CGES Newsletter

CLEAN AND GREEN ENVIRONMENTAL SOCIETY

Lucknow (India) Vol. 1 No. 2 January 2017

VISION

Clean and Green Environment for Healthy Life

MISSION

To Strive for A Clean and Healthy World

In This Issue

Clean and Green Environmental Society
Green Villa, 2/111, Vishwas Khand,
Gomti Nagar, Lucknow - 226010,
U.P. (India)
Telephone: +(522) 4006408
Mobile: +91 9415343141
E-mail: cleanandgreenenv@gmail.com
scsharmagardener@gmail.com
www.cgesindia.org

PRESIDENT'S MESSAGE

Dear CGES Fellow Members,

Greetings for the New Year 2017 and the lovely spring season after a chilly winter.

I am delighted to say that the year 2016 was full of meaningful activities of the Clean and Green Environmental Society (CGES). Several quality members have joined our Society from different parts of the country. During the year, CGES has organized several outreach programs, tree plantation in the parks and gardens in Lucknow the Capital City of Uttar Pradesh. Eminent Botanists, Biotechnologists and Environmentalists were invited to deliver lectures on various environmental issues, Impact of climate change on biodiversity, water conservation and food safety. A get-together of the Scientists and Farmers was organized at Tirath Farm, Kursi Road, Lucknow on enhancing the income of marginal farmers by the cultivation of medicinal and aromatic Plants.

CGES celebrated it's first Foundation Day on July 8, 2016. Er.A.P.Mishra, Managing Director, Power Corporation, Uttar Pradesh was the Chief Guest, Padmashri Dr.Mansoor Hasan the Guest of Honour, and Dr.Rakesh Tuli, Senior Research Advisor and J.C.Bose Fellow, Punjab University, Chandigarh was the Guest Speaker. Dr.Tuli gave an overall picture of the ever increasing population and agriculture production in India. He emphasized that the 21st century belongs to Biotechnology a tool for enhancing agriculture production. Designer crops should be evolved to face the challenge of the climate change. On this occasion, CGES released the first issue of the bi-annual Newsletter, which covered articles on urban population and phyto-remediation, green buildings for sustainable environment and many other environmental related issues.

I am grateful to the Advisors, Vice Presidents, Joint Secretaries, Treasurer, Executive Councilors, Media in-charge and Editors, CGES-Newsletter for working as a team to achieve the aims and objectives of the society. I deeply appreciate the contributions of Dr.S.C.Sharma, Secretary General for his commitment to making the CGES a vibrant society in less than two years.

I hope the year 2017 will be fruitful for creating awareness among the masses for saving the environment and making the world a better place to live in.

I wish to appeal to all the members of the CGES for keeping their surroundings clean and green for leading a healthy and happy life. I convey my best wishes to all our esteemed members and well wishers.

Er. Sumer Agarwal
President
Clean and Green Environmental Society
Chairman, LEVANA Group
Lucknow-226 001

CGES Life Members

Ar.Devesh Mani Tripathi, Capt. Sunil Sharma, Dr.(Mrs.) Rajana Seth, Dr.(Mrs.) Rajkumari Khedasana, Dr.Khuraijam Jibankumar Singh, Dr.Pankaj Seth, Dr.Shankar Verma, Dr.V.P.Sharma, Dr.Y.K.Bhoon, Dr.(Mrs.) Anuradha Sharma, Dr.(Mrs.) Sarita Sinha, Dr.A.K.Asthana, Dr.A.K.Singh, Dr.Ashima Singh, Dr.Bajrang Singh, Dr.D.K.Upreti, Dr.Devomallya, Dr.Harsh Singh, Dr.Jagdish Gandhi, Dr.K.P.Singh, Dr.Kamini Narain, Dr.Mansoor Hasan, Dr.Mirdul Kumar Shukla, Dr.Naveen Kumar Arora, Dr.Nitya Anand, Dr.P.V.Sane, Dr.Prabodh Trivedi, Dr.Priyanka Agnihotri, Dr.R.D.Tripathi, Dr.R.P.Bansal, Dr.Rajan Johri, Dr.Ranjeev Kumar Sahu, Dr.Renu Tripathi, Dr.Ritu Trivedi, Dr.S.C.Sharma, Dr.S.R.Singh, Dr.Samir V.Samant, Dr.Sanjay Dwivedi, Dr.Sanjay Kumar, Dr.Seema Mishra, Dr.Smita Kumar, Dr.Suman Upadhyya, Dr.Tariq Husain, Dr.Uma Shankar, Dr.V.P.Kamboj, Dr.Virendra Nath, Er.Umesh Sharma, Er.A.A.Malik, Er.Anil Sharma, Er.K.K.Agarwal, Er.Lalit Kumar Srivastav, Er.M.L.Sharma, Er.M.S.Gulati Er.N.K.Trivedi, Er.Pankaj Kapoor, Er.R.D.Pal, Er.R.K.Pandey, Er.S.P.Kalsi, Er.S.P.Sharma, Er.Sumer Agarwal, Er.Virendra Agarwal, Justice K.L.Sharma, Mr.Barnabas Nongah, Mr.R.K. Mittal, Mr.Raju Chaurasia, Mr.Sunil Sharma, Mr.Udai Pratap Singh, Mr.Anant Jahauri, Mr.Anoop Upadhyaya, Mr.Balbir Agarwal, Mr.Carol Paul Joseph, Mr.Dinesh Kumar Pathak, Mr.Divakar Tripathi, Mr.Ganga Ram Gautam, Mr.Jitendra Mishra, Mr.M.C.Sharma, Mr.Mewa Lal, Mr.Mohd Usama, Mr.Netesh Agrawal, Mr.Pradip Kumar Tiwari, Mr.R.D.Paliwal, Mr.Ram Sagar, Mr.S.C.Shkla, Mr.Sajal Dhar, Mrs.Dola Vasu, Mrs.Farzana Shakeel Ali, Mrs.Geeta Sharma, Mrs.Kusum Sharma, Mrs.Neena Sharma, Mrs.Neeta Chaurasia, Mrs.Parvati Sharama, Mrs.Preeti Arora, Mrs.Pushpa Sharma, Mrs.Ravjeet Sodhi, Mrs.Rita Agarwal, Mrs.Sarita Singh Agarwal, Mrs.Shail Saxena, Mrs.Sheela Singh, Mrs.Shuchi Sharma, Mrs.Sunita Agarwal, Mrs.V. Shukla, Ms.Akrati Upadhya, Ms.Rachna Singh, Ms.Gauri Sharma, Ms.Kanti Srivastava, Ms.Swati Sachdev, Prof.M.A.Khalid, Prof.Ashok Sahni, Prof.C.R.Bhatia, Prof.Jamal Nasrut, Prof.M.M.Sharma, Prof.P.K.Seth, Prof.Pramod Tandon, Prof.R.K.Kohli, Prof.Rakesh Tuli, Prof.Rana Pratap Singh, Prof.Saroj K.Barik, Prof.Yogesh Sharma, Shri Anil Kumar Anand, Shri K.S.Sodhi, Shri L.K.Jhujhunwala, Shri Nitin Mohan, Shri Piyush Yadav, Shri Ravi Kapoor, Shri Tilak Basu, Shri Vasant R.Pusalkar, Smt.Neelam Sharma, Mrs.Shobha Khalid, Mr.Sajal Dhar, Mr.Barnabas Nongah, Dr.Rajesh Bajpai, Dr.J.S.Singh, Dr.(Mrs.)Raj Kumari Singh, Dr.Shankar Verma.

News and Views

Water, food, and energy security with pollution free environment and clean air to breathe are indispensible for good health, happiness and prosperity of the society. The Clean and Green Environment Society (CGES), since its inception just two years back, has made immense contributions towards this goal. First of all, CGES has considerably enhanced the awareness for clean and green environment. Its tree plantation drives in parks and gardens around Lucknow has converted the awareness into action that will make the area green and dark green, as the foliage grows in years to come. All this was possible due to painstaking efforts of Dr.S C.Sharma, the Secretary General, CGES.

I wish that all urban, and rural areas can have replica clones of Dr. Sharma for motivating them to follow the outstanding example of CGES.

My best wishes to all for contributing to more greenery, trees and affluence.

Dr.C.R.Bhatia
FNA, FNAAS, FASC, FTWAS, FMAS
Former Secretary, Dept.of Biotechnology,
Govt. of India, New Delhi, India
E-mail: crbhatia.bhatia@gmail.com

We had known and experienced that environment has a great impact on our health. When weather changes from summer to winter, our body tries to adjust to the big temperature change. During this change in weather we find that complaints of cold and cough generally increase. Old people experience number of lung related problems. Those with arthritis experiences more pain. Not only humans, the change in whole environment is seen. The lovely winter flowers and plants like *Chrysanthemum Coleus*, gladiolas, roses and many more come up and color of leaves of certain plants changes. This all is also experienced when we move from the cold weather to pleasant spring and then to summer.

This natural change in the environment is now being impacted by exploitation of of the natural resources and pollution caused by the man. Thousands of new chemicals are being released in to the environment. These include pesticides used in agriculture and control of vector borne diseases, metals and solvents used in variety of industries and other chemicals and polymers particularly plastics being used in food, automobile, railways and other industries.

The environmental pollution is impacting the health adversely. Lead is reported to lead to deficit in learning and memory in young children, pesticides lead to variety of disorders including cancer and so are the metals. Open burning of leaves, waste material leads to the emission of PAH, PCB etc which are highly injurious to health and are carcinogenic. Recent evidences suggest that these chemicals act at genetic level and interact with the genes thereby influencing the important functions of gene. This leads to variety of changes in the body. Health issues are of much more concern in developing children

in whom vital body functions are still maturing. The chemical induced disorders are often not seen in early part of life but are visible in adult hood when little can be done.

In order to protect the human health from the increasing adverse impact of environmental pollution there is need to create awareness among the public, academia, and the government. The CGES was formed to carry out these tasks with its Vision- **Clean & Green Environment for Healthy Life** and Mission- **To Strive for a Clean and Healthy World**. The society has made a modest beginning and organized important events. The untiring efforts of Dr. S.C. Sharma, Secretary General and Er. Sumer Agarwal, President and other office bearers of the CGES must be appreciated and applauded. The CGES should undertake programs involving the young children and the society in consonance of its goals.

Prof. P.K.Seth
FNA
Senior Advisor Biotech Park, Lucknow
E-mail: pkseth@hotmail.com

Clean and Green Environmental Society (CGES) being a new organization has been focusing to increase its membership in recent years. I congratulate the President, Secretary, and all other functionaries to make it truly a national level organization by inducting members from different parts of the country, particularly during the year 2016. The organization has also been visible through its Lucknow-based action programs such as organizing tree plantation drives and environment-related lectures.

I wish all success to the members of the CGES especially to Dr.S.C.Sharma, Secretary General, CGES for his untiring efforts in making a vibrant Society.

Prof.S.K. Barik
Director
CSIR-National Botanical Research Institute,
Lucknow (U.P.), India-226 001

In becoming members of CGES, the distinguished members of the Society have accepted to contribute their small bit, to the millennium development goals, agreed at the UN Millennium Summit held in 2000. These goals are functioning as important guidelines for policy coherence among some 200 signatories of the eight MDGs. CGES, very thoughtfully has been focussing on important issues, like sustainability of water, air, energy, health and food. The Society chose to highlight one of the MDGs, that is, "Ensuring Environmental Sustainability" through community action at its first Foundation Day meeting held on July 8, 2016. Members of CGES have been going through a transformative personal journey as they move into their silver years. They have been experiencing some of the happiest cities in the country, like Lucknow and Chandigarh and have visited some of the most environmentally conscientious countries globally. In creating a cleaner and greener environment, Chandigarh has been remarkably successful. Discussions at the Foundation Day addressed some of the agricultural concerns arising out of climate change.

Global climate change is an accepted reality. The climatic shifts are feared to have negative impact on future agriculture, and health of man and livestock. Through the last 1000 years, and more, present day cultivated plant species have been selected and improved to develop varieties with higher yields and economic value. During the selection process, the parameters used were designed under nursed optimal conditions of soil and environment. In such selection processes, an enormous amount of diversity present in nature has been lost or set aside. Currently used crops and varieties are not resilient to biotic and abiotic stresses faced in the field. These are not necessarily the nutritionally best foods for man. These may not be able to stand the changing climatic conditions of higher temperature, lower water availability, higher carbon di-oxide, unpredictable submergence and several other biotic (microbes, pests and ecosystems) factors that may change in the coming decades. An important question being faced by plant scientists is: can we prepare in time to mitigate the feared loss to crop productivity and nutrition?

The discussions during the Foundation Day meeting examined how human ingenuity has no boundaries to addressing the critical issue of climate change and its worrying effects on natural resources and biodiversity. Important challenges lie ahead for refining and applying the new technologies, and deciding in which form and with what ethical limits, these should be used for evolving happier and healthier lives. It may even be possible to design plants that may use the changed climatic conditions favourably to enhance crop productivity! This requires a high order of collaboration and creativity among a number of stakeholders, including natural and social scientists, engineers, entrepreneurs, investors, communities, thinkers and policy makers. CGES may hope to prepare some advisory notes for consideration by public organizations, corporate bodies, communities and individuals. We can team up with industry, institutes and government organizations engaged in teaching, research, nature conservation, community planning, policy development, skill development etc. and catalyze substantive actions in specific areas. CGES has a great responsibility in bringing together such stakeholders and spreading awareness about working for a national ecosystem required to ensure a happier future for mankind.

Prof. Rakesh Tuli
Former Executive Director NABI Mohali
(Punjab)
Senior Research Advisor UIET
Punjab University Chandigarh

The young Society, less than 2 years old, has met often and carried out some environment related programmes particularly Tree Plantations on many occasions that certainly command appreciation. I am sure in future also such programmes will be continued. The Society needs to do something on the 'Clean' aspect also. May be hold a brain storming and plan what can be done. I am sure there are several Societies of the kind we have in Lucknow that wish to improve the environment. Do we have a list of such societies? If not could we make such a list? May be one of these days we should hold a meeting of the Secretaries and Presidents of these group of Societies and find out if together we could do better than individually. No matter how much enthusiasm the Societies have nothing can be done unless there are enough funds available for carrying out activities. While the Societies do not get enough funds the Govt has under its different programmes, including Swatch Bharat, plenty of funds that remain unutilized. I am wondering if Societies like ours could join hands and attempt to get a slice of such funds to undertake specific work. Govt agencies do the job as their duties. Govt certainly needs help in implementing their projects and societies, like ours could provide such help selflessly.
With my best wishes.

Dr. P. V. Sane
FNA
Former Director,
CSIR-National Botanical Research Institute
Lucknow (U.P.), India-226 001

Cycads are contemporary to Dinosaurs in the Jurassic era (150-200 million years back) and known as the living fossils. Due to the climatic change, Dinosaurs have disappeared but Cycads remain unaffected and adapted to the environmental changes. Cycads are eaten as food in the countries where they grow naturally. They are nitrogen fixers in the soils as they have specialized coralloid roots, which are associated with nitrogen fixing Cyanobacteria. Some species are also used in the traditional medicines. Cycads also serve as air purifier and absorb greenhouse gases. Some species are consumed as food by the wild animals. Most of the Cycad species are used as ornamental plants and preferred for outdoor and indoor landscaping. Leaves of *Cycas revoluta* are widely used in the floral arrangements. *Cycas revoluta* is the most common one, which is known as Sago Palm as well as easy to cultivate. Cycads are classified in the Red Data Book as the rare, endangered and threatened species (RET species). They are considered as the most threatened group of organism on the planet. If we want to save the RET species, we should multiply them, rehabilitate and put into the horticulture trade in order to reduce the ensure on natural populations.

Dr. JS Khuraijam,
Scientist Fellow,
CSIR-National Botanical Research Institute
Lucknow (U.P.), India-226 001
E-mail: jskhuraijam@yahoo.com

In context to the current situation of the environment and its restoration, Clean and Green Environmental Society (CGES) with its eminent team of environmentalist, ecologist and professionals is doing exceedingly well. CGES is engaged in all aspects of the discipline, from field work to environmental policy, conservation of the rare, endangered and threatened (RET) plant species. Society has organized several programs and events since its formulation on July 8, 2015. CGES is committed to bring the awareness for saving the environment among the masses. CGES is managing its activities with the limited resources by enrolling quality members in the private, public and individuals. The effort of the society for the plantation drives in and around Lucknow is highly commendable.

Dr. Sanjay Dwivedi
Sr. Technical Officer
Plant Ecology and Environmental Science Division
CSIR-National Botanical Research Institute
Lucknow (U.P.), India-226 001

The climate change due to pollution, is one of the serious global threats in the future. The global average temperature has increased by approximately 0.8 °C during the last 5–6 decades. Combustion of fossil fuels, emissions of halocarbons and other green-house gases, deforestation, land-cover change has contributed in global warming. A drastic increase in CO_2 concentration during second half of the last century has caused shrinking and shifting of habitats, change in communities, extinction of species and physiological and behavioral changes in biota. Climatic fluctuations largely affect species turnover and cause major shifts of terrestrial ecosystem. In Northeast, during past five decades, the drastic increase in anthropogenic pollution, decrease in precipitation and variation in temperature has resulted in significant change in lichen community structure. The Usneoid and Pertusorioid communities has increased, while Physcioid and Cyanophycean has decreased, drastically. Lobarian abolished from the study area and Calcicoid has been introduced in the recent past. Probably post-industrial revolution, the abrupt changes in the environment has influenced CO_2 diffusion and/C fixation of lower plants either as an adaptation strategy or due to toxicity of pollutants.

Dr. Seema Mishra
Plant Ecology and Environmental Science Division
CSIR-National Botanical Research Institute
Lucknow (U.P.), India-226 001

Life cannot be clean and green after exceeding the carrying capacity

C. R. Bhatia

All members of CGES aspire for a stress-free life in clean and green environment for everyone. Ecologist define carrying capacity (CC) of the ecosystem as the population of humans and animals that can be sustained, based on the primary productivity of plants with the available resources – soil, water, energy and environment without damaging the resource base. Others identify CC as the maximum number of individuals of a species that can be supported on a sustainable basis. A more detailed definition is the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a region without progressively impairing productivity and ecological integrity. CC is not a static number and land productivity can be enhanced by inputs of water, energy and plant nutrients, crop genotypes grown and advanced technologies. It provides physical limits for maximum rate of resource consumption and waste generation. Estimations of human CC are not easy due to a large number of variables involved, and inconsistent use of resources by individuals. CC is determined by the primary productivity of crops. The global CC increased when humans shifted from nomadic hunters and food gathers to cultivation of crops. Yet another increase of global CC came with the chemical fixation of atmospheric nitrogen into synthetic fertilizers. The green revolution technology based on semi-dwarf genotypes of wheat and rice, high inputs of chemical fertilizers, and pesticides made it possible in India and elsewhere to produce enough food for increasing population.

All manmade things are designed for a specified CC; cars, boats, trains, ships, aero planes for conveyance and elevators for vertical transport. So are the roads, housing and bridges. Overloading these increases discomfort for the occupants and enhances risk. On exceeding the designed CC, boats sink, planes fail to take off, bridges collapse and elevators start beeping, and do not budge. Movement of vehicles on the road slows down when they exceed the designed CC. People drop off from the overcrowded trains, as in Mumbai locals where I live. Humans and animal face similar fate in natural systems when their numbers exceed the CC. Availability of water and food are the main determinants of CC in nature. In the past, though the population was much lower, famines were frequent in the Indian subcontinent. Import of food from distant places, rationing, and public distribution system has prevented such famines in independent India, since the Bengal famine of 1943 where estimated human deaths range between 1.2 to 4 million. With advances in crop production technology, the same area is currently supporting 1.2 billion population. Natural resources that determine food production are availability of land /soil, water and other inputs like energy, seeds and fertilizers.

Land

Land area is finite and limited; per capita availability has fallen drastically from 0.91 ha. in 1951 to about 0.42 ha. in 2001. It is projected to decline further to 0.08 ha. by 2050. Land under cultivation can be increased only by cutting down of the natural forests. Indian soils have low organic matter and poor fertility. Land degradation is high due to the current cultivation practices. Loss of prime crop land to competitive demand for housing, schools, recreation, industries and transport can be seen around all major urban centers. Housing has grown vertically in most urban areas, as compared to single houses in the past. Will farming also go vertical in future to overcome the shortage of land? It is likely for local production of green salads, tomatoes and strawberries grown under hydroponics or aeroponics with LED lights in vertical farms.

Water

Water in the atmosphere, surface, soil and ground essentially constitutes a single interconnected resource. Per capita availability of water is going down. Competitive demands for water for non-agricultural uses are increasing. It is estimated that the demand would grow to nearly 1.5 trillion m^3, driven by rice, sugarcane and wheat. The current supply is approximately 740 billion m^3. With increase in demand, the cost is likely to go up. Exploitation of ground water has reached critical levels in many districts. There is growing consensus among the water experts that the current water resource development and management is not sustainable. Water may not be a constraint if cheap energy is available for desalinization of sea water, and transport of fresh water. Use of conservation agriculture, drip and sprinkler irrigation can reduce the water requirements.

Energy

Agricultural production and productivity are closely linked to energy inputs. Manufacturing of fertilizers, pesticides; irrigation, farm operations and transport all need energy. Current agricultural practices are increasingly dependent on inputs of commercial energy derived either from coal or fossil fuels. It is said that modern farming is conversion of fossil fuels into food. Current per capita consumption of electricity is 704 kWh in India, as compared to 11,218 in Australia, and 13, 616 in USA. Currently there is deficit of about % in demand and supply of electricity in the country, besides the erratic supply.

Future outlook

Conversion of land area from food crops to bio-energy

crops, and climate changes are additional threats for the food production. Anticipated changes in climate, rise in temperature, erratic rains and prolonged periods of drought are like to reduce productivity of good crops, further reducing CC. At the same time, technological development can enhance CC, as in the past. Reducing the demand for food, including wastage by reducing consumption and wastage can be helpful in short term. Negative population growth is the only lasting solution. Imagine, if the country can go back to the population of 340 million at the time of independence in 1947, with the food production, per capita income, health care and educational opportunities in 2015; all social statistics would improve. everyone will have enough. Negative population growth is the only solution to live within the CC, and reach the vision of CGES.

Dr. C. R. Bhatia
17 Rohini, Plot No. 29-30, Sector 9-A, Vashi,
New Mumbai – 400 703, India
E-mail: crbhatia.bhatia@gmail.com

Environment impact on human health: the cancer

Rajni Shukla and Yogesh Kumar Sharma

Environment is the surrounding in which all the plants, animals and human beings live. There are two types of environment called- natural environment and built environment. The natural environment exists naturally, and the built environment is that for which man is responsible such as cities etc. Natural environment on this planet provides a favourable required conditions and supports the existence and growth of various forms of life. Natural environment automatically gets disturbed and both hugely affect the human health together. A balanced natural cycle exists between environment and human beings, plants and animals. Human society is playing vital role in degenerating the natural environment which in turn negatively affects the lives on this planet.

Some of the environmental problems are rapid growth in world population, deteriorating natural resources, diminishing forests and wetlands, erosion of soil and coral reefs, depleting underground water, regular shortage of fresh drinking water, vanishing plants, salinization etc. Some other issues are loss of biodiversity, rapid extinction of some important animal species, collapse of fisheries, rising air and water pollution, rise in atmospheric temperature, thinning of ozone layer, spoiling rivers, seas and underground resources. Many of the human activities like deforestation, industrialization, technological improvements and so many others are leading our environment towards danger and keeping lives at risk by influencing the growth, development and survival of all organisms. Various types of environmental changes are disturbing the ecosystem and causing variety of health hazards to the human beings and animals. The environmental consequences of global warming, will probably affect through famine, or war long before the health of the population by a serious temperature change. However increasing extremes of temperature, as a result of climatic change, could result in increased mortality even in temperate climates. A gradual increase in accumulation of heavy metals in soil of many agricultural fields owing to the discharge of industrial and municipal residual wastes, has caused a serious problem to the crop production and hazards to human and animal health.

Environmental factors affect human health in important ways, both positive and negative. Positive environmental factors sustain health, and promoting them is preventive medicine. They include: sources of nutrition (farming: soil quality, water availability, biodiversity/bio-integrity, genetically modified organisms; hunting, fishing: wildlife, fish populations.), water (drinking, cooking; cleaning / sanitation); air quality; ozone layer (protection from UV etc); space for exercise and recreation; sanitation / waste recycling and disposal.

Negative environmental factors are threats to health, they include: environmental conditions favouring disease vectors (endemic and exotic vectors); invasive biota (viruses, bacteria, etc), their hosts and vectors; environmental disruptions: floods, droughts, storms, fires, earthquakes, volcanoes; air quality: pollen and pollution leading to respiratory diseases or cancers; water quality: biotic and abiotic contaminants; integrity of water transport and treatment infrastructure; poor monitoring and management of municipal, agricultural, industrial outflows to the environment (gases, liquids, solid wastes); human changes of the environment that create conditions which favour disease; disruption caused by other war etc.

Cancer is one of the major causes of deaths worldwide. Other than skin, prostate cancer is the most common non-skin malignancy and the second leading cause of cancer death in men in developed countries. Breast cancer is the most commonly diagnosed invasive malignancy and a leading cause (after lung cancer) of cancer deaths in women in developed countries. Normal mammalian cells maintain genomic integrity through controls that regulate their ability to progress through the cell cycle when they encounter the environmental stress. When these controls are deranged, the result is

genomic instability resulting into various diseases like cancer etc. Climate can have a huge impact on an individual's health. A prime example of this would-be Australia having such a high rate of skin cancer such as melanoma, and of cataract because of the harmful effects of the ultraviolet (UV) radiation from the sun. Different countries have their own set of health problems due to their location. Some pollutants such as chlorofluorocarbons (CFCs) used as refrigerants or in aerosol propellants or in the manufacture of certain plastics are damaging the "ozone layer" in the higher atmosphere (stratosphere) and thus allowing more UV light to reach us, and harm us directly. Radon gas arising from certain rock types beneath dwellings also contribute to cancer risk. The explanation for leukaemia clusters around nuclear power plants is also reported. Similar clustering can occur in other parts of the country too. Some cancer rate statistics according to the Cancer Prevention Coalition are :

- Cancer incidence rates have risen an overall total of 60%
- Non-Hodgkin's lymphoma has increased nearly 100%
- Brain cancer up 80-90%
- Breast cancer up 60%
- Testicular cancer up 300%
- Childhood cancers up 40-50%
- Cancer rates are estimated to double by 2050

Childhood leukaemia has been linked to electrical wiring, spray paint, dyes, household pesticides, and incense, as well as vehicle exhaust, insecticides, and nitrites, such as those found in processed meats. Many cancers have been linked to pesticides, chemical cleaners, and plastics. Breast cancer has been linked to underarm shaving and antiperspirant use, a decrease in the occurrence and duration of breastfeeding, synthetic hormones found in food production and pharmaceuticals, and various other environmental factors. Processed foods have been linked to food allergies, childhood obesity, and childhood leukaemia. The pesticides, herbicides and fertilizers used in modern farming have been shown to contribute to water, land and air pollution, childhood leukaemia, various type of cancers, and infertility, just to name a few.

The ever changing (negatively) environment is the issue of whole human fraternity because we all are the reason of this negatively declining environment so we all are responsible to save our natural environment for the healthy survival of life on the earth. If human s health is to be improved, all of the environmental factors affecting their health must be addressed, and not just their immediate medical problems. It's difficult to watch the damage done to the environment affecting human health and not feel spurred to change. But many people still fail to see the correlation between their actions and its effects on us, due to denial or simple unawareness of our relationship with the natural world.

Illiteracy is also a problem which has complex dimensions attached to it as it is more or less concerned with different forms of disparities that exist around us. Each and every contribution by a literate person can make a contribution to eradicate the menace of environment. A focus on soil/water/air -plant-animal-human continuum will certainly identify that where the problem exists? To run the life in healthy happy way, we all need a healthy and natural environment hence it is our responsibility to save our environment and earth and make the possibility of healthy and happy life here.

Rajni Shukla and Yogesh Kumar Sharma
Department of Botany, University of Lucknow,
Lucknow - 226 007, India

Economically important medicinal plants

A.K. Singh

Over exploitation of the natural flora has created an alarming situation of biodiversity loss and endangerment to many important medicinal plants. The situation demands urgent attention towards strategy formulation to enrich the medicinal plants wealth through cultivation and sustainable utilization of major medicinal and aromatic plants. These plants can easily be cultivated integrated in the existing cropping system by the farmers. Besides this, majority of these plants can also be grown in poor, less fertile and different categories of wastelands and can withstand the adverse climatic conditions which quite often are detrimental to the cereal and vegetable crops. Under such circumstances, medicinal plants may ensure some return to the farmers. These crops are reported to be least or almost not affected by the plant diseases or wild animals. In the present article, effort has been made to provide brief information on some of the major economically important medicinal plants and estimated income that can be obtained through cultivation of these crops.

Ashwagandha (*Withania somnifera*)

Asgandh or Aswagandha *(Withania somnifera*) is an important medicinal plant whose roots have been employed in Indian traditional system of medicines, Ayurveda and Unani. This shrubby bush plant grows well in dry and subtropical regions. Therefore, ashwagandha

is a potential cash crop for greening the dry land zones, making productive and beautifying the wasteland. It is cultivated in about 5000 hectares area in north western region of Madhya Pradesh on marginal land in and around Mandsaur district of Madhya Pradesh in Manasa, Neemuch, Jawad and Bhanpura.

It is also grown in adjoining villages of Kota, Jaipur and Jodhpur districts of Rajasthan and Jammu forest. One hectare plantation of Ashwagandha yields on an average 8-10 quintals of dried roots which are sold at about Rs 10,000 per quintal giving a net return of about Rs 75,000 from a 5-6 months crop. CSIR-CIMAP's initiatives in popularizing this important crop in Ananthapur district of Andhra Pradesh have shown a new hope of agri-economic development in otherwise dry land area. Variety 'Poshita' developed by CIMAP is presently grown in about 3 000 hectares of land due to the continued efforts made by CIMAP Research Centre, Hyderabad under the institute's ongoing rural development programme. The State Medicinal Plants Board of Andhra Pradesh has also supported the project which enabled the farmers under the technical guidance of CIMAP to produce and distribute approximately 3000 kilogram seeds which will further facilitate the expansion of the crop and subsequent raising of income of the growers. Another Ashwagandha variety NMITLI – 118 was developed jointly by CIMAP and NBRI and released in September-2009. The variety has uniform crop canopy, non-spreading plant architecture (more plant / unit area), high root yield and high withanolide yield per unit biomass, phytochemically uniform and is the first pharmacologically validated variety. It has Withanolide A and Withanone in roots and high content of Withaferin A (up to 2 %) and no Withanone in leaves. The variety is reported to give root yield (dry weight) of about 15 quintals / hectare. Another variety of Ashwagandha named NMITLI-101 was also released in 2015 which has potential to yield about 25 quintals dry roots under optimal agronomic conditions.

Sarpagandha (*Rauvolfia serpentina*)

Rauvolfia serpentina roots, commonly known as serpentine roots or sarpgandha, are one of the most important drugs used in traditional as well as in modern system of medicine. It is a drug for various types of ailments, ranging from disorders of central nervous system, such as maniacal behavior, insanity, epilepsy and insomnia to intestinal disorders. Whereas, in modern system, it is used as antihypertensive and sedative drug. It is an erect, evergreen 0.60 to 1.0-meter-high, shrub and grows in Indian sub-continent, Sri Lanka, Thailand and Indonesia. It is generally collected from wild. Its cultivation is on the limited scale and is currently being promoted by different organizations / institutes as the plant has become rare in most of the accessible areas of its natural occurrence due to over exploitation. To facilitate the quality production of this plant, CIMAP has developed an improved variety 'CIM-Sheel' along with agro-technology which are being popularized presently through regular training programmes conducted by the institute.

The plants raised from seeds give better yield of roots ranging from 100 gm to 400 gm per plant. It is estimated that with a spacing of 60 cm x 30 cm and survival of 80 percent, the yield of roots per hectare from seed raised plants found to be about 1,175 kg (dry basis). Average root yield/ ha under irrigated condition from 2- year old plantation is about 1200-1500 kg. Roots sell at about Rs. 150 per kg, so a grower may get a net return of Rs. 1,50,000 from one hectare.

Kalmegh (*Andrographis paniculata*)

Kalmegh is an important medicinal plant which is employed in Indian traditional system of medicine mostly to cure liver disorders. It is widely distributed throughout the plains of India from Uttar Pradesh to Assam, Madhya Pradesh, Jammu, Tamilnadu, Kerala, Orrisa etc. Its whole herb is used as medicine. Its major bitter principle is andrographolide used in bitter tonic. The whole plant has astringent, anodyne, antipyretic, anti-inflammatory, immunosuppressive and anthelmintic properties. Recently, its cultivation has been started in India due to efforts made by CIMAP and other organizations. Considering its pharmaceutical potential, there is need to increase its large scale systematic cultivation in India. CIMAP has developed a high yielding variety 'CIM-Megha' and released to the farmers for cultivation. A well-maintained crop grown in one hectare area during monsoon season yield 2.5 to 3.0 tonnes of dried herb giving a net income of about Rs. 45,000 from about 3-month crop.

Satavar (*Asparagus racemosus*)

Asparagus racemosus, popularly known as Sataver, is an indigenous medicinal plant used in Siddha and Homeopathic medicines. Sataver roots are used mainly as lactogogue which promotes secretion of breast milk. It is useful in improving the body weight and is also considered as an aphrodisiac. In general, it helps to maintain the health by providing immunity to diseases. The demand for Sataver roots are on the increase and destructive nature to harvesting the whole plant has resulted in shrinking of natural population. It is estimated that in India, more than 500 tonnes of Sataver roots are required every year for medicinal preparations. CIMAP is promoting cultivation of Sataver by providing seeds /saplings of the improved variety 'CIM-Shakti' developed recently. It takes about 18-20 months for the crop to mature. However, better yield can be obtained after two years of planting. The crop should be harvested during October and December (dormancy period). On an average, 5 to 6 tonnes of dried root may be obtained from one hectare giving a net profit of about Rs 350,000 from two years crop.

***Artemisia annua (*Quinghao)**

Artemisinin, derived from the plant *Artemisia annua* (commonly known as Quinghao), is the only cure from chloroquine resistant *Plasmodium falciparum*. The demand of this drug is on the rise due to World Health Organization (WHO) approving artemisinin combination therapy (ACT) for the treatment of cerebral malaria. CIMAP has developed agro-technology of this plant and genetically tagged superior varieties like 'Jeevan Raksha' and 'CIM-Arogya' producing significantly higher yields of artemisinin (about 1%). Another improved plant variety named 'CIM-Sanjeevni' possessing about 1.2% artemisinin has also been released in the year 2016.

The manufactures of artemisinin derivative of the drug have been importing artemisinin from international sources but the non-availability of sufficient raw material has forced Indian industry to depend on cultivation of this crop indigenously for self-reliance. Looking at the high artemisinin content in the Indian variety of *Artemisia annua* developed by CIMAP, the crop can be promoted by the pharma companies in the near future. The IPCA Laboratory, Ratlam, Madhya Pradesh has organized contractual cultivation of CIMAP variety involving farmers of Uttar Pradesh and Uttarakhand.

Isabgol *(Plantago ovata)*:

Isabgol or psyllium is important for its seeds and husk which have been used as laxative, particulary beneficial in habitual constipation, chronic diarrhoea and dysentry for centuries all over the world. India continues to rank first in its production and trade in the world market. It is also the sole exporter of isabgol to the world market about 80-90 percent produce is exported. The export of husk and seed is valued at Rs 4650 and 6120 million. Thus, it is the first ranking foreign exchange earner crop among medicinal plants. Isabgol can be grown on variety of well-drained soil. It however, does well on light well drained sandy-loam to rich loamy soils of pH about 7.2 to 7.9. It thrives well in warm temperate regions. In India, the crop is grown in winter. In general, cool and dry weather is favourable to the crop. During the Rabi crop season the land is ploughed, harrowed and brought to a fine tilth. The land is laid in to flat beds of convenient size i.e. 6.0m x 3.0 m depending upon the source of irrigation. Light irrigation of field is essential before sowing of seeds. Very few varieties are available for commercial cultivation, i.e. Gujarat isabgol 1 and 2, H1-5 for only Gujarat, Rajasthan and adjoining areas. For north Indian conditions, one variety Niharika was developed and released by CSIR-CIMAP. One ha crop may yield about 10-12 quintals of seeds giving a net profit of about Rs 40,000 from 4-5 months crop.

Senna (*Cassia angustifolia*)

Leaves and Pods from *Cassia angustifolia* and *Cassia acutifolia* are the commercial Senna drug of the Unani system of medicine. Both the species-*Cassia angustifolia*, (native of south Arabia, West Asia) and *Cassia acutifolia* (Sudan, East Africa) are exotic to India. In their native lands, these species grow on arid tracts as perennial bushes. However, these are maintained as annual herb when cultivated. Now both the species are commonly known as *Cassia senna*. Although most plant parts contain sennosides (glycosides) but leaves and pod shells contain highest concentration described as sennosides A, B, C, and D. Of the two parts pods contain higher percentage of total sennosides (3-5 percent) than of foliage (2.5-4 percent). Demand for leaves is higher for use in herbal tea, bakery products, and other home preparations in West and Central Europe. The UK and USA have preference for pods. It is used as laxative. Indian pharmaceutical industry uses about 100 tons of leaves & pods. The total world requirement is about 10,000 tons of leaves & pods. India is the major exporter and exports upto 5000 tons worth Rs 20 crores every year.

Senna grows well on sandy loam and laterite soils with low to moderate fertility and pH ranging from 7.0 to 8.5. Dry summer with moderate temperature is the actual requirement of the crop. Fall in temperature, rain and water logging conditions are injurious to the plant. It is a 130-150 days summer crop in Northern India where as winter crop in Southern India. CSIR-CIMAP's variety Sona has become popular among the farmers of Rajasthan which covers huge area under cultivation at present. It has been observed that younger leaves and pods contain high sennoside content. To obtain desired level of biomass, first picking should be done between 70 to 90 days when sennoside content is optimum. The picking is done by hand so that most of the growing tops are removed to induce further better leafty growth and delay the flowering. Second picking can be done between 90-110 days and 3rd between 130-150 days when entire plants are harvested to include both leaves and pods together. One ha plantation of senna can give a net profit of about Rs.27000-30000.

Aloe (*Aloe vera*):

Commonly known as Ghrit Kumari or Ghikwar, Aloe is a native of north Africa but is found abundantly throughout the world. *Aloe vera* is a plant of great potential and of immense value in the field of therapeutics, pharmaceuticals and cosmetic industries. It is used in indigenous, Unani system of medicine and in cosmetics, shampoos and anti-dandruff creams, etc. *Aloe* is particularly useful in the treatment of burns, blood disorders, skin diseases, etc. *Aloe vera* can be grown on a variety of soils. It however, does well on light well drained- coarse sandy loam to rich loamy soils. It is considered as one of the best suitable crops for marginal lands particularly coarse sandy, un - irrigated, sloppy and stony soils. The water logging should be avoided for *Aloe* crops. *Aloe* flourishes in a variety of climates ranging

warm temperate to semiarid sub-tropical regions but needs protection from frost. In India, the crop can be grown in any season. In general, hot and dry weather is favorable to the crop. CSIR-CIMAP has developed 'CIM Sheetal' variety and released to the farmers. On an average about 50 tonnes of leaves can be obtained from one ha crop of aloe giving a net return of about Rs. 1,25,000. The cultivation should be promoted only when processing units for aloe are located in the vicinity so that the fresh leaves can be sold for making sap, juice or gel.

Dr. A.K. Singh
Former Chief Scientist,
CSIR-CIMAP, Lucknow-226007, India
E-mail: ak.singh391@gmail.com

Plastics and Agriculture: Changing Dynamics with Environmental Needs

V.P. Sharma

Plastics products have permeated into the entire spectrum of consumer items and cover every sphere of life like clothing, housing, construction, furniture, automobiles, household items, agriculture, horticulture, irrigation, packaging, bio-medical, electronics, electrical etc. Approximately 35 % of the food products produced in India are wasted due to deficient infrastructure and insufficient or lack of food processing capabilities. The plastic industrialists face comments from environmentalists due to non-degradability of synthetic moieties and issues related to environmental sustainability. The recycling, recovering and reuse of plastics may be a vital step towards fostering innovation and sustainability. Infact, plastics may serve as a boon or bane depending on our usage, disposal pattern, sustainability approaches and perception. Plastics find applications in packaging which protects the longevity and quality of food. This sector also offers significant potential for growth leading to increase in demand for plastics. Thus, there are few advantages and disadvantages of plastics and polymeric products. We need to proceed with a caution and prevent injudicious usage.

Considering, the use of plastic in the modern agriculture set up, its dependence is seen in terms of wide spectrum of polymeric products ranging from irrigation systems through greenhouse technologies, protective nets, soil covers, animal husbandry, food packaging, and transportation of value added products to consumers in attractive containers with publicity materials and branding. India is a vast country and every region has its specific agricultural characteristics and issues. The area specific issues may be solved with innovative and scientific use of plasticulture techniques. Plasticulture provides variety of applications in modern agriculture and promises to dynamically change agricultural practices in the future. Both the quality and the quantity of the crops and other farm products can be optimized using various techniques. This would not only maximize the output of farms but also optimizes the input factors. The level of sophistication production and usage of plastics in agriculture are increasing multifold with scientific progress made during the last several decades. Globally, the innovations in plasticulture are translated into practices that support agriculture for improving the production, quality and safety of food items. Due efforts are needed in adoption and propagating advanced plasticulture approaches in progressive countries. The innovative products are targeted towards different types of growers, from large corporate to the small agriculturists. The increased awareness of the environment and improving quality of life has led to market demands for eco-friendly agriculture. Plasticulture is developing for substituting harmful chemicals, degradable products and plastics recycling. The ever-increasing use of plastics in agriculture has helped farmers increase crop production, improve food quality and reduce the ecological footprint of their activity. Several varieties of plants which are grown in semi natural environments under simulated conditions are usually of better quality than those grown in an open field.

Variety of plastics are used in agriculture viz polyolefin, polyethylene (PE), Polypropylene (PP), Ethylene-Vinyl Acetate Copolymer (EVA), Poly-vinyl chloride (PVC) and, in less frequently, Polycarbonate (PC) and poly-methyl-methacrylate (PMMA). These plastics provide:

- **Innovative and Sustainable Solutions**: The plastic irrigation pipes and devices prevent waste of water and nutrients, rain water may be retained in reservoirs built with plastics and the use of agrochemicals may be reduced by keeping crops in a closed space such as a greenhouse or, for mulching, under a plastic film. Further, the spray or emissions of agrochemicals in the atmosphere will be reduced as they will remain fixed on the plastic cover.
- **Recycling/Recovery/Reuse Opportunities**: Agricultural plastics viz greenhouse covers, other sheets may be recycled. After retrieving from the fields, plastics may be systematically washed to eliminate sand, herbs and agrochemicals prior to being grinded and extruded into pellets. The material may be used again in the manufacturing of articles such as outdoor furniture. In case where recycling is not feasible the energy may be obtained from agricultural plastic waste in a process called co-combustion or other state of art technologies.

Waste to Wealth

Waste may be converted into wealth with attractive modes or styles of presentation. The growth in the productivity with green revolution has been slow in recent years and resulting in a decline in the income of farmers. There have also been negative environmental effects in the form of depleting water table, emission of greenhouse gases, and the contamination of surface and ground water. Rapid policy interventions are required to protect the interests of stakeholders and farmers. Internationally, BASF and other National/International recognized organizations are working closely with customers on testing formulations prior to production scale-up to further improve the durability of plastic materials and develop innovative and sustainable solutions. There are few leading suppliers of plastic additives with more than several decades of experience. Comprehensive and innovative product portfolio includes stabilizers which provide ease in processing, heat and light resistance to a variety of polymers and applications including molded articles, films, fibers, sheets and extruded profiles. The conventional plastic materials used for agriculture applications have not only benefits derived from their use, but also a number of serious associated problems.

Disposal of Plastics and Recycling

After use, plastics need to be disposed in landfills where they will remain unchanged for a long time. Some ways of disposing of used conventional plastics by recycling and composting were proposed. Incineration may lead to release of toxic gases depending on composition. Recycling of plastic materials wastes is applicable for a limited number of plastics, while composting is the most desirable solution. Biopolymers may degrade entirely and safely in the composting environment and they represent a viable alternative to common plastic materials. Materials based on polylactic acid (PLA) have drawn much attention in recent R & D due to the biodegradable nature. These materials are suitable both for high performance applications as well as for traditional commodity uses. Some applications include food containers, soil retention sheeting, agriculture film, waste bags and the packaging material in general. The advanced agriculture sector is based on a competitive, focused toward market policy, aiming to fulfill also other public concerns, such as protecting the environment. Agriculture generates a considerable amount of waste from plastics, estimated at 10% of the total plastic weight in landfills. In this context, the development of biodegradable products for agriculture use is consequently an important point to reduce the environmental impact of cultivated land. In agricultural field, biodegradable polymers are also widely used for many applications. The updated national regulatory guidelines need to be followed for effective implementation.

Bio-based composites e.g. Poly Lactic Acid [PLA], Poly Hydroxy Alkanoate [PHAs] and wood fibers are designed to produce tomatoes yarns and transplanting pots. Since all components are biodegradable, composites are also expected to be biodegradable. Modern culture systems are particularly important in tomato production to reduce disease problems and fruit rotting. In spite of the associated labor and material costs for training tomatoes, the benefits of increased air circulation and reduced contact with the soil are significant. Biodegradable plant pots are known in the nursery and greenhouse industry. They are used in growing seedlings, which are transplanted into the ground after the seedling attains maturity. The advantage of a biodegradable plant pot is that they may be planted along with the growing medium and the seedling, without impeding the root development of the seedling, as the biodegradable plant pot breaks down and degrades after being planted in the soil. The major barrier is the scarcity of two major resources for agriculture – cultivable land and water. Commonly, households and establishments discard away the waste on the street or dump it in open without segregating the waste which reduces the quality and at times could make it hazardous. It is essential to save the recyclable waste material from going to the waste processing and disposal sites and using up landfill space. The ideal method for energy recovery may be by forming a habit of keeping recyclable waste material separate from food waste and other bio-degradable wastes at the source of waste generation, by having a two-bin or colored bin/ identifiable container system for storage of waste at homes, shops and establishments where the domestic food waste goes into the municipal solid waste collection system and recyclable waste may be handed over to the waste collectors (rag-pickers) at the doorstep for transporting the same to the recyclers. While plastic mulch provides important benefits of increasing crop productivity and water conservation, its disposal presents a serious challenge for farmers. Extensive research and innovation are needed to provide farmers with sustainable disposal alternatives as well as appropriate suitable biodegradable alternatives to plastic mulch. Plastic films may be used in soil fumigation to control fumigant emission into the atmosphere. The ways to make recycling viable and economical for the farmers using these materials need to be found. The barriers for effective management LDPE agricultural plastic film need to be eliminated. This includes finding cost-effective ways to conveniently collect, clean, and store the materials, and finding end markets for the recycled product.

The major barriers in impeding farm productivity are the lack of new technologies and major breakthroughs. There is a lack of interest of students in pursuing research in agriculture. The significant application of plastics is in food processing and packaging. It is a material of choice due its characteristics and versatility of applications. It is light weight, corrosion

resistance, moisture proof, highly versatile and can be moulded into attractive shapes. Additionally, packaging standards have become more stringent with introduction of new Indian norm closer to global standards which are also driving the use of plastics in packaging. It is anticipated that with rising income, consumer preference for packaged products and changing food habits the food processing industry and the use of plastics may grow at a faster pace than expected. The macroeconomic trends, variability, increasing urbanization, changing lifestyle and demographic dividend are other factors promoting the opportunity of downstream plastics especially in northern and eastern India. The safe and quality food, agricultural products are now a day innovatively packed for supply to personnel at national boundaries.

Plasticulture applications are offering multitude of benefits which result in moisture conservation, water saving, reduction in fertilizer consumption, helps in precise application of water and nutrients and controlled environment agriculture. This is needed for economic viable solutions with protection of plants from insects, disease etc. through nets and innovative packaging solutions. Moreover, it may contribute in increasing shelf-life, storage and transportation of fruits and vegetables. Optimal usage patterns and environment sensitive approach could pave way for both agriculture growth and sustainable development.

Dr.V.P.Sharma
Sr. Principal Scientist and Head Quality Assurance
CSIR-IITR, Lucknow, India
E-mail: vpsharma@iitr.res.in

Designer green belts to combat urban pollution and climate cooling

Ashutosh Awasthi and Rana Pratap Singh

Green and open spaces are unique urban assets serving society through the provision of opportunities for gathering, socialization and recreation. These spaces can also play an important role in providing low cost mitigation of global warming if planted with dense vegetation. Recent developments such as COP-21 have highlighted the importance of boosting green urban areas and connecting fragments of green space to improve biodiversity and climate adaptation in urban landscape. If adequately designed, green belts can improve urban ventilation, allowing for cooler air from outside and enhanced soil carbon sequestration reducing thus the urban heat island effect. The capacity of vegetation to retain water of the fertile soil can also increase with greening (Fig.1).

Such new green belts in cities can provide cooling through shading and enhanced evapotranspiration. Green patches of urban woodlands generally separate dense human habitats from each other, which affect the ability of many woodland species to disperse, or move among different locations with similar habitats. The creation of green areas and corridors will be valuable in urban planning and development of smart cities, towns, and villages in most urban areas. The wide array of available techniques to develop new designed ecosystems in different parts of habitations allows establishment of new green belts with very different characteristics in limited spaces. These techniques include constructed green patches, green belts, green wetlands, green roofs and walls in all open spaces around within and on the buildings to provide cooling in summer and thermal insulation in winter.

Managing the urban landscape is a complex process subjected to multiple agendas such as housing, transport infrastructure, commercial infrastructure and expenditure logistics etc. Investing in green infrastructure needs smart and integrated approaches to land management, urban design and strategic spatial planning and yet it is cheaper than developing all other structures with due planning, expertise and cost effectiveness. Green infrastructures need to be established in a careful way, considering local characteristics and vulnerabilities to climate change. The selection of species to be adopted for designing the green belts is crucial, as they have to be adapted to local environment succeed with each other in co-existence and to be climate resilient. Certain plants may be allergic or can provide shelters to the pests and insects. Identification of plant species should be done with care for the introduction of non-exotic species, and value added plants with good fragrance, timber yielding, insect repellent, and with ood flowers and sweat fruits. Studies suggest that these measures can add the social, ecological and financial benefits of such designed green belts. Benefits include, increased urban biodiversity, higher environmental like absorption and assimilation of air pollutants e.g. CO2, SOx, NOx, and settlement of PM25, PM10, PM2.5 and PM1 etc.

Urban green belts can be very useful in urban carbon sequestration and, as long as the vegetation is preserved, results in an overall reduction of atmospheric carbon dioxide concentrations is maintained. Understanding the carbon balance of any green space therefore requires an analysis of the relative amounts of sequestration and decomposition, in addition to any maintenance related greenhouse gas emissions (e.g., through mowing, irrigation and the use of fertilizer). Overall, urban green spaces take in more carbon than

they return to the atmosphere but their design and maintenance play a crucial role in determining how much carbon they will store. For example, a "forest-like" green space with many trees and native vegetation ground cover maximizes carbon sequestration over a park like design with fewer trees and frequently mown grass. As well as creating new green space, looking after existing mature trees is particularly important because they continue to sequester and store large amounts of carbon.

Usually parks in cities are lying barren or filled with concrete structures in its place. Large parks and woodland regions are able to support the widest range of species, but even small areas of vegetation such as roundabouts, roadside verges and green roofs can support a range of plants, insects and birds. These parks should also contain green belts, water ponds, flower beds, and biodiversity centers which increase its entertaining, potential, ecological sustainability, economic values and ecosystem services. For many city dwellers, spending time in urban green spaces is their only regular opportunity to be surrounded by nature. Research suggests that people get more enjoyment from spending time in green space when they perceive there to be a high level of biodiversity and that visitors to green spaces would be willing to pay to see an enhancement in the species richness of plants, birds and invertebrates. Urban green spaces can act as "wildlife corridors", linking together larger parks, and providing links to rural areas on the outskirts of towns and cities. This facilitates the movement of animals, birds and insects between individual green spaces and prevents the fragmentation and isolation of wildlife.

The creation, maintenance and management of green space also generates employment opportunities, and may have indirect benefits to local economies by encouraging further investment and property development in the area. However, it is not clear whether

Fig. 1: Designer green belts

the assignment of monetary values can fully capture the importance of non-monetary effects, such as increased biodiversity or the cultural significance of woodland. Further research is required to develop approaches that can combine both monetary and non-monetary valuations in order to assess the true value of urban green spaces.

In conclusion, urban development has to meet the challenge of establishing adaptation strategies in response to climate change. In view of its potential to regulate urban climates, multi-functionally designed green belts will assume a critical role in these strategies. In addition to their positive microclimatic effects, as a source of cooling in dense, hot cities urban green spaces can contribute to mitigation. They can operate as carbon sinks or can reduce energy consumption for air conditioning by providing shade by urban trees or roof-top greenery.

Dr. Ashutosh Awasthi and Prof. Rana Pratap Singh*
Department of Environmental Science
Babasaheb Bhimrao Ambedkar University,
Lucknow-226025, India
E-mail: cceseditor@gmail.com

Composting of agricultural waste by wood decaying fungi: Switching the pollution-generating waste into organic fertilizer factories

Rachna Singh, Jitendra Mishra and Naveen Kr. Arora

Earth is essentially a closed system thus can exchange energy but not matter from outer space. Matter on earth is recycled by various physical and biological factors and converted from one form to another. Energy in the form of solar radiation is entrapped and incorporated into the living system of earth by plants. Only a small fraction of solar energy (0.02%) that reaches on earth, is entrapped by plants in the form of chemical energy and utilized in biomass production. With this conversion of solar energy into chemical energy, recycling of other minerals also occurs through various metabolic processes. However, increasing human interference in nature is continually disturbing the balance of nature and recycling of matter. One such human activity that imposes huge negative impact on nature's balance is the production of large amount of agricultural waste and its disposal by burning.

Human population is rapidly expanding and with this, agricultural production is also increasing to eradicate hunger of growing population. Large amount of agricultural waste is generated by agriculture sector each year which is disposed-off by burning. Burning of agricultural wastes has been standard practice in most

countries for disposing off such wastes. The amount of crop residues available in India is estimated to be approximately 620 million tons. About half the quantity of agricultural-residues are used as fodder, in manufacturing of packing material, as fuel for domestic and industrial sectors and for other economic purposes. Remaining unutilized residues are eliminated by burning in the field which is still the easiest and least expensive way for disposal of agricultural waste. The New York Times (November 2, 2016) reported how straw burning by Indian farmers massively contributed to the increase in particulate levels in Delhi on October 31 which was recorded 688 µg per cubic metre, about ten times higher than the safe limit. The farmers claimed that burning of crop residues is the cheapest and most feasible way and they could not afford to dispose of the material any other way.

Biomass burning as an agricultural practice is considered to be a significant source of air pollution due to the release of CO_2, dioxins and other harmful gases. A report by Commission for Environmental Cooperation (CEC, 2014) estimated that concentration of dioxins in the atmosphere was found 17 times higher during the week of most intense agricultural-residues burning in Taiwan. Similarly, in China, larger amounts of dioxins are emitted in the provinces with more agricultural production which accounts for about 20% of total emissions of dioxins. Release of dioxins from burning is due to the presence of chlorinated pesticides, such as pentachlorophenol (PCP) fungicide and the herbicide known as 2,4-dichlorophenoxyacetic acid (2,4-D). Release of harmful gases from burning of crop residues not only increase pollutant level in atmosphere but it also causes respiratory problems and increases the fog incidences even in distant cities.

About 50 % of the total residues generated in India, are produced by rice, wheat and oilseed crops. These crop residues contain about 0.5% N, 0.2% P_2O_5 and 1.5% K_2O. On an average, 50% of crop residues which are disposed by burning, holds the nutrient potential of 6.5 million tonnes of NPK per annum, which accounts for 30 % of total NPK consumption in India. Conversion of this enormous agricultural waste into organic fertilizer not only reduces the pollutant release into atmosphere but also can provide an economic support to farmers.

Where many scientists all over the world are busy in finding some convenient biorefining strategies for the conversion of agricultural waste into valuable products, wood decaying fungi hold the potential to convert these wastes into organic fertilizers (Fig.2). These fungi produce an array of enzymes to degrade lignocellulosic biomass and recycle the agricultural waste with high economic efficiency. Wood decaying fungi represent an inevitable group of microscopic eukaryotes which play an important role in maintaining the biogeochemical cycling of minerals on Earth. Many wood decaying fungi

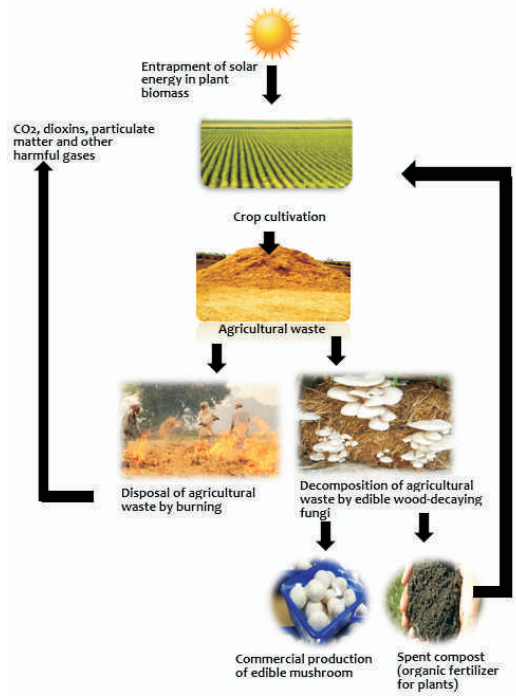

Fig. 2: Composting process by wood decaying fungi

are edible and consumed by humans as food (rich protein source) and medicine. Waste plant biomass such as straw, sawdust, bagasse, cotton seed hulls and other agricultural waste can be used for the cultivation of edible fungi. During growth, wood decaying fungi accelerate composting of waste substrate and convert it into organic fertilizer by breaking down the complex lignin, xylan, cellulose, hemi-cellulose components and by releasing the bound sugars, amino acids and other mineral forms. The substrate which is left after cultivation and harvesting of edible fungi or mushrooms, is known as spent compost. Spent compost can be used as a balanced source of carbon, nitrogen and for humus formation in soil. Spent compost acts as a good soil conditioner and fertilizer and used in many countries for cultivation of vegetables, ornamental and medicinal plants in garden soil. Mixing of spent compost to soil also accelerates the process of humus formation, thus improves soil aeration and water holding capacity.

With strict prohibition of burning of crop residues by state and central governments, pressure on Indian farmers is increasing for environment-safe disposal of agriculture waste. Management of agricultural waste through composting not only will help farmers to get rid of this huge amount of waste but can also support financially by cultivating edible mushrooms and by producing good quality organic fertilizer an easy, cheap and ecofriendly way.

Rachna Singh, Jitendra Mishra & Naveen Kr Arora*
Department of Environmental Science
Babasaheb Bhimrao Ambedkar University
Lucknow (U.P.), India-226025
E-mail: nkarora.bbau@gmail.com

CGES Events

Tree Plantation Program at Biotech Park Kursi Road Lucknow

A tree plantation program was organized jointly by Clean and Green Environmental Society (CGES) and Biotech Park, Lucknow. About 50 trees including Maulshri, Ashok, Royal Palm, Salix, etc. were planted by distinguished scientists and members of the society. Welcoming the guests, Padma Shri Prof Pramod Tandon, CEO, Biotech Park emphasized that we should include children in spreading the message of cleanliness and environmental protection effectively. Prof Tandon also suggested that Biotech Park can organize a course on skill development for the gardeners in collaboration with CGES. The president of the Society Sumer Agarwal said that CGES is committed to educate people towards protection of the environment. He told that Society will soon launch a program in this context in some schools. Secretary General of CGES and scientist Dr.S.C.Sharma spoke on tree culture known as Arboriculture. Prof.P.K.Seth Vice President, CGES gave the concluding remarks on the program. Dr.Virendra Nath, Treasurer, CGES proposed the Vote of Thanks.

First Foundation Day of the Clean and Green Environmental Society (CGES)

CGES celebrated the first Foundation Day on July 08, 2016 at the Hotel LEVANA, Hazratganj, Lucknow. Er.Sumer Agarwal, President, CGES welcomed the Chief Guest Er.A.K.Mishra, Managing Director, Power Corporation, Uttar Pradesh, Lucknow, Guest of Honour, Padma Shri awardee Prof.(Dr.) Mansoor Hasan, former Director, Lari Cardiology Centre, KGMU, Lucknow and Guest Speaker, Dr.Rakesh Tuli, Senior Research Advisor and J.C.Bose Fellow, Panjab University, Chandigarh. Er. M.S.Gulati, Vice President, introduced the Chief Guest Er.A.K.Mishra, Dr. Tariq Husain introduced the Guest of Honor, Dr.Mansoor Hasan while Dr.S.C.Sharma, Secretary General, introduced the Guest Speaker, Dr.Rakesh Tuli. Dr.Tuli delivered the Foundation Day Lecture on "**Designing Climate-Ready Crop Plants**" followed with the interactive Session with the distinguish gathering**.** On this occasion the first CGES Newsletter was released by the Chief Guest, Er.A.K. Mishra. Dr.A.K.Singh Executive Councilor proposed a Vote of Thanks to the Chief Guest, Guest of Honor and the Guest Speaker.

CGES, Program to felicitate Prof. S.K. Barik, Director, CSIR-National Botanical Research Institute, Lucknow

Clean and Green Environmental Society felicitated Prof. S.K. Barik**,** Director, CSIR-National Botanical Research Institute, Lucknow in the conference room of LEVANA, Hazratganj, Lucknow on November 08, 2016. Er. Sumer Agarwal, President, CGES welcome Prof. Barik and the guests on the occasion. Dr.S.C.Sharama Secretary General introduced Prof. Barik to the distinguished gathering. Before joining NBRI, Prof. Barik was Head of the Botany Department, North East Hill University (NEHU), Shillong (Meghalaya). Prof. Barik delivered a very interesting talk on his thirty years experience in North East Region. Prof. Barik is a renowned Plant Ecologist having rich experience of Ecological Niche Modeling of the Rare, Endangered and Threatened (RET) plant species in North East Region of the country.

Prof. Barik is an inspiring leader and model to the young scientist and teachers. Apart from his profession, Prof. Barik is a Rotarian of the Orchid Club, Shillong and a popular figure in the urban and rural areas of Meghalaya. Prof. P.K.Seth gave the concluding remarks on the function. Dr. Tariq Husain, Executive Councilor proposed the Vote of Thanks to the Chair and guests.

Forthcoming Conferences

7th International Conference on Environmental Science and Engineering (ICESE 2017)
11 - 13 April 2017; Seoul, Korea (South)
Contact person: Ms. Iris Tang
CBEES Senior Editor
E-mail: icese@cbees.org
Website: http://www.icese.org/

ECOSUD 2017
11th International Conference on Ecosystems and Sustainable Development
26 - 28 April, 2017; Cadiz, Spain
Contact: Stephanie Everest
Wessex Institute, Ashurst Lodge, Ashurst
Southampton, SO40 7AA, U.K.
E-mail: severest@wessex.ac.uk
http://www.wessex.ac.uk/conferences/2017/ecosud-2017

Books

Plant Responses to Air Pollution
(Eds.) Umesh Kulshrestha & Pallavi Saxena,
Springer 2016
ISBN: 978-981-10-1199-3
Price: $219.00

Bioformulation: for Sustainable Agriculture
(Eds.) Arora NK, Mehnaz S & Balestrini R
Springer 2016
ISBN: 978-81-322-2779-3

Microorganism for Sustainability (Book Series)
(Series Ed.) Arora NK
Springer 2016

Microbial Models : From Environmental to Industrial Sustainability
(Series Ed.) Arora NK
(Ed.) Castro-Sowinski S

Restoration of Degraded Land to Functioning Forest Ecosystem
Authors: Bajrang Singh & Vijay L.Goel
CSIR-National Botanical Research Institute, Lucknow
Year: 2012

CGES

Published by
Clean and Green Environmental Society
Head Office
Green Villa, 2/111
Vishwas Khand, Gomti Nagar,
Lucknow - 226 010, U.P. (India)
Telephone: +(522) 4006408
Mobile: +91 9415343141
E-mail: cleanandgreenenv@gmail.com
scsharmagardener@gmail.com
Website: www.cgesindia.org

Our Banker

army printing press
www.armyprintingpress.com
Lucknow (0522) 6565333