is felt across world, the nature of the impact varies from location to location. The climate change problem, therefore, requires locally-rooted solutions, but based on global science. This require the entire human population to be aware of cause and impact of climate change. As a major emphasis, given the new approach to its goals, IUBS has widened its knowledge base and has expanded its global partnerships to lead a high-profile **program on Climate Change Education.**

TROP ICSU: Climate Change Education across the Curricula, across the Globe

The vision of TROP ICSU is Democratization of Knowledge through freely accessible digital resources, which helps all of humanity to invest their talent, skills and ambition in a focused way to address the problems of climate change.

- TROP ICSU has developed/is developing educational resources (Teaching Tools and Lesson Plans) that bring climate studies into the mainstream education.
- Resources are designed to integrate climate science with core curriculum of high school and undergraduate college syllabi across the world.
- Idea is not to make climate change education a stand-alone topic rather to bring it to the core of all curriculum of the formal education system.

What makes the project unique is its focus on those education and citizen-science modules that are locally rooted yet globally relevant for much wider outreach. The project aims to integrate relevant education and science communication modules in the education system to help future citizens across the globe in improving their understanding of the science of climate change and in developing necessary skills to mitigate its impact.

Example:

Lesson plan designed around the case study: Bamboo

As an **undergraduate Biological Sciences** teacher through the set of computer-based tools teaches about differences in **photosynthesis** in different types of plants (**C3, C4 and CAM**) and how they are affected by climate change: which is more resilient or less resilient. These basic concepts in plant physiology using the case study: Uganda's massive expansion of Bamboo, a C3 plant, to address the issue of heavy deforestation, under changing climatic conditions.

This lesson plan helps the students find answers to:

1. What are C3, C4, and CAM plants? Describe the differences in their photosynthetic pathways?
2. Describe what factors have the most impact on the photosynthetic efficiencies of C3, C4 and CAM plants.
3. How global warming and higher CO_2 concentrations may affect the growth and development of C3, C4 and CAM plants?
4. Explain physiological limitations in C3, C4 and CAM plants to adapt to climate change.
5. How is a C3 plant Bamboo, suited to restore the fractured forest ecosystems of Uganda?

Advantages of TROP ICSU

- Incorporates a multidisciplinary approach to teaching, leading to better educational outcome
- Introduces relevant Climate change topics to the classroom (a small effort without deviating from the curriculum/syllabus, but bringing major social shift)
- Use technology in the classroom
- Enhances learning outcome through location and language specific examples (this incentivizes teachers to use this approach).

Prof. L.S. Shashidhara is a Distinguished Professor at Ashoka University. He is currently on lien from IISER, Pune. He specialises in Genetics, Molecular Biology and Evolutionary biology. He did his undergraduate and post-graduate studies at the University of Agricultural Sciences, Dharwad, India and holds Ph.D. from the University of Cambridge, UK. He started his independent research career at the Centre for Cellular and Molecular Biology (CCMB), Hyderabad as a Scientist and Group Leader, where he built a strong developmental biology group. Following that, he moved to IISER, Pune and contributed to its growth since its inception.

Prof. Shashidhara has served in the past as Vice-President of Indian National Science Academy (INSA) and Secretary General of the International Union of Biological Sciences (IUBS). He is currently the President of IUBS (first Indian to be elected in its 100 years of glorious history). He has represented India in several delegations and international platforms. He is recognized with CSIR Technology and SS Bhatnagar Prizes and JC Bose National Research Fellowship. He is a Fellow of Indian National Science Academy; National Academy of Sciences, India; and Indian Academy of Sciences. In 2018, Prof. Shashidhara was elected as Associate member of European Molecular Biology Organization (EMBO), an international recognition for excellence in research in life sciences.

Transcription and editing by Dr Nandita Singh, NBRI, Lucknow.

Tropospheric ozone an emerging air pollutant damaging crops and vegetation

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Reproduction of the Second ISEB Silver Jubilee Seminar delivered on 6th March, 2020 at CSIR-NBRI, Lucknow

Tropospheric ozone (O_3), a phytotoxic secondary air pollutant and a short-lived greenhouse gas, is formed due to oxidation of carbon monoxide and hydrocarbons in presence of nitrogen oxides and sunlight. During the last few decades, O_3 has become one of the most widespread toxic air pollutants, causing threat to food security, vegetation and human health around the globe (IPCC, 2013). Due to substantial escalation in anthropogenic activities, O_3 concentration is considerably higher in the northern than the southern hemisphere. At the global scale, O_3 concentrations are highest in Central Europe, Eastern China and the Eastern USA. Ozone concentrations in the south Asia is higher due to more emissions of precursor gases and warm weather conditions.

In rapidly developing countries like India and China, production of precursor gases of O_3 are extremely high due to tremendous increase in population, urbanization, industrialization along with transport activities during last few decades. Ozone precursors particularly CO is associated with open biomass burning, which is quite common in South Asia including India. At present, the global tropospheric O_3 concentration frequently exceeds 40 ppb, the threshold concentration for protecting plants. The summer concentration of O_3 is found to be above 60 ppb in 25% of the world's countries. It is projected to increase by 13% in the main parts of India by 2050 mainly due to anthropogenic emissions.

Phytotoxic nature of O_3 and prevalence around the globe has made O_3 a major air pollutant causing significant yield losses in major crops. The global annual yield reductions in soybean, wheat, rice and maize are estimated to be 12.4, 7.1, 4.4 and 6.1%, respectively. Lal et al. (2017) calculated the yield losses of wheat and rice due to ambient O_3 which amounted to ~9 million tons ~2.6 million tons, respectively. Indo-Gangetic Plain (IGP) is the most fertile and productive agricultural area in India and the modelled and exposure based studies have shown the highest burden of yield losses for all the major crop plants under ambient and elevated O_3 concentrations in this area.

In the exposure-based assessment of yield losses under current and future concentrations of O_3 in India, it was found that on an average it varied between 11-20% for wheat, 7-13% for rice, 4-6% maize and 6-19% mustard. Ambient O_3 also negatively affected the quality of grains/seeds in relation to reductions in oil, starch, protein, and nutrient contents.

A study conducted with 14 Indian wheat cultivars under ambient+30 ppb O_3 compared to ambient, showed reductions in the grain yield varying from 10% in Kharchiya 65 to 31.3% in HD 2987. The study further suggested that the cultivars released before year 2000 were more tolerant at elevated O_3 compared to those released after 2000. Maize, a comparatively tolerant plant under ambient O_3 showed lower yield losses by 8 and 11% and 10 and 15% in normal maize cv. DHM117 and quality protein maize cv. HQPM-1, respectively under ambient+1 ppb and ambient+30 ppb O_3 exposures. The quality of grain was also altered due to loss in starch content and increments in protein content concurrently with reductions of essential amino acids, tryptophan and lysin. The loss in yield was also found in soybean and *mung* along with alterations in the seed quality of all the cultivars. Dose response studies

conducted with mustard showed high yield losses and decline in oil, nitrogen, protein, total amino acids, saturated fatty acid and omega-3-fatty acids contents.

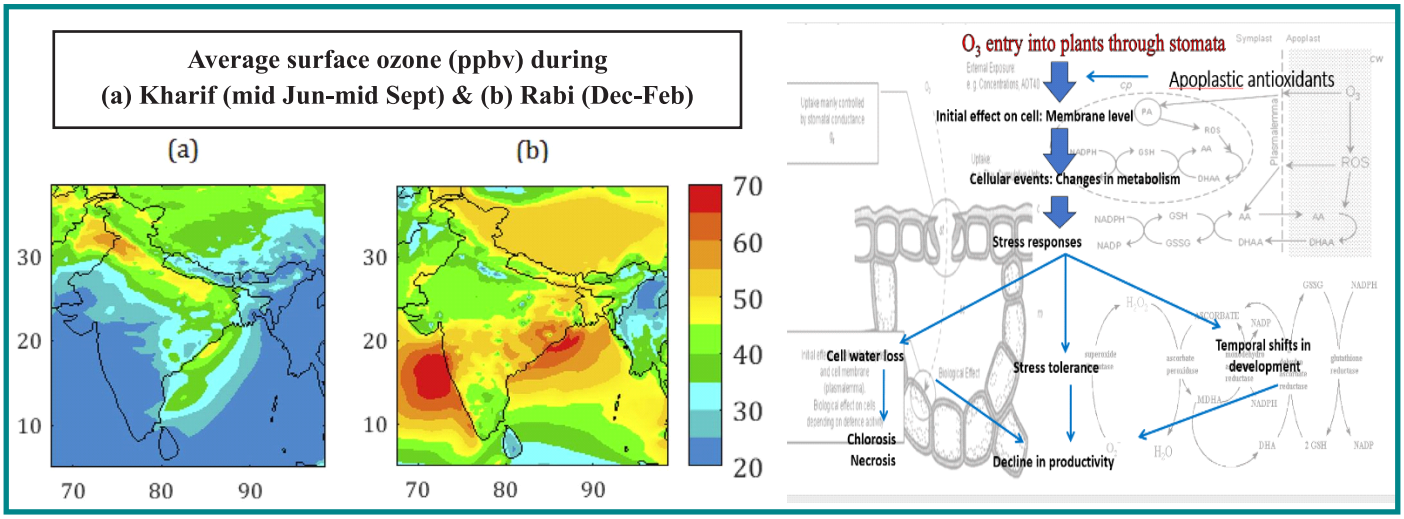
The main route for O_3 entry into the leaves is via stomata and hence stomatal conductance decides the influx of the gas and its further impact on the leaf interior (Yadav et al., 2020). After uptake, breakdown of O_3 takes place in aqueous condition or it reacts with constituents of cell wall or apoplastic fluid to generate reactive oxygen species (ROS) such as superoxide radical($^{\cdot}O_2^-$), hydroxyl radical ($^{\cdot}OH$) and hydrogen peroxide (H_2O_2), and disturbs the normal cellular homeostasis. The production of ROS further leads to a chain of reactions, which cause significant negative effects on cellular metabolism of the plants, resulting in damage to membrane lipids, proteins, carbohydrates and nucleic acids. In response to the O_3 induced stress, the plants activate a network of signalling pathways, resulting in development of molecular cascades involving the stress perception, signal transduction, alterations in the gene and protein expression patterns, accumulation of stress hormones and activation of defense mechanisms and thus counterbalance the oxidative stress (Tiwari and Agrawal, 2018).

ROS generation is an integral part of plant metabolism, but O_3 stress enhances its production at apoplastic region being the primary site, which then moves inside the cell via aquaporins and activates intracellular ROS production. Under normal metabolism, the constitutive antioxidants reduce the ROS levels to maintain the normal cellular homeostasis, but the excessive ROS under oxidative stress caused by O_3 disturbs the equilibrium and stimulates the cellular defense mechanism to produce more antioxidants. Induction of high ascorbic acid content is correlated with tolerance of crops and tree species cultivars (Tiwari and Agrawal, 2018). Exposure to ambient and elevated O_3 leads to increases in the activities of SOD, APX, CAT, POD and GR in leaves of crop, grass and tree species. Sensitive variety of rice showed lower magnitude of increment in SOD activity compared to tolerant under ambient O_3 (Tiwari and Agrawal, 2018). Differences in the antioxidant defense response are often related with the differential O_3 sensitivity in various plants.

Reduction in photosynthesis rate and stomatal conductance of various cultivars of crop, grass and tree species under ambient and elevated O_3 concentrations have been widely reported in natural field conditions (Tiwari and Agrawal, 2018). A decline in the photosynthesis rate of O_3exposed plants is associated with reduction in photosynthetic pigments, structural damage to thylakoids, reduction in the efficiency of excitation energy captured and negative effects on the electron transport system in photosystems (PSI and PSII) as well as decline in the amount and activity of ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO) (Tiwari and Agrawal, 2018). Angiosperm tree species are found to be affected more than gymnosperms and younger trees are affected less than the older ones. Some species induce closure of stomata in order to decrease the stomatal conductance and thus O_3 diffusion gets reduced into stomatal chamber/ leaf mesophyll. Stomatal acclimation and stomatal sluggishness are also found in tree species upon O_3 exposure, hence affecting the photosynthesis rate. The reduction in the ratio of Fv/Fm, a measure of maximum efficiency of PS II under elevated O_3suggests decrease in linear flow of electron through PS II leading to lesser electrons available for Calvin Cycle and water-water cycle. Reduction in total chlorophyll content in leaves of O_3 exposed plants is a most common response observed widely. Exposure of plants under elevated O_3transfers the carbon fluxes from primary to secondary metabolic pathways to shift the available resources for the synthesis of secondary metabolites, thus reducing the pool of primary metabolites. Being a strong oxidant, O_3 causes visible symptoms of injury on crop plants and natural vegetation. The injury symptoms may be in form of chlorosis, necrosis, flecks, stipples, mottling, bronzing, reddening and leaf abscission.

Tropospheric O_3 is one of the major air pollutants in India and particularly in IGP. Ozone concentrations are more in sub-urban and rural areas compared to urban areas. High temperature, sunshine hours and low humidity lead to higher O_3 concentrations. Ozone at current and elevated concentrations adversely affects the vegetative growth and reproductive development of a variety of agricultural crops and grassland and tree species. It also reduces the marketable yield and quality of crop species even in the absence of visible injury. Modern cultivars are more sensitive to elevated O_3 than old cultivars. Early sown cultivars are more sensitive than late sown. Forbs are more sensitive than grasses. Stomatal conductance and genetically controlled defense capabilities are found to be main contributors to the susceptibility of plant species.

The above discussion suggests the need of O_3 monitoring in agricultural and natural areas, and to develop bioindicator protocols with the help of sensitive plants to map the high O_3risk



areas. Yield response relationships should be developed for Indian crops to project future yield losses at increasing O_3 concentrations. Interactive effects of elevated CO_2, temperature/ drought and O_3 on plants should be researched in view of future climate change scenarios. Policy intervention is required to establish realistic air quality guidelines for ozone to protect crops and vegetation. Plant response modelling should be attempted to identify individual or combined effects of future O_3 and other stresses under different climatic conditions. Programs should be organized among farmers for awareness of O_3related problems to crops and suggest them to grow O_3 tolerant crops and to follow agricultural practices useful in reducing the damage to the plants. The breeding programs should consider O_3 tolerant traits to develop O_3 tolerant genotypes. There are very limited studies on responses of natural vegetation to elevated O_3 in India despite current evidences of high concentrations of O_3 in the country. Future studies are required to understand the O_3 deposition pattern in forests and grasslands and consequent effects on biodiversity loss and carbon sequestration.

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Yadav et al. 2020. Responses of an old and a modern Indian wheat cultivar to future ozone level: physiological, yield and grain quality parameters. Environ. Pollut. 259: 113939.

Dr. Madhoolika Agrawal, is Professor of Botany and Coordinator, Interdisciplinary School of Life Science at Banaras Hindu University, Varanasi, India. She obtained her M.Sc. and Ph.D degree in Botany from Banaras Hindu University. Prior to joining B.H.U. during 1984, Dr Agrawal worked as a Scientist at CSIR-IITR, Lucknow for a short period.

Dr. Agrawal has made significant contribution in the field of air, water and soil pollution and global climatic change effects, with particular emphasis on the cause effect relationship of plant stress interaction. Dr. Agrawal has extended her research work on global climate change effects with particular reference to enhanced ultraviolet- B radiation and elevated CO_2. She estimated carbon foot print under various agricultural practices. Dr. Agrawal is a recipient of US Fulbright Fellowship, INSA- Royal Society exchange fellowship, UNESCO/ROSTASCA young scientist award, Professor Hira Lal Chakraborty Award, UGC Swami Pranavanand Saraswati National Award in Environmental Science and Ecology, and Dr. P Sheel (Young Women Scientist) Memorial Lecture Award of National Academy of Science. She is Fellow of Indian National Science Academy, National Academy of Sciences, India and National Academy of Agricultural Sciences, India. She has worked on various projects of Government of India and international projects.

ISEB Fellowship/Young Scientist Award 2019

ISEB Fellowship

Prof. (Dr.) S.P.S. Kushwaha, Former Group Director and Dean, IIRS, ISRO. He has developed technology to monitor India's forests using satellite imagery in 1982, which was transferred to Forest Survey of India. He has co-authored 3 books and published more than 200 papers. He has provided effective leadership in forest carbon flux modelling using eddy covariance technique. He was awarded coveted German Alexander von Humboldt Fellowship in 1992 and elected as Fellow of National Academy of Sciences, India in 2014.

Dr. Naser Anjum is Assistant Professor at Department of Botany, Aligarh Muslim University. He has made significant contributions to the biology of 'Plant/Crop-Environment Adaptation'. Dr. Anjum received prestigious research awards from Portuguese Foundation for Science and Technology (FCT) (Portugal) and Academia Sinica (Taiwan). He has published > 85 peer-reviewed articles with cumulative impact factor of >200 and edited 15 books and journal special issues.

Prof. (Dr.) Naveen Kumar Arora, is Professor and Head in Department of Environmental Science, Babasaheb Bhimrao Ambedkar University, Lucknow. He is a renowned researcher in the field of Environmental Microbiology and Biotechnology. He has more than 70 research papers published in international journals and editor of 28 books. He has 1 patent to his name. He is Editor in Chief of the journal "Environmental Sustainability" and Series Editor of book series "Microorganisms for Sustainability" published by Springer Nature. He has been advisor to 13 doctoral students.

Dr. Rajeev Pratap Singh is an Assistant Professor at the Institute of Environment and Sustainable Development (IESD), Banaras Hindu University. His main research interests include solid waste management, bio-composting, eco-toxicology and green technologies. Dr. Singh has edited 7 books and 54 research papers on solid waste management.

Dr. Sanjeeva Nayaka, is currently working as Senior Principal Scientist at CSIR-NBRI. He has about 20 years of experience in the area of lichenology, and has discovered 21 species as new to science and reported 48 species as new to India. Dr. Nayaka has authored three books and about 200 research papers. He has guided four students for Ph.D. He visited Antarctica twice for studying diversity and physiology of lichens.

Dr. Ashwani Kumar is an Assistant Professor in the Department of Botany, School of Biological Sciences at Dr. Harisingh Gour Central University, Sagar India. His research deals with plant microbe interaction, plant abiotic stress, bio-energy production, and metagenomics. He has published more than 55 peer reviewed research papers.

Dr. Penna Suprasanna is Head of Plant Stress Physiology and Biotechnology Group, BARC, Mumbai. Dr. Suprasanna has made significant contributions to crop biotechnology, radiation technologies, genomics and abiotic stress tolerance. He has published more than 250 research papers and edited books published by Springer.

Prof. Daizy Rani Batish is Chairperson, Department of Botany, Panjab University, Chandigarh. Her main work is on invasive alien plants in Forests and its Management. She has published 127 papers and edited 7 books. She has guided 24 students. She is recipient of National Scientific Awards.

Dr. Prabhat Kumar Rai is Assistant Professor in Department of Environmental Science Mizoram University with 13 years of teaching and research. He has published 126 publications in the form of research/review journal articles, books and book chapters. Dr. Rai is currently the elected member of INSA (INYAS) New Delhi and NASI, Allahabad (Prayagraj).

ISEB Young Scientist Award

Dr. Gaurav Kumar Mishra is working as a National Postdoctoral Fellow at the CSIR-NBRI. His work is based on lichen taxonomy, biodiversity and biomonitoring studies. For outstanding contributions in the field of Lichenology, Dr. Mishra received the prestigious "Dr. Dharani Dhar Awasthi Award" by International Association for Lichenology (IAL) at the 8th IAL Symposium held at Helsinki, Finland in 2016. He has published more than 30 research papers in reputed national and international journals and authored and co-authored four books and five book chapters.

GLIMPSES OF ISEB SILVER JUBILEE CELEBRATION (March 6th, 2020)

Mycoremediation: Cleaning up Contaminated Sites naturally with..... Fungi?

Like animals, fungi derive energy by breaking down large molecules into smaller compounds. They do so by secreting enzymes and acids onto whatever it is they intend to consume, and then absorbing the by products of this digestion process. While fungi primarily consume biological matter (like dead wood), their enzymes can also break down a wide array of man-made compounds. In fact, fungi are so good at this, we're now employing them to clean up contaminated soils via a technique known as my core mediation.

Of course, these fungi are just doing what they evolved to do eons ago. Underneath our feet, massive fungal networks run through the soil, with many fungal species developing a symbiotic relationship with plants whereby a part of the fungus (the mycelium) grows adjacent to–and sometimes inside of–the roots of the plant. The mycelium is capable of breaking down and transporting nutrients and minerals essential for the plant's survival. After detecting and digesting these compounds, the mycelium ferries them to the plant's roots, where they're absorbed. In exchange, the plant releases compounds that are vital for the fungi's survival.

It's the fungi's ability to break down and/or transport compounds that make them useful for restoring damaged soils. Often, these soils have been saturated with compounds made up of dangerous–and relatively large–molecules. By breaking these molecules into smaller pieces, fungi help to reduce their toxicity. In other instances, soils are contaminated with fundamental elements such as cadmium, arsenic, and mercury, which can't be broken down. However, fungi still have the ability to uptake and transport these substances, and to eventually concentrate them in their fruiting bodies (mushrooms). We can then remove the fruiting bodies, and the contaminated ecosystem will be one step closer to regaining health.

Fungi can break down and/or absorb a wide range of compounds, including oil and other petroleum products, PAHs, PCBs, PCPs, neurotoxins, airborne pollutants, synthetic dyes, cadmium, lead, arsenic, mercury, copper, dioxins and organophosphates.

If fungi are so effective at cleaning up our environment, why isn't this technique more widespread? For starters, it's a slow process. As with any biological strategy for environmental clean-up, mycoremediation is limited by the speed of metabolism. If a polluted area needs to be cleaned quickly, other options may be better. Another issue with mycoremediation is that it often fails to completely rid soil of a given toxic compound, instead simply reducing the concentration. It can also be hard to justify economically, as no one wants to eat a mushroom full of heavy metals.

However, the biggest reason for my core mediation's relative lack of fame and use might simply be a lack of data from field tests. It's a relatively new technique, without many case studies to support its use (despite a good amount of lab testing). Thankfully, this situation is changing. In 2017, for example, a large batch of oyster mushrooms was used to remediate soil damaged by California wildfires. The same variety of fungus has also been used to clean up oil spills and other toxic messes.

Sam Heller, (Source - E-The Environmental Magazine, Feb. 13, 2020)

Plant extinction 'bad news for all species'

Almost 600 plant species have been lost from the wild in the last 250 years, according to a comprehensive study.

The number is based on actual extinctions rather than estimates, and is twice that of all bird, mammal and amphibian extinctions combined. Scientists say plant extinction is occurring up to 500 times faster than what would be expected naturally. An UN report (May, 2019) estimated that one million animal and plant species were threatened with extinction. Researchers say their analysis of all documented plant extinctions in the world shows what lessons can be learned to stop future extinctions. Most people can name a mammal or bird that has become extinct in recent centuries, but few could name an extinct plant, said Dr Aelys Humphreys of Stockholm University. "This study is the first time we have an overview of what plants have already become extinct, where they have disappeared from and how quickly this is happening," she added. The lost plants include the Chile sandalwood, which was exploited for essential oils, the banded trinity plant, which spent much of its life underground, and the pink-flowered St Helena olive tree. The biggest losses are on islands and in the tropics, which are home to highly valued timber trees and tend to be particularly rich in plant diversity.

What did the study find? Scientists at the Royal Botanic Gardens, Kew, and Stockholm University found that 571 plant species had disappeared in the last two and a half centuries. This data suggests plant extinction is happening as much as 500 times faster than what would be expected normally, if humans weren't around.

Why does plant extinction matter? All life on Earth depends on plants, which provide the oxygen we breathe and the food we eat. Plant extinctions can lead to a whole cascade of extinctions in other organisms that rely on them. "Millions of other species depend on plants for their survival, humans included, so knowing which plants we are losing and from where, will feed back into conservation programmes targeting other organisms as well," explained Dr Eimear Nic Lughadha, scientist at Royal Botanic Gardens, Kew.

What lessons can we learn? The researchers are calling for a number of measures to stop plant extinction:

- Record all the plants across the world
- Support herbaria, which preserve plant specimens for posterity
- Support botanists who carry out vital research
- Teach our children to see and recognise local plants.

The research is published in the journal, Nature Ecology and Evolution.

Helen Briggs, (Source - BBC News, Science & Environment, Jun 11, 2 019)

CONFERENCES

9th Environmental Science and Pollution Control Congress

12-13 October 2020 (Webinar)

E-mail: pollutioncontrol@theexpertsmeet.com

Website: https://pollution.earthscienceconferences.com

10th International Conference on Biodiversity and Conservation

12-13 October, 2020 (Webinar)

Sydney, Australia

Email: biodiversitymeet@expert-meetings.com

Website: https://biodiversity-ecosystem.conferenceseries.com

4th World Congress on Environmental Toxicology

26-27 October, 2020 (Webinar)

Osaka, Japan

E-mail: environmental-health@asiapacificmeets.com

Website: https://environmentalscience.conferenceseries.com

7th Global Summit on Climate Change

18-19 November, 2020 (Webinar)

Lisbon, Portugal

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E-mail: greenenergy@europemeet.com

Website: https://climatechange.global-summit.com

15th International Conference on Biofuels and Bioenergy

23-24 November, 2020 (Webinar)

E-mail biofuels@theannualmeet.com

Website: https://biofuels.insightconferences.com

International Conference on Environmental Toxicology and Public Health

09-10 December, 2020 (Webinar)

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