CGES Newsletter

CLEAN AND GREEN ENVIRONMENTAL SOCIETY

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SPECIAL ISSUE

VISION

Clean and Green Environment for Healthy Life

MISSION

To Strive for A Clean and Healthy World

In This Issue

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PRESIDENT'S MESSAGE

प्रिय सदस्यगण, नमस्कार

Greetings on 6th Foundation day of the CGES!

With the active support, affection and cooperation of the executive committee and the active participation of its committed member Clean and Green Environmental Society (CGES) has successfully completed six years in July 2021.

Today there are nearly 200 life members all over the country as well as abroad in the society and 30% are ladies. There are Padma Awardees, former High Court Judge, eminent Scientists, former Vice Chancellors, CEOs, Directors of the National Research Institute, Engineers, Architects, Professors, Doctors and Social workers.

It gives me immense pleasure and great joy to extend very warm and friendly greetings to all of you on our 6th Foundation day.

On this happy occasion, I extend an enthusiastic and cordial welcome to our Chief Guest Dr. Sanjay Kumar, Director CSIR–IHBT, Palampur, who shall be delivering a talk on **"Conservation and Value Addition to Bio-resources A-Step Forward to Green Economy."**

In a green economy, growth in employment and income are driven by public and private investment into such economics actuaries, infrastructure and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services.

Even in these difficult times, when we in India, are in the second phase of Corona and trying to cope with it mentally and physically. CGES has been able to organize webinars on different issues related to environment.

अपने मुख्य अतिथि के स्वागत में मैं कहना चाहूंगा - महक उठा यह घर आंगन जब से आप पधारे है ऐसा एहसास होता है जन्मों से आप हमारे है।''

I heartily congratulate the members of the society for the successful completion of the last one year of CGES. I would like specially to thank Dr. S.C. Sharma, Senior Vice President and Chairman Webinars for his dedication, commitment and innovative ideas for making the CGES, a vibrant society.

My heartfelt thanks to Prof. S.K. Barik, Director CSIR-NBRI, Lucknow, who has been a constant source of guidance and inspiration for CGES. और एक अच्छे इंसान होने के साथ साथ बहुआयामी प्रतिभा के भी धनी है।

I sincerely appreciate and gratefully acknowledge the contributions of Dr. S.C. Sharma, Senior Vice President, Prof. Yogesh Sharma, Secretary General, Col. Ajay Gupta, Secretary and IT Advisor, Prof. Naveen Kumar Arora, Editor, CGES News Letter and the support of CGES executive committee and the senior members and the contribution of the faculty members of C.B. Gupta Post Graduate Agricultural College, Lucknow.

सब दोस्तों के लिए मैं कहना चाहुंगा।

''ईश्वर ने भी कीमती रत्न गिनती के बनाए है, इन रत्नों में सबसे कीमती हमारे CGES में है।''

It has been more than a year since Covid 19 touched off the worst Pandemic, I would appeal to all of you to Take Care and Stay Safe.

Once again a big thank to you and to everyone involved in the CGES.

Thank you one and all.

धन्यवाद ''पर्यावरण के लिए पेड़ लगाओ, देश बचाओ दुनिया बचाओ।
अब बोलेगी चिड़िया डालीडाली, पहले फैलाओ चारो तरफ हरियाली।''

जय हिन्द, जय सी०जी०ई०एस

सुमेर अग्रवाल

(इं. सुमेर अग्रवाल)

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Message

I became a member of CGES in February 2016 and have 5 years as its member. During the short span of 5 years of my membership, I saw the Society hosting two National Conferences and a number of small sessions on very important and relevant topics of various types of Pollution, Bio Diversity and Environment in general for the benefit of its members. During Covid 19 pandemic when physical meetings could not be arranged for safety reasons, Society organized webinars, wherein eminent speakers were invited to address the participants. The membership drive to increase the members in the Society by mouth to mouth publicity and by motivating educated class has yielded results and the strength of members today is around 215. While the existing members had a role to play in this, sincere efforts were put in by Sri Sumer Agrawal President and Dr. S.C. Sharma Senior Vice President to fulfill the objectives. The Society is striving to achieve the goals as laid down in its Vision and Mission Statements and I am confident those who have taken membership of the Society will feel satisfied with its gradual progress in all the parameters laid down to gauge its development. But what happens when the environment is so uncertain that no amount of analysis will allow us to predict the benefits the CGES shall be able to provide to Society. In a highly uncertain environment, it is the Vision and Mission of the CGES which shall guide and lay down the path to follow so that steady progress is maintained in its work to achieve positive results. However, how do we know if our Vision is good and how does one keep it viable amidst the turbulence of the continuous environmental degradation that has adversely affected the quality of our life. It is, therefore, a matter of great concern for all of us. Under these circumstances, it shall be commendable if the CGES is able to contribute even a little bit to improve and provide healthy life to people at large. CGES should be able to educate the present generation on the effects of polluted environments and how to meet the challenges of the same to lead a better and safer life. The Vision Statement says “Clean and Green Environment for Healthy Life”. CGES is moving ahead to fulfill its goal. It is working in the direction of making the younger generation aware of the ill effects of a polluted environment and motivating them to adopt better practices in life to face the challenges of the ever-changing environment by organizing educative events in schools and colleges. This shall help the students to develop the art of reading and communicating widely outside one's course material. This is important because understanding the current and emerging realities is essential. The CGES is moving in the right direction and it is hoped that it shall continue to prosper and earn a name for itself in days to come.

Er. N.K. Trivedi
Former Director
Scooters India Ltd, Lucknow

New Life Members

Prof. Gauri Saxena
Botany Department, University of Lucknow
Dr. Satyendra Kumar Singh
Assistant Professor Chandra Bhanu Gupta, Post Graduate, Agriculture College, Lucknow
Dr. Sidhrath Tiwari
Principal Scientist, National Agri-Food Biotechnology Institute, Mohali
Mr. Mithilesh Kumar
Assistant Professor, Govt. Degree College, Uttar Pradesh

Shri Dileep Chakraborty husband of Smt. Aparna Chakraborty succumbed due to COVID-19 on April 18, 2021. Aparna is a computer assistant on casual basis helps in day to day official work of the Clean and Green Environmental Society (CGES). Due to the demise of her husband, she is in acute financial crisis. On the appeal from the President, Er. Sumer Agarwal to the CGES, Members a sum of Rs. Forty Thousand only (Rs. 40, 000/-) was collected as the donation for giving to Smt. Aparna Chakrborty to help her in this tragic time.

List of the CGES, members, who donated to this noble cause:

Shri Vasant Pusalkar, Er. Sumer Agarwal
Dr. S.C. Sharma, Dr. Seema Ghate
Shri Ram Ji Prasad, Er. N.K. Trivedi
Prof. Y.K. Sharma, Dr. S.N. Pandey
Shri Tilak Basu, Dr. A.K.Singh

About CGES

VISION

Clean and Green Environment for Healthy Life

MISSION

To strive for a Clean and Healthy World

Clean and Green Environmental Society (CGES) is a registered Society under the Society Registration Act XXVI, 1860 with its Head Office at Lucknow. The major aim of the Society is to promote awareness for saving the environment. On the last World Environment Day, June 5, Dr.S.C.Sharma, former Director Grade Scientist, Head Botanic Garden, Horticulture and Bio-aesthetic Planning, CSIR-National Botanical Research Institute, Lucknow, conceptualized the Idea for establishing an NGO for promoting environmental awareness among the masses, which should think Globally but act Nationally.

Brief History

On July 8, 2015 for discussing the modelties, Dr.S.C.Sharma convened the meeting under the chairmanship of Prof. P.K. Seth, CEO, Biotech Park, Lucknow. Prof.P.K.Seth, Er.Sumer Agarwal, Dr.S.C.Sharma, Er.S.P.Kalsi, Er.M.S.Gulati, Prof.Rana Pratap Singh, Dr.H.M.Behal, Dr.Virendra Nath. Dr.Tariq Husain, Dr.Uma Shankar, Shri Piyush Yadav, Prof.Naveen Arora, Shri Rajiv Verma. Participated in the meeting. Dr.S.C.Sharma explained the genesis for establishing the Society. After discussion, It was resolved that the society may be formulated and named as the Clean and Green Environmental Society (CGES). Members for the first first Executive Body were nominated: Prof.P.K.Seth, Vice President, Er.Sumer Agarwal, Vice President, Er.M.S.Gulati, Vice President, Dr.S.C.Sharma Secretary General, Prof.Rana Pratap Singh, Joint Secretary, Prof.Yogesh Sharma, Joint Secretary, Dr. Virendra Nath, Treasurer, Dr.Tariq Husain, Executive Councillor, Shri Piyush Yadav, Executive Councillor and Er.S.P.Kalsi, Advisor. The members requested Dr.S.C. Sharma for drafting the constitution of the Society in consultation with some legal expert. Dr.S.C.Sharma, Secretary General and Justice K.L.Sharma, former Legal Rememberancer, Uttar Pradesh and Former Judge, Allahbad High Court, drafted the Memorandum of the Association, Aims and Objectives, Rules and Regulations, Bye Laws and Members of the Executive Body of the Clean and Green Environmental Society. The draft was circulated among the Members for their views. After incorporating the views of the members, the draft was finalized and the Clean and Green Environmental Society (CGES) was registered in the local Registrar office on January 1, 2016 for a period of five years. Dr.S.C.Sharma and Dr. Virendra Nath opened the bank account in the State Bank of India, Gomti Nagar, Lucknow-226 010.

Clean and Green Environmental Society (CGES) offers Advisory/Consultancy Services for Inspection, Selection, Collection and Plantation of the Pollution tolerant Trees, Shrubs and Herbs for the Green Belts, Highways, Flyovers, Road sides, Dividers, Construction of Urban Ecology and Phyto-remediation of Outside and Inside Pollution of our Surroundings.

Articles

Restoration of Mangrove Ecosystem

Sharad B. Chaphekar, Mumbai

Introduction

Mangroves are flowering plants that occupy coastal saline areas of creeks and estuaries in tropics and warm subtropics. These areas are muddy lands, gradually sloping towards waterfront, washed by tidal water every day. Soils are saline, rich in mineral nutrients, released by decaying litter brought by river runoff. Warm temperature, high humidity and mineral rich wet soils make these areas very fertile and support salinity-tolerant dense vegetation. The vegetation provides shelter and food for marine biota of high diversity – planktons, arthropods, snails, corals, annelids, fishes, etc. Deep sea fishes visit estuarine areas during breeding season and for growth of young fingerlings.

Ecological Significance of Mangrove Vegetation :

The high biodiversity estuarine vegetation provides protection to inland habitats–forests, agriculture and human settlements from oceanic storms and cyclones. Moreover, it also acts as sponge for retaining captured organic debris carried by runoff from land and prevents sedimentation of creek beds.

For coastal and even other human settlements, mangrove vegetation provides usufruct benefits in the form of a variety of seafood, like fishes, molluscans, prawns, as also timber, tannins and medicines.

Such rich mangrove ecosystems however, are subject to over-exploitation and destruction. Several causes lead to the degradation of mangrove ecosystems, such as –

1. Harvesting for high energy fuel, 2. Harvesting for tannins from bark of trees, 3. Pathways for movement of local communities, 4. Construction of ponds for fish and prawn farming, 5. Salt cultivation, 6. Kharland agriculture, 7. Dragging of fishing nets from boats to huts of fishermen, 8. Parking of fishing vessels, 9. Construction of docks and 10. Urban expansion – Housing, Roads, Bridges, Industries, etc.

Background of the Project :

When a Mumbai-based thermal power generation industry was allotted closed and abandoned salt pan land in Dahanu, they were also mandated to restore stretches of barren coastline along Dandi and Savta creeks along the proposed project site. The concerned industry approached the Institute of Science in Mumbai, where research on coastal areas of Mumbai was in progress.

The Project Site:

Dahanu is a pristine Taluka place in Palghar district of coastal Maharashtra, about 100 km north of Mumbai. The place is famous for sapota (Chiku in vernacular) plantations, a delicious fruit. It was introduced by a local trader by bringing saplings from Argentina and planting them in a nearby village Gholwad, in the year 1898.(The fruit has recently earned GI tag as Gholwad Chikoo).

Barren coastline of Savta creek.

Lone Tiwar tree that survived.

During site visit, we noticed the absolute barrenness of the banks of two creeks. Reasons for denudation of mangroves here were identified as 1. Decades of salt cultivation and recent abandonment and 2. Movement of local fishermen for undertaking fishing expeditions.

During discussion with industry authorities, it was mutually agreed to plan and execute three research-based sub-projects simultaneously – 1. Restoration of coastal mangrove vegetation, 2. Conversion of non-coastal saline land into orchards (Sapota and Coconut) and 3. Stabilization of fly-ash emitted by the factory and stored in hectares of ash-ponds. In this article, we will detail on the first sub-project only.

The Project :

Tiwar (*Avicennia marina*) is the most common mangrove along west coast. Hence it was decided to start with large scale plantation of Tiwar. During early monsoon, Tiwar seedlings are often found scattered in hundreds beneath a stand of mature Tiwar forest. These seedlings with 4 to 10 leaves can be uprooted from loose mud during rainy season without affecting their delicate roots for transplantation. However, to cover dozens of coastal hectares, number of required seedlings would be in thousands. Seedling collection, transportation to project site and transplantation was a challenging task. Youth of 'Warli' tribe from nearby villages accepted the challenge. They would visit, during rains, other nearby undisturbed coastal areas covered with Tiwar, collect young seedlings in hundreds, put them in baskets, cover with wet cloth and bring to project site on bicycles.

Warli men and women from nearby villages were organized for undertaking Tiwar plantation. After working on their small paddy fields, they were available for project work. The task became smooth with unstinted help from a civil engineer from the industry and his staff for coordinating with local farming community and incidental labour. Incidentally, during previous years, many of the Warli farmers were trained for methodical transplantation of paddy seedlings from seed bed ('gaadi-wafa') to fields in neat rows and gaps between transplants, for optimization of yields (as part of NSS activity of three colleges from Mumbai University, including volunteers from the Institute of Science, under the guidance of this author).

(Note: The science-agriculture linkage programme of NSS of the University was highly commended by Prof. S.M.Sarkar during his Presidential Address to the Indian Science Congress session at BHU, Varanasi).

Local Warli farmers and their families planting Tiwar seedlings.

Field nursery of mangrove species.

Large scale plantation of Tiwar was carried out during the first half of rainy season, maintaining some 16 seedling per sq.meter, along two banks of both the creeks. Braving slushy mud, bending for long durations for transplanting, was no problem for these tribals used to working on their (and those of big landlords) paddy fields. Hundreds of meters along banks of two creeks were planted in this fashion by local tribals, under our guidance, during the first year of the project. Periodic monitoring revealed that though overall survival rate of planted seedlings was above 70%, stormy monsoon conditions in July-August resulted in seedling re-distribution, leading to some

5-year growth of planted Tiwar.

Undergrowth of Machul

quadrats with only 5 to 10 saplings and some others in the immediate vicinity with 30 to 40 saplings.

The standardized plantation was carried out for five consecutive years, as a result of which bushy growth of Tiwar formed 100% cover along the water front. It was a pleasant site of layered greenery along water front of the creeks. During an inspection visit by the authorities of Dahanu Taluka Environment Protection Committee (set up by the Ministry of Environment and Forests, N.D.), the Chairman expressed satisfaction, since the count of surviving Tiwars, carried out by Forest Department officials, revealed between 4.5 to 5 lakh young trees along the coasts. Late Dr.Untawale of N.I.O., Goa, as Expert Member of the Committee, suggested that diversity of species should be added to the vegetation. Accordingly, plantation of Kandal (*Rhizophora mucronata*) and (*Aegiceras corniculatum*) through viviparous seedlings, Chipi (*Sonneratia apetala*) through air-layering and Machul (*Suaeda fruticosa, Sesuvium portulacastrum*) through cuttings, was undertaken, and with success.

Acknowledgements

The Author gratefully acknowledges the following for their timely encouragement, permission to visit site and facilities provided, and for site visits with students and student volunteers from time to time, between 1984 and 2000.

Authorities of Bombay Suburban Electric Supply Ltd., Santa Cruz and Dahanu.

Shri Madhukar Deshpande, Shri A.V.Patil and others at BSES Ltd, Dahanu.

Director, The Institute of Science, Mumbai.

Dr.Jayantrao Patil, Kosbad, (then in Thane dist; for tips to enable working with tribal populace.)

Importance of vaccination in fighting the COVID-19 pandemic

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The coronavirus disease 2019 (COVID-19) pandemic raging since 2020, has already caused huge number of mortalities in almost all the countries around the globe. It has resulted in enormous economic and social impact, affecting human life in more than one ways. Battling with the recurring waves of COVID-19, along with several mutations in the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causal organism of COVID-19, and the emergence of variants around the world has resulted in unprecedented challenges resulting in collapse of healthcare systems. The containment of the virus is dependent on coordinated management and three-tier system of isolation, testing and treatment. As such there is no certain treatment for the disease caused by a RNA virus which is high in mutation rate and has diverse effects in the population. Hence the major option left is prevention rather than cure. Prevention can be achieved by isolation of infected people, by imposing lockdowns or strict quarantine methods. But these options are not sustainable and result in long term impact on the economy and social welfare of the society. The only option left is vaccination of the population throughout the globe so that herd immunity is achieved as soon as possible and stress on the healthcare system is also reduced. Vaccination drives have already proved to be successful in eradicating diseases like small-pox and almost eliminated polio. Understanding the mechanism behind vaccination and herd immunity a simple flowchart can be illustrated that if coronavirus cases multiply exponentially and half of the population gets vaccinated the spreading rate would equivalently be reduced and finally the pandemic can be snuffed out.

The year 2020 was both challenging and golden time of the "scientific era" where on one hand encounter with a novel SARS-CoV-2 virus collapsed the health and medical systems and on the other hand major success in the field of vaccine development was seen. As of June 2021, the list of vaccines approved by WHO include Astra Zeneca /Oxford vaccine (also known as Covishield in India), Johnson and Johnson, Moderna, Pfizer/BionTech, Sinopharm and Sinovac, which have met the necessary criteria for safety and efficacy. Apart from this India has approved Covaxin, developed indigineously by Bharat Biotech International Ltd, Hyderabad, for administration in its population. AstraZeneca/Oxford vaccine and Johnson & Johnson are viral vector vaccines, Pfizer/BionTech and Moderna are mRNA based vaccines and Covaxin, Sinopharm and Sinovac are attenuated virus vaccines. The basic theme and expectation of vaccination is "sterilized immunization" i.e. blocking the germ from invading and infecting the body, a total shutdown to transmission and infection. Vaccination can save lives, avert hospitalization, break the transmission chain and can prevent the generation of more virulent and transmissible variants. Studying the mechanism of action of vaccines, it is observed that there is a threshold amount of "neutralizing antibodies" required to prevent the infection from COVID-19 virus and the training chaperoned by vaccines vary according to individuals' health conditions, age, underlying diseases and so on. Research shows and predicts that if vaccination rate is tripled then hospitalization and death rates would cut by more than half. Again concerning about the development of variants, WHO demarks that if vaccination followed by social-distancing, hygiene and masking are ensured, then this would reduce the transmission of virus and reduce their opportunity to mutate. As for the already reported virulent variants like South Africa's B.1.351, India's B.1.617/ B.1.618 the experts are already hinting towards the administration of booster doses or development of variant specific vaccines. For this it becomes very important to keep on tracking the variants/ mutants developing in the population. Proper surveillance of the novel variants of the coronavirus in the populations is also very necessary for development of booster doses and future vaccines for SARS-CoV-2. More centers should be developed for sequencing of the genomes of the SARS-CoV-2 to track the variants. Looking at the pace of variation in the genome of novel SARS-CoV-2 booster doses and development of new vaccines may be the norm in near future.

At present mankind is facing a fiery battle against a largely unknown entity in the form of novel coronavirus. Vaccines can prove to be the turning point in this battle and tilt it towards the humans. An array of vaccines available in different countries have been developed on diverse principles. This also gives an opportunity for the research and future development of effective vaccines not only against novel coronavirus but also against many more such future pathogens. Vaccines can definitely prove to be the game changer in this and many other battles against human pathogens including viruses and bacteria. In these unprecedented times it is our responsibility to get vaccinated

and also motivate everyone around us to go for vaccination. This will not only help in prevention from the deadly virus but also result in controlling the raging pandemic bringing life back to normalcy.

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Degradation of ecosystems in India and their restoration

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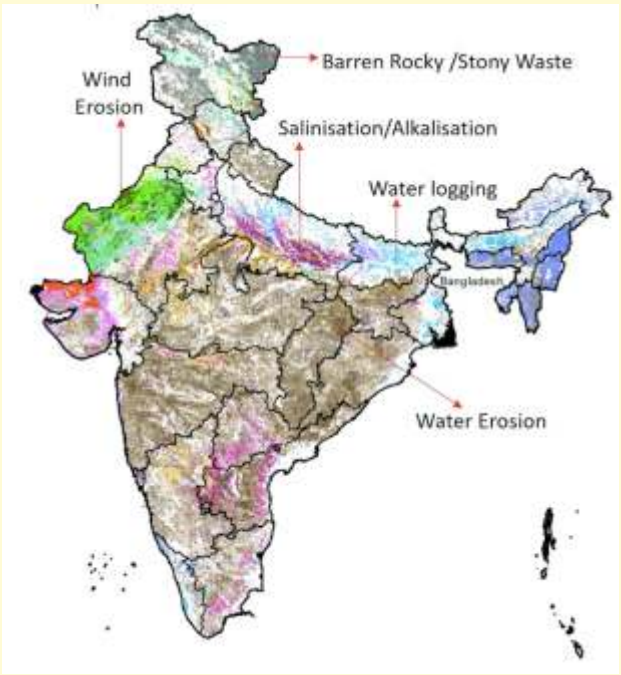
An ecosystem is defined as a unit that includes all the living organisms interacting with their physical environment, so that a flow of energy leads to a clearly defined trophic structure and cycling of materials (after Odum 1971). An ecosystem can be as small as a tiny portion of a decomposing dead wood on the forest floor or as large as an ocean. The examples of other ecosystems are grassland, forest, desert, lake, river, pond, and man-made agriculture ecosystems (briefly referred to as agro-ecosystems). Each ecosystem has an important functional attribute called homeostasis that maintains the stability of an ecosystem through two alternate mechanisms viz., resistance and resilience. Resistance offers stability to an ecosystem by resisting the external perturbations, while through resilience a damaged ecosystem (succumbed to perturbation) quickly bounces back to the original state. When an ecosystem fails to maintain its structure, function, processes, and cannot provide the desired levels of ecosystem services i.e. the benefits that humans derive from an ecosystem, is considered as a degraded ecosystem. Environmental degradation is the deterioration of the environment through depletion of resources such as quality of air, water and soil. Ecosystem degradation drastically depletes natural resources, reduces primary productivity far below the optimum level, and decreases biodiversity. Consequently, the socio-economic conditions of the ecosystem-dependent human populations get negatively affected and the degradation often threatens the survival and development of human beings. Therefore, the ecosystem degradation has attracted the attention of governments, policy makers, technocrats and scientific communities worldwide. The main types of ecosystem degradation in India include, degraded forest ecosystems, salt-affected/sodic lands, degraded grassland ecosystems, desertification of lands, mine-affected ecosystems, polluted wetlands, and soil erosion affected lands. Restoration and rehabilitation of these degraded ecosystems bring back the ecosystems to an accepted level of structure and function.

Causes of ecosystem degradation are many that include both natural and anthropogenic. Conversion of forest ecosystems to agro-ecosystems including shifting cultivation, and industry-pollution driven conversion of wetlands into effluent-filled water bodies are the examples of man-made or anthropogenic ecosystem degradation. The underlying factors causing degradation are termed as drivers of ecosystem degradation. These include market forces, social factors such as poverty, lack of awareness, and resource management and governance issues.

Land degradation is the foremost consequence of ecosystem degradation. The land degradation map at 1:50,000 scale developed by ISRO based on LISS-III imagery pertaining to the period 2015-16 (Figure 1) provides the spatial extent of land degradation in India.

Using LISS-III data acquired during 2015-2016, the fifth cycle of wasteland map has also been prepared by DRDO (Figure 2). Shifting cultivation fallows are one of the important wastelands created by the ecosystem degradation (Figure 2). The wide spread shifting cultivation being practiced in various north-eastern states, although currently with a declining trend, has been depicted in Table 1.



Source: DRDO: https://www.isro.gov.in/earth-observation/land-degradation

Figure 1: Land degradation map of India
(generated using LISS-III data of 2015-16)

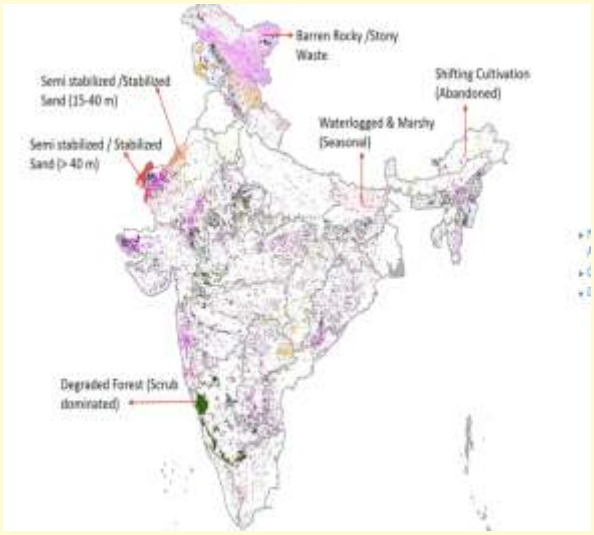


Figure 2: Wastelands map of India
(generated using LISS-III data of 2015-16).

Table 1: Area statistics of jhum land estimated for 2014-15 and 2017-18 (* high cloud cover) using Landsat-8 imagery.

State	Area (in % w.r.t. state geographic area)	
	2014-15	2017-18
Mizoram	1.518	1.108
Tripura	0.741	0.256
Meghalaya	0.790	0.449
Manipur	0.871	0.723
Arunachal Pradesh	0.278	0.256
Assam	0.080	0.039
Nagaland	*0.477	0.720

Ecosystem Restoration

UN Decade on Ecosystem Restoration (2021-2030), UNEP and FAO (2021) provide the definition, strategies and importance for ecosystem estoration during the current decade, which are reproduced below:

"Ecosystem restoration means assisting in the recovery of ecosystems that have been degraded or destroyed, as well as conserving the ecosystems that are still intact. Healthier ecosystems, with richer biodiversity, yield greater benefits such as more fertile soils, bigger yields of timber and fish, and larger stores of greenhouse gases. Restoration can happen in many ways – for example through actively planting or by removing pressures so that nature can recover on its own. It is not always possible – or desirable – to return an ecosystem to its original state. We still need farmland and infrastructure on land that was once forest, for instance, and ecosystems, like societies, need to adapt to a changing climate. Between now and 2030, the restoration of 350 million hectares of degraded terrestrial and aquatic ecosystems could generate US$9 trillion in ecosystem services. Restoration could also remove 13 to 26 gigatons of greenhouse gases from the atmosphere. The economic benefits of such interventions exceed nine times the cost of investment, whereas inaction is at least three times more costly than ecosystem restoration."

Although ecological restoration principles are more or less same for all ecosystem types, the strategy and the nature of interventions widely vary among different degraded ecosystems. As an example, eco-restoration of degraded forest ecosystems, recovering from the damage caused due to short-cycle shifting cultivation has been demonstrated here. Both the strategies and interventions of ecorestoration viz., Passive and Active have been described.

Passive ecosystem restoration: A case study of forest ecosystem restoration in Meghalaya

(a)	UF	CF1	RF5	RF10
Trees				
Shannon's diversity (H)	3.64	2.99	2.83	3.16
Dominance (D)	0.04	0.06	0.08	0.06
Evenness (J)	0.57	0.74	0.6	0.69
Fisher's alpha diversity (a)	19.3	9.23	6.31	7.08
Shrubs				
Shannon's diversity (H)	2.46	2.72	3.31	2.47
Dominance (D)	0.1	0.09	0.04	0.1
Evenness (J)	0.84	0.66	0.85	0.79
Fisher's alpha diversity (a)	4.39	5.59	10.3	4.27
Herbs				
Shannon's diversity (H)	2.59	3.14	2.86	2.45
Dominance (D)	0.08	0.07	0.07	0.08
Evenness (J)	0.83	0.75	0.79	0.89
Fisher's alpha diversity (a)	4.62	8.86	6.15	3.813.8

Most of the structural and functional attributes of the forest ecosystems did not return to the original state even after 10 years of passive restoration (Table 2 a and b).

Table 2: Eco-restoration vis-à-vis Reference Ecosystem (a) Community structural attributes (Diversity indices), (b) Functional attributes of forest ecosystem (Changes in soil physicochemical properties and net N mineralization rates during forest recovery (values are mean ± SE, n = 32) (after Mylliemngap, Barik et al. 2016)

	UF	CF1	RF5	RF10
Soil temperature (°C)	15.56 ± 1.28^{a}	16.77 ± 1.56^{a}	17.04 ± 1.29^{a}	14.97 ± 1.15^{a}
Soil moisture content (%)	25.20 ± 3.04^{a}	30.68 ± 2.71^{a}	28.28 ± 2.97^{a}	25.02 ± 4.21^{a}
Soil organic C (%)	1.80 ± 0.16^{a}	2.25 ± 0.05^{a}	2.09 ± 0.06^{a,b}	2.25 ± 0.06^{a}
Total Kjeldahl N (%)	0.24 ± 0.04^{a}	0.47 ± 0.02^{a}	0.30 ± 0.03^{a}	0.40 ± 0.02^{a}
NH_4^+-N (µg g^{-1})	7.40 ± 0.60^{a}	13.06 ± 0.94^{a}	9.98 ± 0.80^{a}	8.47 ± 0.62^{a}
NO_3-N (µg g^{-1})	12.74 ± 0.78^{a}	17.46 ± 1.34^{a}	16.37 ± 0.80^{a}	14.56 ± 0.83^{a}
Net ammonification (µg g^{-1} month^{-1})	2.93 ± 0.98^{a}	0.31 ± 0.05^{a}	2.28 ± 0.88^{a}	2.99 ± 0.99^{a}
Net nitrification (µg g^{-1} month^{-1})	2.04 ± 0.60^{a}	1.62 ± 0.17^{a}	0.39 ± 0.09^{a}	4.42 ± 0.77^{a}
Net N mineralization (µg g^{-1} month^{-1})	5.42 ± 1.23^{a}	2.12 ± 0.77^{a}	2.67 ± 0.46^{a}	7.41 ± 1.42^{a}

Within a row, values followed different superscripts are significantly different from each other (Tukey HSD test, $P < 0.05$)
UF old-growth undisturbed forest, *CF1* 1-year-old recovering stand, *RF5* 5-year-old recovering stand, *RF10* 10-year-old recovering stand

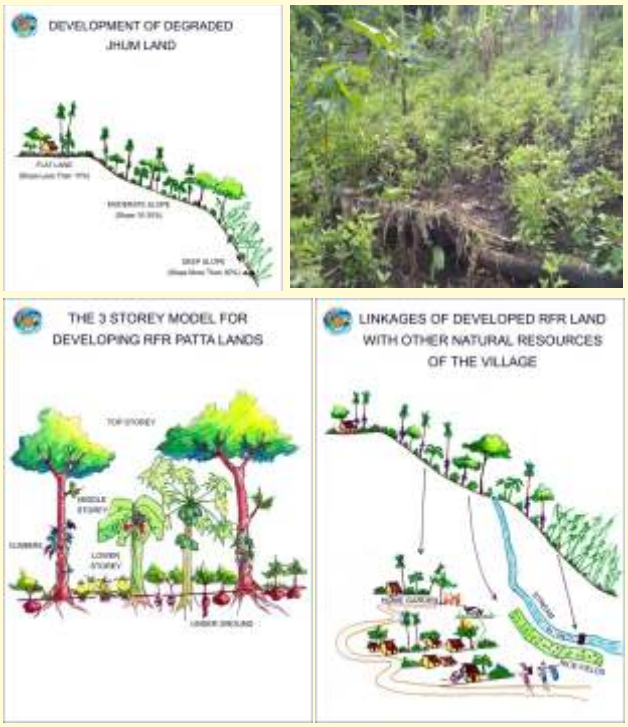


Figure 3: Active ecosystem restoration: Abandoned shifting cultivation fallow land restoration using three-storey plantation model (upper storey tree canopy, middle storey fruit tree/shrub canopy, Ground layer agricultural and tuber crop) in Tripura under Indo-German Development Cooperation project (2009-2016). The concept and field activities have been demonstrated.

Active ecosystem restoration: A case study of forest ecosystem restoration recovering from abandoned short-cycle shifting cultivation fallow in Tripura.

Utilizing the above restoration model (Figure 3), the success story of Shri Amonjoy Reang of Ganganagari ADC Village (Ganganagar RD Block) of Tripura is narrated in the following paragraph. Out of shifting cultivation, locally called *Jhum*, he had a monthly income of Rs.3000/- (maximum for 7 months) to support his family.

In the year 2012-13, he started 3-tier plantation model under the Indo-German Development Cooperation Project. He got Rs. 4162/- as financial input from the Project to arrange seedlings, and for preparing the land for raising the plantation. Till date (3 years since plantation), from the lower and middle tier plantations alone, he has been earning about Rs. 1,10,000/- per year, which is a 5 -fold increase in his income. Once, the top tier (Mango, Guava, Jackfruit etc.) plantation starts giving yield in another, 3 years, his annual income is expected to cross Rs.1,50,000/. The degraded forest ecosystem due to jhum has now

recovered to a great extent as evident from several structural and functional attributes of the ecosystem (IGDC Six-monthly Report, 2016).

Cost-effective technologies are the need of the day to restore diverse degraded ecosystems of the country. To effectively implement these technologies to restore back the ecosystem structure, function and services, people's participation in such programmes is a must. Appropriate policies need to be in place for restoring the degraded ecosystems. In addition, steps must be taken to conserve the remaining well-protected ecosystems to ensure their continued existence.

Acknowledgements

The data used in this article are from IGDC Project Progress Report, 2016 and Ecological Research, 2016, which are gratefully acknowledged.

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Impact of biodiversity loss on human health

Yogesh K Sharma* S.C. Sharma**

Around the world up to 2004, 2,87,655 plant species (excluding bacteria, algae and fungi) and 1,12,50000 animal species (excluding bacteria, insects and mites) have been identified. The species are quickly disappearing because of human encroachment and human influences. Efforts to slow down the decline of species are underway on a number of fronts But the primary mean is the preservation of critical habitat for threatened species. Researchers from various areas aim to combine their skills in applied combinatorial optimization and theoretical ecology to create a Science of Design for Nature Reserve. The survival of a species depends strongly on reserve size and shape, but these issues have previously received virtually no attention even in the still emerging reserve design literature, a literature that is still developing its mathematical approaches.

India is one of the 12 mega biodiversity centres on our planet, having over 45,000 plant species. Its diversity is unmatched due to the presence of 16 different agro-climatic zones, 10 vegetative zones and 15 biotic provinces. The country has nearly 18,000 flowering plants, 23,000 Fungi, 2,500 algae, 1600 lichens, 1800 bryophytes and 30 million micro-organisms.

The earth is home to a diverse array of living organisms, whose genetic diversity and relationships with each other and with their environment constitute our planet's biodiversity. Biodiversity is the 'foundation of human life' on earth. Biodiversity includes variety and variability among living organisms from all sources including ecosystem and ecological complexes in which they occur, and it comprises diversity within species and in ecosystems. The distribution and magnitude of the biodiversity that exists today is a product of over 3.5 billion years of evolution, involving speciation, migration, extinction and more recently, human influences.It helps in producing more productive and stable ecosystem capable of surviving in stress condition. Our country accounts for two hotspots i.e. Eastern Himalayas and Western Ghats which figure in top eight most important hotspots of biodiversity of the world. Biodiversity supports human and societal needs, including food and nutrition security, energy, development of medicines and pharmaceuticals and freshwater, which together underpin good health. Medicinal resources of the tropical forests are important to human beings.

It also supports economic opportunities and leisure activities that contribute to overall human wellbeing. It is Ecological life support as it provides functioning ecosystems that supply oxygen, clean air and water, pest control, waste water treatment and many ecosystem services. Higher biodiversity controls the spread of certain diseases as pathogen will need adapt to infect different species. Therefore, rapid biodiversity loss accompanies high incidence of pathogenic diseases.

Rate of extinction of species as estimated today is 10 to 100 times higher than natural extinction rate of 1-10 species per year due to habitat loss, introduction of non-native species, pollution, over exploitation and global climate change. Chiefly the environmental deterioration constitutes the drastic effects on biodiversity. A changing climate endangers whole ecosystem and entire species.The continuing loss of biodiversity is underpinning our ability for poverty reduction, food and water security, human health and the overall goal of leaving nobody behind. Biodiversity loss is hurting our ability to combat pandemics.The increasing frequency of disease outbreaks is linked to climate change and biodiversity loss. Between 1980 and 2020 there were 12,324 recorded outbreaks, comprising 49 million individual cases and affecting every country in the world. A number of trends have contributed to this rise, including high levels of global travel, trade, connectivity and high-density living. But the links to climate change and biodiversity are the most striking. At the same time, new infectious diseases appear to be emerging at an increasing rate. They include new diseases such as severe acute respiratory syndrome (SARS) as well as reemerging diseases that have expanded in geographic range, such as West Nile virus, Corona Covid-19 etc. A common feature of emerging infectious diseases is that they are associated with anthropogenic changes to the environment.

Deforestation has increased steadily over the past two decades and is linked to 31% of outbreaks such as Ebola, and the Zika and Nipah viruses. Deforestation drives wild animals out of their natural habitats and closer to human populations, creating a greater opportunity for zoonotic diseases - that is, diseases that spread from animals to humans. More broadly, climate change has altered and accelerated the transmission patterns of infectious diseases such as Zika, malaria and dengue fever, and has caused human displacement. Movements of large groups to new locations, often under poor conditions, increases displaced populations' vulnerability to biological threats such as measles, malaria, diarrheal diseases and acute respiratory infections. Corona virus has pandemic potential.

There is scientific evidence to support this relationship. The loss or extinction of large predators because of hunting and land-use change can increase the population of a particular vector or host. This loss can result in a greater prevalence of pathogens among hosts, and consequently, pose an increased risk of transmission to humans. It has also been shown that the loss of specialist predators can affect the

health of animal populations, as diseased individuals can survive longer and increase the potential for transmission. Conversely, when nonnative species are introduced into a system, they can alter ecosystems, impact biodiversity, and change native host-parasite dynamics. Introduced pathogens and vectors can also cause high levels of mortality in wildlife and humans .Land-use changes can lead to multiple impacts on disease transmission, especially if vector species adapt to newly created niches in different ways. More research is essential to help decision-makers assess the effects on human disease transmission from changes in biodiversity.

Innovative technologies are critical in the search for new vaccines. One promising area of research is gene-encoded antibodies that create "factories" in our bodies to make antibodies against specific pathogens. Another is monoclonal antibodies (mAbs), typically used to treat existing disease, but which can also prevent infection. Successful drug development is not always about advanced synthetic biology - there is also a link to nature-based solutions and biodiversity as researchers are increasingly "reverting to nature" to look for new therapeutic options. An estimated 50,000 to 70,000 plant species are harvested for traditional or modern medicine, while around 50% of modern drugs have been developed from natural products that are threatened by biodiversity loss.

More results are awaited on- Improved understanding of the mechanisms that link biodiversity change and risks of infectious disease; identification of the anthropogenic or social factors that affect biodiversity loss;Use of monitoring and predictive tools to reduce the incidence of human infectious diseases;Improved strategies and communication that can encourage changes in human behavior to help reduce biodiversity loss and to decrease exposure to disease risks; Improved analysis of land-use planning that considers environmental and human health impacts. Technological advancement is not possible without a rich biodiversity. New technologies offer hope in the search for countermeasures but protecting the natural world must play a part, too.

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Drug Delivery System and Nanoparticles: An Overview

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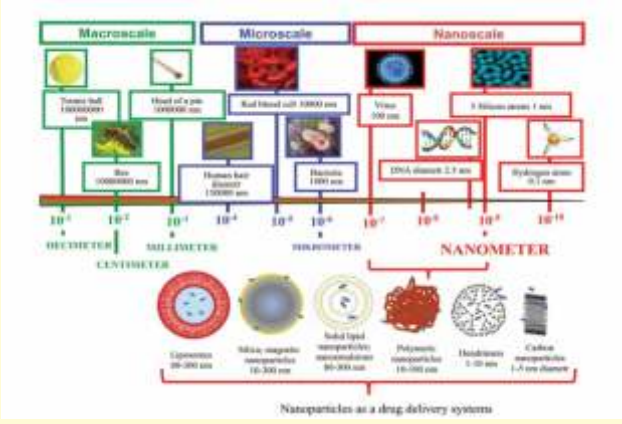
Introduction

The prefix “nano” has found in last decade an ever-increasing application to different fields of the knowledge. Nanoscience, nanotechnology, nanomaterials or nanochemistry are only a few of the new nano-containing terms that occur frequently in scientific reports, in popular books as well as in newspapers and that have become familiar to a wide public, even of non-experts. According to the definition from NNI (National Nanotechnology Initiative), nanoparticles are structures of sizes ranging from 1 to 100 nm in at least one dimension. However, the prefix “nano” is commonly used for particles that are up to several hundred nanometers in size. Nanotechnology is the science of the small; the very small. It is the use and manipulation of matter at a tiny scale. At this size, atoms and molecules work differently, and provide a variety of surprising and interesting uses. Nanotechnology and Nanoscience studies have emerged rapidly during the past years in a broad range of product domains. It provides opportunities for the development of materials, including those for medical applications, where conventional techniques may reach their limits. Nanotechnology should not be viewed as a single technique that only affects specific areas. Although often referred to as the 'tiny science', nanotechnology does not simply mean very small structures and products. Nanoscale features are often incorporated into bulk materials and large surfaces. Nanotechnology represents the design, production and application of materials at atomic, molecular and macromolecular scales, in order to produce new nanosized materials. Pharmaceutical nanoparticles are defined as solid, submicron-sized (less than 100 nm in diameter) drug carrier that may or may not be biodegradable.



Mechanisms of drug release

The polymeric drug (are polymers that exhibit pharmacological activity that can be harnessed for therapeutic benefits) carriers deliver the drug at the tissue site by any one of the three general physico-chemical mechanisms.

- By the swelling of the polymer nanoparticles by hydration followed by release through diffusion.
- By an enzymatic reaction resulting in rupture or cleavage or degradation of the polymer at site of delivery, there by releasing the drug from the entrapped inner core.
- Dissociation of the drug from the polymer and its de adsorption/release from the swelled nanoparticles.

Preparation of nanoparticles

The properties of Polymeric nanoparticles (PNPs) have to be optimized depending on the particular application. In order to achieve the properties of interest, the mode of preparation plays a vital role. Thus, it is highly advantageous to have preparation techniques at hand to obtain PNPs with the desired properties for a particular application. Different techniques like polymerization, preformed polymers or ionic gelation etc are used. The selection of appropriate method for the preparation of nanoparticles depends on the physicochemical character of the polymer and the drug to be loaded. The primary manufacturing methods of nanoparticles from preformed polymer includes:

- Emulsion-Solvent Evaporation Method
- Salting Out Method
- Emulsions- Diffusion Method
- Solvent Displacement / Precipitation method

Characterization of Nanoparticles

Nanoparticles are generally characterized by their size, morphology and surface charge, using such advanced microscopic techniques as

scanning electron microscopy (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM). The average particle diameter, their size distribution and charge affect the physical stability and the in vivo distribution of the nanoparticles. Electron microscopy techniques are very useful in ascertaining the overall shape of polymeric nanoparticles, which may determine their toxicity. The surface charge of the nanoparticles affects the physical stability and redispersibility of the polymer dispersion as well as their in vivo performance.

Nanoparticles applications

- Healthcare/medical
- Targeted drug delivery
- Alternative drug and vaccine delivery mechanisms (e.g. inhalation, oral in place of injection).
- Bone growth promoters
- Cancer treatments
- Biocompatible coatings for implants
- Sunscreens (e.g. using ZnO and TiO2) / cosmetics
- Bio labeling and detection (e.g. using Au)
- Carriers for drugs with low water solubility
- Fungicides (e.g. using ZnO)
- MRI contrast agents (e.g. using superparamagnetic iron oxide)
- New dental composites
- Biological binding agents (e.g. for high phosphate levels)
- Antiviral, antibacterial (e.g. Ag), anti-spore non- chemical creams
- Powders (using surface tension energy on the nanoscale to destroy biological particles)

Future opportunities and challenges

Nanoparticles provide massive advantages regarding drug targeting, delivery and with their potential for combine diagnosis and therapy and one of the major tools in Nanomedicine. These are many technical, challenges in developing the following techniques:- Virus-like systems for intracellular systems, Architecting of biomimetic polymers, control of sensitive drugs, functions (of active drug targeting, bioresponsive triggered systems, systems interacting with me body smart elivery), nanochips for nanoparticle release, carriers for advanced polymers for the delivery of therapeutic peptide / proteins. Drug delivery techniques were established to deliver or control the amount & rate. Most major and established internal research programmes on drug delivery that are formulations and dispersion containing components down to nano sizes.

Conclusion

Nanocarriers as drug delivery systems are designed to improve the pharmacological and therapeutic properties of conventional drugs. The emergence of nanotechnology is likely to have a significant impact on drug delivery sector, affecting just about every route of administration from oral to injectable. The present pharmaceutics is often characterized by poor bio-availability which far too often results in higher patient costs and inefficient treatment but also, more importantly, increased risks of toxicity or even death. Nanotechnology focuses on the very small and it is uniquely suited to creating systems that can better deliver drugs to tiny areas within the body. Nano- enabled drug delivery also makes it possible for drugs to permeate through cell walls, which is of critical importance to the expected growth of genetic medicine over the next few years. Further advances are needed in order to turn the concept of nanoparticle technology into a realistic practical application as the next generation of drug delivery system.

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प्रकृति रक्षतिरक्षिता

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भारत उन प्रमुख राष्ट्रों में से एक है जहाँ ईरान, मेसोपोटामिया, यूनान और मिस्र की तरह सभ्यता व संस्कृति का आरम्भ और विकास हुआ 'भारतीय समाज दरअसल हिन्दू सामाजिक संरचना और संगठन के साथ कालांतर में घुले इस्लामिक, डच, पुर्तगाली, हूँण, तुर्की, पारसी, ईरानी, यूनानी, मुगल एवं ईसाई सामाजिक संगठनों के तत्वों की देन है 'भारत जैसाजटिल समाज होना कठिन है। यह एक विविधतापूर्ण बहुस्तरीय बहुलक समाज है।

पर्यावरण संरक्षण के प्रति भारतीय संस्कृति के प्रेति प्रेम का अनुमान हम इसी तथ्य से लगा सकते हैं कि यहाँ पशु, पक्षी, पर्वत, नदियां, वृक्ष, पत्थर सभी आस्था के पात्र हैं 'हमारी संस्कृति में गाय, और नदियों को मां का दर्जा देते हुए इनके संरक्षण की बात कही गयी है' हमारी संस्कृति में मनुष्य को प्रेंति से जोड़ने के वे सभी प्रयत्न दिखाई पड़ते हैं जिनकी आज पर्यावरण संरक्षण के सन्दर्भ में नितांत आवश्यकता महसूस की जा रही हैय क्यूंकि आज से तीन दशक पूर्व दुनिया इसी गफलत में जी रही थी कि आर्थिक विकास ही मानव विकास का सूचकांक है 'इस सोच के चलते जहां विकसित देशों ने तीव्र आर्थिक विकास के लिए अतिवाद की सीमा तक प्राकृतिक संसाधनों का दोहन किया,वही ऐसा करते हुए विकासशील देशों के प्रोंतिक संसाधनों का भी भरपूर दोहन किया गया 'इससे आर्थिक विकास तो हुआ सो हुआ किन्तु हमसे पर्यावरण प्रतिकूल रूप से अतिवाद की सीमातक प्रभावित हुआ है 'यह स्थिति सामने आने पर विशेषज्ञों को यह बात समझ आने लगी की यदि पर्यावरण की दशा में तुरत प्रभाव से सुधार न लाया गया तो सिर्फ आर्थिक प्रगति से मानव विकास सम्भव न हो पाएगा' अतः जरूरी हो गया है कि दुनिया अंधे आर्थिक विकास पर लगाम लगाये 'परन्तु, हमें यह नहीं भूलना चाहिए कि पर्यावरण को बचाना एक वैश्विक चुनौती है और सततविकास भी तभी संभव है जब दुनिया के सभी देश इसके लिए अपनी नैतिक जिम्मेदारी को समझें 'शहरीकरण और औद्योगिकरण के विस्तार ने प्राकृतिक संसाधनों क अविवेकपूर्ण दोहन किया है' इसके परिणाम हमारे समक्ष चुनौती के रूप में खड़े हैं और मानव

सभ्यता संकट के दौर से गुजर रही है 'आज जब एक अकाट्य संकट मानव सभ्यता पर कहर बनकर टूट पड़ा है और विवश किया हुआ है अध्यात्म को भी और विज्ञान को भी तब हमारी नींद टूटी है'।

आज आवश्यकता है कि आर्थिक विकास की प्रत्येक गतिविधि का पुनरावलोकन कर पर्यावरण पर होने वाले प्रभाव का पुनः आंकलन किया जाये जिससे हम पर्यावरण के अनुकूल विकास को ही प्रोत्साहित कर पर्यावरण विकास को ही दृष्टिगोचर कर सकें' आज आवश्यकता इस बात की भी है कि विकास की नीतियां बनाते समय हमें इस बात का ध्यान रहे कि प्राकृतिक संसाधनों का दोहन न्यूनतम हो 'प्राकृतिक ससाधनों के पुर्नचक्रण तथा दोबारा इस्तेमाल की आधुनिक विधियाँ विकसित कर पर्यावरण को संतुलित करने की दिशा में ध्यान देना होगा' ऊर्जा सरक्षण के लिए तेल और कोयला जैसे गैर नवीकरणीय संसाधनों की अपेक्षा सौर ऊर्जा जैसे संसाधनों को अपनाना होगा 'वनों का अंधाधुंध विनाश मानव समाज के अस्तित्व को संकट में डाल रहा है प्त्वरित अविवेकी वनोन्मूलनके परिणामस्वरूप ही आज प्राणवायुकी दुर्लभता का वीभत्स परिश्य तो हमारे समक्ष है ही और यही निर्वनीकरण अनुक्रमशः जलवायु परिवर्तन के लिए भी उत्तरदायी है।

कृषि क्षेत्र में बेतहाशा बढ़ते कीटनाशकों और उर्वरकों के प्रयोग में आज सावधानी बरतने की आवश्यकता है। उनके प्रयोग को नियमित करने की आवश्यकता है। हमें इस क्षेत्र में ऐसी प्रोद्योगिकी की खोज में औरअधिकअनुसंधान करने होंगे जो कीटनाशकों और उर्वरकों के प्रयोग को सीमित और अल्प कर सके। आज पुनः जैविकृषिको व्यापक स्तर पर अपनाने की आवश्यकता है 'जैवि कृषि में उर्वरकों एवं कीटनाशकों के रूप में जैविक पदार्थों का ही उपयोग किया जाता है।' पर्यावरण के समक्ष और सततविकास के समक्ष भयावह चुनौती बढ़ी हुई जनसंख्या भी है 'हमें राजनीति से इतर बढ़ती हुई जनसंख्या पर लगाम लगाने के लिए कोई नीति अपनानी होगी' जनसंख्या परिमाण और पारिस्थितिकी तंत्र की उत्पादक क्षमता के बीच सामंजस्य स्थापित करना आवश्यक है। आज आवश्यकता है कि मानवीय जनसंख्या को पर्यावरण की धारण क्षमता तक सीमित रखा जाए 'कुल मिलाकर आज अतिआवश्यक है कि हम विकास में पारिस्थितिकी दृष्टिकोण को अपनाएं।

आज के समय की भयावहता अतिबाजारीकरण ने और अधिक बढ़ा दी है। आज बाजार में सब कुछ बिकाऊ है, जल, वायु और ऊर्जा भी बिकाऊ हैं। आज बाजारवाद की पराकाष्ठा ही है की शायद मनुष्य का मनुष्य से सम्बन्ध व मानवीय संवेदनाएं ही नहीं बल्कि इससे भी कहीं अधिक मनुष्यता और मानवता भी बिकाऊ हैं। आज के इस भयावह समय (कोरोनाकाल) में भी समस्त मानवीय मूल्य, समाज और सामाजिक जीवन सभी मनुष्य की लालसाओं महत्वाकांक्षाओं और आधुनिक अतिबाजारीकरण के वशीभूत हो अति निम्नता की ओर अग्रसर होते प्रतीत हो रहे हैं 'आज हमें समझना होगा कि यह आधुनिक बाजार और बाजार सम्बंधित समस्त कार्यकलाप अंततःजीवन और पर्यावरण विरोधी ही है और यह चमचमाता आधुनिक बाजार और इसके विभिन्न अवांछित उत्पाद हमारे अपने जीवन और हमारे पर्यावरण के संतुलन को धीरे धीरे नष्ट ही कर रहे हैं। अतः आज आवश्यकता है, आवश्यकता की अतिरेक को रेखांकित कर इस अति उत्साही अतिबाजारवाद को धराशायी करने की इस हेतु व्यक्तिगत स्तर पर ही कठिन परिश्रम करने होंगे और बाजार की चमक से परे हो प्रकृति प्रेम और प्रकृति समृद्धि के प्रयास फलीभूत करने होंगे।

हमें महात्मा गांधीजी के उस कथन को आत्मसात करना होगा जिसमें उन्होंने कहा था की पृथ्वी पर हर व्यक्ति की जरूरत को पूरा करने के लिए तो पर्याप्त है परंतु किसी व्यक्ति के लालच को पूर्ण करने के लिए नहीं है। बापू के इसी दृष्टिकोण को आज अपनाने की आवश्यकता है। हमें स्वयं को प्रेंति का हिस्सा मानना होगा और पारिस्थितिकी दृष्टिकोण को अपनाना होगा।

वर्तमान की आर्थिक प्रणाली जो धन के अधिकतम प्रवाह, अधिकतम उत्पादन, अधिकतम उपभोग, संसाधनों का अधिकतम इस्तेमाल पर आधारित है। इसके स्थान पर हमें इस संयमित अर्थव्यवस्था को अपनाना होगा जिसे 'स्पेसशिप इक नमी' कहा जाता है। इस अर्थव्यवस्था में पुर्नभरण, संरक्षण, नवीकरणीय संसाधन के उपयोग, सतत् वस्तुओं के उत्पादन, सतत् वस्तुओं के उत्पादन तथा स्वक्ष एवं स्वस्थ पर्यावरण पर विशेष ध्यान दिया जाता है। शिक्षा और जागरूकता बहुत महत्वपूर्ण है, इसके अभाव में समाज में पर्यावरण के प्रति जागरुकता और प्रकृति के महत्व पर विशेष ध्यान देने की आवश्यकता है। हमीं ऐसी प्रोद्योगिकी अपनानी होगी जो स्थानीय संस्कृति और पर्यावरण के अनुकूल हो। इसमें स्थानीय शिल्पियों को प्रोत्साहन दिया जाए। यह प्रोधौगिकी प्रदूषणहीन हो अथवा बहुत कम प्रदूषण फैलाने वाली हो। इसी के साथ यह भी जरूरी है कि सतत विकास पर एक प्रभावी जनमत का निर्माण पर्यावरणविदों, प्रकृति प्रेमियों, वैज्ञानिकों, सामाजिक कार्यकर्ताओं व गैर सरकारी संगठनों की मदद से किया जाये और एक पर्यावरण समृद्धि की अवधारणा को परिकल्पित ही नहीं परिपोषित भी किया जा सके।

आज आवश्यकता है की हम अपनी संस्कृति के उस दर्शन की ओर लौटें जिसमें पर्यावरण एवं प्रकृति को पूज्य माना गया है। इस दर्शन की सबसे बड़ी विशेषता है कि हमने सदैव स्वयं को प्रकृति का ही अभिन्न हिस्सा माना तथा स्वयं को प्रकृति के साथ ही जीवन जीने के सुविचार को ध्यान दिया। भारतीय दर्शन में जड़ को पूज्य व वंदनीय मानने की जो समृद्ध परंपरा है वह अन्यत्र दुर्लभ है।

आज पर्यावरण समृद्धि हेतु भारतीय संस्कृति में निहित स्थानीयता के महत्त्व को पुर्न परिभाषित कर जनजागरण करना होगा। हमारी लोक संस्कृति एवं तीज त्योहारों का समूचा ताना बाना प्रकृति और पर्यावरण को ही ध्यान में रखकर बुना गया है। ताकि हम प्रकृति के सानिध्य में रहकर प्रकृति सरंक्षण के लिए प्रयत्नशील रहें। हमने धरती को माता कहकर संबोधित किया इसके पीछे धारणा यही थी की हम इनका संरक्षण करें ताकि ये मानव जीवन को सुखमय बनाये। हमारे यहाँ उस वसंत को महोत्सव के रूप में मनाने की परंपरा रही है जिसे सन्तुलन कहा गया है। हमारे वेद एवं ग्रन्थ पर्यावरण संरक्षण के सिद्धांतों व शिक्षाओं से भरे पड़े हैं जिनमें कहा गया है की 'प्रकृति रक्षति रक्षिता' अर्थात प्रकृति हमारी रक्षा करती है यदि हम उसकी रक्षा करें।

Bonsai: An alternative art to grow trees in modern cities

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The word **"Bon-sai"** (often misspelled as **bonzai** or **banzai**) is a Japanese term which, literally translated, means **"planted in a container"**. This art form is derived from an ancient Chinese horticultural practice, part of which was then redeveloped under the influence of **Japanese Zen Buddhism**. So, bonsai is an art of growing and training of a plant to a miniature form having a natural look of old age. It is an old Chinese art of growing trees. Bonsai comprises a tree or shrub planted in a small container for developing as a miniature or dwarf plant showing the general appearance of that plant species found in nature. The optimum size of bonsai may be only 30 to 60 cm in height, but miniature sizes of below 25 cm have also been preferred.

Important Plants Suitable for Bonsai

Although the suitability of plants for developing as Bonsai has been tested in Japan consisting mostly of sub-tropical and temperate plants, very little information is available on the response to the growth of tropical trees in miniature form.

Among the tropical trees that thrive well as miniature plants are: ***Adenanthera pavonina, Adonsonta digitata, Anthocephalus cadomba, Brassia actinophylla, Bombax malabaricu, Butea frondosa, Caesalpinia coriaria, Erythrina cristagalli, E. parcelli, Ficus religiosa, F.bengalensis, Jacaranda mimosaefolia, Kigelia pinnata, Putranjiva roxburghii, Tabebuia chrysantha*** and ***Thespesia populnea.***

Several tall shrubs like ***Adenium obesum, Brya ebenus, Fortunella japonica, Hamelia patens, Hibiscus schizopetalous, Jatropha podagrica and Murraya*** exotica form very attractive dwarf plants. There are many woody climbers like *Combretum, Derris scandens, Hiptage madhablata, Jasminum auriculatum* and *Roupellia grata* can also be prepared as Bonsai. Among the conifers grown in tropical conditions, *Juniperous prostrata* and *Pinus khasiana* used to form good Bonsai.

To develop a tree as a Bonsai depends on various factors which make it suitable:

1. The plant should be hardy so that it can be grown in a small container for many years with all the manifestations of a living plants.
2. The trunk should develop a natural appearance.
3. The branches should grow in natural but artistic forms.
4. The growth of the tree and its appearance should be suitable with the shape of the container.
5. The miniature plant showing seasonal variation in growth and flowering is a very interesting feature of Bonsai.
6. Plants of low height and strong trunk, thick at the base are good as Bonsai.

Growing the Bonsai

Plants suitable for growing as Bonsai are planted in small containers. In tropical climate, the monsoon is the best season for planting or transplanting. For making Bonsai, plants growing wild or seedlings grown in the nursery for several years should be carefully uprooted, grown in ordinary pots for a year or two and then planted in a shallow container. Plants may also be obtained from layering of a large branch, grafting or by raising seedlings in a pot. It is advisable to grow the plant in the ground for a year or two which helps in developing a strong root system and healthy branches. They are the transferred into a container after pruning the roots and branches. The plants grown in pots may also planted directly in the container.

Techniques to prepare Bonsai:

The development of bonsai incorporates a number of techniques either unique to bonsai or, if used in other forms of cultivation, applied in unusual ways that are particularly suitable to the bonsai domain. These techniques involve:

- **Leaf trimming,** the selective removal of leaves (for most varieties of deciduous tree) or needles (for coniferous trees and some others) from a bonsai's trunk and branches.
- **Pruning the trunk,** branches, and roots of the candidate tree.
- **Wiring branches and trunks** allows the bonsai designer to create the desired general form and make detailed branch and leaf placements.
- **Clamping** using mechanical devices for shaping trunks and branches.
- **Grafting** new growing material (typically a bud, branch, or root) into a prepared area on the trunk or under the bark of the tree.
- **Defoliation,** which can provide short-term dwarfing of foliage for certain deciduous species.
- **Deadwood bonsai techniques** such as *Jin* and *Shari* simulate age and maturity in a bonsai.

Containers used for Bonsai preparation:

The containers should be unglazed shallow pots of various sizes and shapes. They may be round, rectangular or square, the size and depth depending on the plant to be grown. The containers should be simple and non-eye catching.

Soil preparation for bonsai:

The soil for potting should be fresh, well-drained, and on very rich in fertilizer. It should not be highly acidic or alkaline (between 6.5 to 7.5). Clay-loam or loam of different structures and clump sizes, obtained by sieving the soil is used in potting. It should not be very sticky or sandy. Well-rotted leaf mould is mixed with the soil. The common ingredients in **bonsai soil** are akadama, pumice, lava rock, organic potting compost and fine gravel.

The soil is dried in the sun and sieved through meshes of at least three sizes. Large, medium and fine soil obtained by sieving are kept in separate containers. At the time of planting, the larger particles are placed at the bottom of the pot and a thin layer of medium-sized particles is spread over it. The tree is planted and the top soil consisting

of small particles holds the plant in position and comes in close contact with roots.

Removal of tree:

The soil of the plant to be transplanted should be kept on the dry side to facilitate removal of the plant from the pot. It may be necessary to remove thick roots and also the tips of some fibrous roots with a pair of sharp shears. After pruning the roots, the shoots are pruned depending on the growth habit and the desired appearance of the plant in miniature form, when the branches are crowded in any part of the plants. In the case of unbranched seedlings growing terminally, the main stem is cut to a height, which may form a well-shaped Bonsai.If the branches are small and well arranged, pruning is not needed but the terminal growth is removed to minimise the height of the plant and to encourage the growth of axillary branches. In case the branches have already grown to a size too tall for a Bonsai, they are pruned to 1/2 to 1/3 the length depending on the rate of growth of the plant and its response to pruning. Generally broadleaved plants and harder pruning than small-leaved conifers.

Planting in Container:

The holes of the container are first covered with crocks or plastic net. Then a layer of large soil particles is placed with a thin layer of medium-sized soil above it. The tree is then placed in the soil. Before it is finally planted, the side presenting the best view should have been determined. The medium-sized soil is placed around the root region a consolidated by means of a bamboo stick without pressing too hard. Then a layer of fine soil is spread on the top, levelled and pressed gently. While planting, care should be taken to keep the base of the trunk from where the main roots rise above the soil and to place the plant in the middle of the container. After planting, watering should be done with the help of a fine rose from the top of the plant.

Care of the Plant:

The container is kept on a platform in a cool and shady place for about two weeks to allow the roots to develop and the plant to establish. It is then gradually exposed to sunlight for longer durations beginning with the morning sun for two hours. The soil should never be allowed to dry up completely. In summer months with high temperature and low humidity, the plants may be placed in shade in the midday and afternoon. They also need protection from frost. The miniature plants should be arranged in a planned fashion on a platform or on stands of different sizes and heights so that the collection of plants looks like a garden. Proper spacing between the rows will facilitate watering the maintenance of the plants.

Watering:

Watering is very important for Bonsai, as they are grown in shallow containers with small amount of soil. They should not be allowed to dry as temporary wilting of the plants adversely affects their growth. If the roots shrivel due to shortage of moisture in the soil, the plants are likely to die. Excessive watering often causes poor growth and waterlogging for a considerable period may cause rotting of the roots.

Pruning and Pinching:

Removal of buds from Bonsai is an important practice. Pruning maintains the shape of the plant, stimulates branching and helps in the utilization of energy for the growth of other parts of the plant. The frequency and mode of pruning will depend on the growth habit rate of shoot growth, response to pinching and subsequent growth of auxiliary shoots.In order that the plant may maintain an attractive appearance, pinching is not done at the same length in all the direction. In the case of two axillary branches growing in two directions, one may be pinched at the apical bud, while the other one is pruned up to several nodes below the terminal bud. If the plant tends to grow fast in a particular season or continues to grow in length throughout the year if may be necessary to pinch more than once a year. But frequent pruning leads to the formation of thin and weak shoots, which may wither in an unfavourable environment. Pinching or pruning should be done clean without damaging the shoot at the cut end It should be ensured that the plants remain in a fixed position and the soil and root are not disturbed at the time of pruning. Bonsai varies in shape and size.

Following are common types:

1. A single tree with straight trunk
2. A tree with twisted trunk
3. A tree with slanted trunk
4. A tree with a large hanging branch
5. A tree with two trunks
6. A tree with several trunks
7. Several trees grown in a single pot
8. Tree grown on rocks

Bonsai Tools

Arrangement of Branches

Arrangement of Branches:

The arrangement of trunk and branches is also an important technique to be followed to develop an attractive Bonsai. It is done to improve the shape and to help in the manifestation of natural appearance of the plants. In order to maintain the space between two branches the lower one is suspended by a strong twine or wine. Before using wire, the portion of the branch is wrapped with raffia where the wire is to be tied. To improve the arrangement of the branches on the plant, wire is to be used very carefully and the technique needs experience, skill and proper tools. Wire cutter and pincers are normally used for the purpose. Copper wire is better than iron wire, as it is softer and can be seen easily and does not rust. Another very effective method of modifying the shape of the tree or arranging the branches is to tie wire around the trunk or branches so that they may grow in the desired direction and form.

Different styles of Bonsai:

The Japanese tradition describes bonsai tree designs using a set of commonly understood, named styles. The most common styles include formal upright, informal upright, slanting, semi-cascade, cascade, raft, literati, and group/forest. Less common forms include windswept, weeping, split-trunk, and driftwood styles. These terms are not mutually exclusive, and a single bonsai specimen can exhibit more than one style characteristic. When a bonsai specimen falls into multiple style categories, the common practice is to describe it by the dominant or most striking characteristic. A frequently used set of

Formal upright-style
Bald cypress

Informal upright-style
Bougainvillea

Forest-style Pine

(Photographs taken from commons.wikimedia.org and freepik.com to represent the style only)

styles describes the orientation of the bonsai tree's main trunk. Different terms are used for a tree with its apex directly over the centre of the trunk's entry into the soil, slightly to the side of that centre, deeply inclined to one side, and inclined below the point at which the trunk of the bonsai enters the soil.

i. **Formal upright:**
It is a style of trees characterized by an upright, straight, tapering trunk. Branches progress regularly from the thickest and broadest at the bottom to the finest and shortest at the top.

ii. **Informal upright** is a style of trees incorporating visible curves in trunk and branches, but the apex of the informal upright is located directly above the trunk's entry into the soil line.

iii. **Slant** is a style of bonsai possessing straight trunks like those of bonsai grown in the formal upright style. However, the slant style trunk emerges from the soil at an angle, and the apex of the bonsai will be located to the left or right of the root base.

iv. **Cascade** is a style of specimens modelled after trees that grow over water or down the sides of mountains. The apex (tip of the tree) in the **semi-cascade** style bonsai extend just at or beneath the lip of the bonsai pot; the apex of a *full* cascade-style falls below the base of the pot.

A number of styles describe the trunk shape and bark finish. For example, the deadwood bonsai styles identify trees with prominent dead branches or trunk scarring.

- **Shari** is a style involving the portrayal of a tree in its struggle to live while a significant part of its trunk is bare of bark. Although most bonsai trees are planted directly into the soil, there are styles describing trees planted on rock.
- **Root-over-rock** is a style in which the roots of the tree are wrapped around a rock, entering the soil at the base of the rock.
- **Growing-in-a-rock** is a style in which the roots of the tree are growing in soil contained within the cracks and holes of the rock.

While the majority of bonsai specimens feature a single tree, there are well-established style categories for specimens with multiple trunks.

- **Forest or group** is a style comprising the planting of several or many trees of one species, typically an odd number, in a bonsai pot.
- **Multi-trunk** styles have all the trunks growing out of one spot with one root system, so the bonsai is actually a single tree.
- **Raft** is a style of bonsai that mimic a natural phenomenon that occurs when a tree topples onto its side from erosion or another natural force. Branches along the top side of the trunk continue to grow as a group of new trunks.
- **Literati** is a style characterized by a generally bare trunk line, with branches reduced to a minimum, and foliage placed toward the top of a long, often contorted trunk.
- **Broom** is a style employed for trees with fine branching, like elms. The trunk is straight and branches out in all directions about 1.3 of the way up the entire height of the tree. The branches and leaves form a ball-shaped crown.
- **Windswept** is a style describing a tree that appears to be affected by strong winds blowing continuously from one direction, as might shape a tree atop a mountain ridge or on an exposed shoreline.

Repotting:

Bonsai needs repotting when the soil is completely exhausted or the container is filled with roots. In general, plants in the growing stage are repotted once a year, and a full-grown tree once every two or three years. Containers should be used after thorough washing and drying. While repotting, the old soil should be removed as far as possible and dead roots and ends of fine roots pruned. Unnecessary branches are also removed to improve the appearance of the tree. Then the Bonsai is planted firmly in the container using the similar type of soil mentioned earlier.

Application of Manure and Fertilizer:

Fertilizer is necessary for Bonsai as the plant thrives and grows in a small container. One kilogram of mustard cake is diluted with six litres of water and allowed to decompose thoroughly. After about 3-4 weeks, the water above the decomposed manure is again diluted with 5-10 times the amount of water and the dilute solution is applied to the soil leaving the base of the trunk. Thoroughly powdered cake is lightly mixed with the topsoil slightly away from the trunk, in two or three areas using 1-2 tablespoonful of cake in each case. The plants should be manure in the spring and again in the rainy season when they show vegetative growth. During the growing season the plants can be manure once a month followed by watering.

Control of Diseases and Pests:

Diseases and pests are common with Bonsai. Root rot is a common and serious disease caused by excess watering, drying of soil, poor drainage, direct contact with undecomposed organic matter, etc. the affected plant will show poor growth and decay of shoots. Following measures can be taken to control the diseases:

1. In the case of fungus infection either on shoots or on root, the diseased part should be removed at the earliest opportunity.
2. Spraying of insecticides and fungicides should be a routine practice. To summarise bonsai may live for a century or more and may be handed down from one generation to another as valued family possessions. Aesthetics of scale call for short needles on conifers and relatively small leaves on deciduous trees. Small-flowered, small-fruited varieties of trees are favoured. Open space between branches and between masses of foliage are also important aesthetically. In diminutive forests the lower portions of the trunks should be bare. It has been around for well over a thousand years. The ultimate goal of growing a Bonsai is to create a miniaturized, but realistic representation of nature in the form of a tree. Bonsai are not genetically dwarfed plants, in fact, any tree species can be used to grow one.

पत्तेदार सब्जियों पर जहरीले एवं प्रतिबंधित कीटनाशकों के प्रयोग से बढ़ रही बीमारियाँ रहें सतर्क

डॉ. सत्येंद्र कुमार सिंह
सहायक आचार्य, कीट विज्ञान विभाग,
चंद्र भानु गुप्त कृषि स्नातकोत्तर महाविद्यालय बक्शी का तालाब लखनऊ-226 201

आहार में जिस तरह से सब्जियों की उपलब्धता आवश्यक है आज के परिवेश में लोग विभिन्न प्रकार की सब्जियाँ जिसमें लुभावनापन अधिक होता है उन्हें खाने हेतु प्रयोग अधिक करते हैं जिसमें पालक, रंग बिरंगी चौलाई, धनिया, सोया, मेथी एवं मूली की रंग बिरंगी प्रजातियों शामिल है। इन सब्जियों में लगने वाले कीटों को प्रबंधित करने के लिए किसान क्लोरीन, फास्फोरस तथा कार्बामिक अम्ल युक्त रसायनों का अधिक प्रयोग हो रहा हैं। इन रसायनों में फास्फोरस, क्लोरीन तथा जहरीली गैसों के साथ में ऑर्गेनिक कंपाउंड होते हैं जो शरीर को बहुत अधिक नुकसान पहुंचाते हैं, जिसकी वजह से गंभीर परिणाम देखने को मिल रहे हैं। इन रसायनों की वजह से शरीर में विभिन्न प्रकार की बीमारियाँ हो रही हैं, जिनमें प्रमुख रूप से कैंसर, लीवर खराब होना, आँखों से कम दिखाई देना, दांत कमजोर हो जाना, प्रजनन संबंधी बीमारियाँ, उक्त रक्तचाप का होना, यूरोल जिकल समस्या तथा न्यूरोल जिकल समस्या तथा रोग प्रतिरोधक क्षमता का ह्रास प्रमुख हैं।

खतरनाक रसायनों की जगह पर जैविक कीटनाशक एवं जैविक खाद का प्रयोग करने की आज अधिक आवश्यकता है। पत्ती वर्गीय सब्जियां स्वास्थ्य के लिए बहुत लाभदायक होती हैं, बाजार से पत्ती वर्गीय सब्जियाँ लाने के बाद 2 दिन से अधिक इनको स्टोर नहीं किया जाना चाहिए क्योंकि जहरीले रसायनों का प्रभाव इसमें काफी दिन तक रहता है। इसलिए रसायन का सीधा असर मनुष्य के शरीर पर पड़ता है जिसकी वजह से शरीर में विभिन्न प्रकार की व्याधियों उत्पन्न होने लगती हैं। आज के परिवेश में लगातार अंधाधुंध कीटनाशकों का प्रयोग हो रहा है जिसकी वजह से कीटनाशकों का शरीर के अंदर जमाव अधिक हो रहा है जो काफी चिंता का विषय है।

जब तापक्रम में निरंतर गिरावट आ रही हो जिससे चूसक कीटों की संख्या बहुत अधिक बढ़ने लगती है किसानों को इन कीटों को प्रबंधित करने के लिए ब्यूबेरिया बैसियाना जो एक जैविक फफूंदी उत्पाद है। इसका प्रयोग करके छोटे पत्ती चूसक कीटो को नियंत्रित किया जा सकता है इसके लिए 5 ग्राम ब्यूबेरिया बैसियाना पाउडर को 1 लीटर पानी की दर से घोल बनाकर 10 से 15 दिन के अंतराल पर शाम के समय छिड़काव करें यह जैविक उत्पाद अंडा देने वाले इन कीटो तथा पौधों के लिए बहुत प्रभावी होता है, इसकी उत्पाद की उम्र 1 वर्ष होती है, एक बार प्रयोग कर देने से पत्ती वर्गीय सब्जियां अपने पूरे सीजन में कीटों से बची रहती हैं। छोटी पत्ती वर्गीय सब्जियों को प्रबंधित करने के लिए नीम का तेल का प्रयोग लाभकारी होता है इसके साथ में गाय का मूत्र मिला दिया जाए तो इसका कीटनाशक गुण भी बढ़ जाता है। यह तरल वानस्पतिक कीटनाशक है इसकी गंध एवं स्वाद के कारण कीड़े भाग जाते हैं, इस प्रकार के जैविक उत्पादों को पौधों के ऊपर छिड़कने से कीटों का जीवन चक्र छोटा हो जाता है तथा उनकी वृद्धि एवं विकास प्रभावित होता है। नीम जनित उत्पाद बाजार में मिलते हैं इनकी 2 मि.ली मात्रा को 1 लीटर पानी में घोल बनाकर छिड़कने से अधिक लाभ मिलता है और यह स्वास्थ्य के लिए लाभदायक होते हैं। वर्तमान समय जैविक कृषि का वैश्विक स्तर पर महत्व बढ़ता जा रहा है तथा बाजार में जैविक रूप से उत्पादित किए गए फल सब्जी एवं अनाज की अत्यधिक मांग है अतः किसानों को जैविक कृषि पर ध्यान देने की आवश्यकता है। जैविक उत्पाद वातावरण को सुरक्षित रखते हैं, प्रमुख रूप से वातावरण में होने वाले प्रदूषण को कम करते हैं, इन उत्पादों के प्रयोग से उपयोगी जीव जंतु मृदा में बने रहते हैं। आने वाले समय में जैविक प्रबंधन को अपनाकर किसानों की आय बढ़ाने के साथ-साथ उन्हें स्वस्थ भोजन भी उपलब्ध कराया जा सकता है।

बाजार से हरी लुभावनी पत्तेदार सब्जियाँ खाने से पहले निम्नलिखित बिंदुओं पर ध्यान देने की आवश्यकता है। इस प्रकार की सब्जियां खरीदते समय यह देख ले कि किसी भी प्रकार का रंग या रोगन का प्रयोग तो नहीं किया गया है, घर में जब इस प्रकार की सब्जियां लाई जाएं तो उन्हें गुनगुने पानी में अच्छी तरह से भिगोकर साफ करके ही खाने में प्रयोग किया जाए, जूस या सूप बनाने के लिए जब भी इस प्रकार की सब्जियों का प्रयोग करें तो उन्हें पहले अच्छी तरह से धो लें कुछ समय तक उन्हें धूप में सुखाकर उसके बाद खाने में प्रयोग करें। इस प्रकार की सब्जियों को यदि सुखाकर प्रयोग में लाना चाहते हैं तो सबसे पहले इन्हें गर्म पानी में कुछ समय तक उबालने के बाद धूप में अच्छी प्रकार से सुखा कर ही प्रयोग करें। इन रसायनों की जगह जैविक कीटनाशकों के प्रयोग करने पर विशेष जोर देना चाहिए क्योंकि जैविक कीटनाशक सुरक्षित, हानि रहित परिस्थितिकी मित्र होते हैं और यह मनुष्य के ऊपर कोई जहरीला प्रभाव नहीं छोड़ते साथ में पर्यावरण सुरक्षित रहता है।

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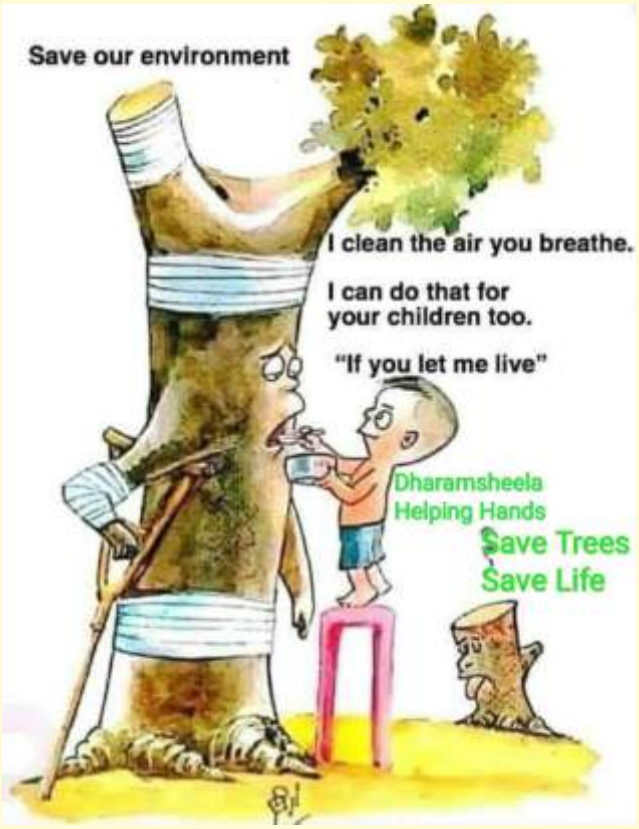
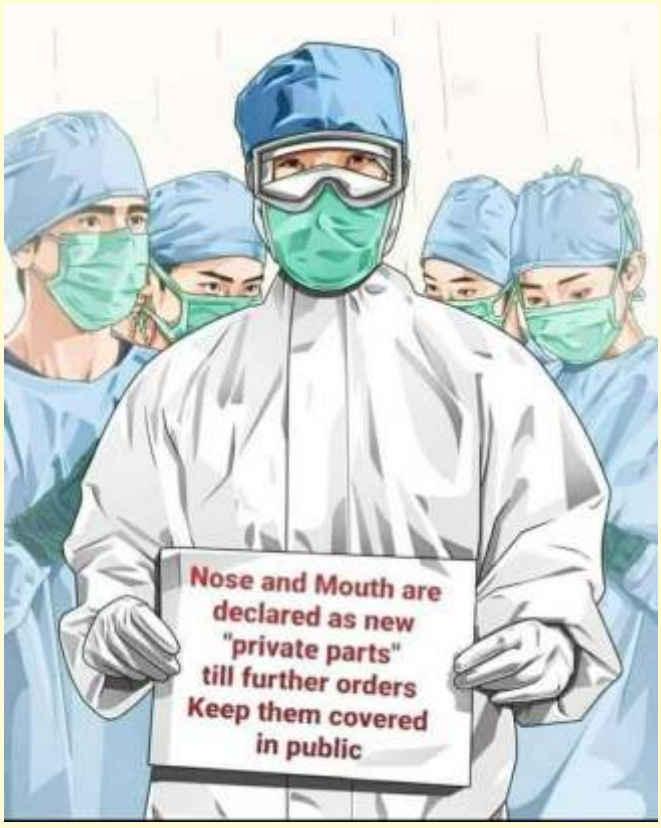
GREEN AND CLEAN CAMPUS

Envirotoons





Envirotoons

New Publication

- Lotus (*Nelumbo nucifera* Gaertn.): National Flower of India
  Authors: S. C. Sharma, A. K. Goel and Y. K. Sharma
  Publisher: Bishen Singh, Mahendra Pal Singh, Dehradun (India)

Forthcoming Events

- Tree Plantation Drive in the colleges and farms.
- Clean and Green Society will organize National Conference in collaboration with CSIR-NBRI in February, 2022.

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