SOIL AND WATER CONSERVATION Today

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IN THIS ISSUE

International Decade of Soils 2015-2024

FROM THE PRESIDENT'S DESK

Land is a basic natural resource for the survival and prosperity of plants, animals and humans. It provides all the services of ecosystems that are home, food, raw materials, fresh water and medical resources through biodiversity to the entire living organism including human beings. Land is both a source and a sink of greenhouse gases (GHGs) and plays a key role in the exchange of energy, water and aerosols between the land surface and atmosphere. Land degradation is an issue of increasing global concern. It threatens not only the productivity of land but also water quality, human health and the fundamentals of ecosystems on which all life depend. Therefore, it is very essential to not only protect and prevent from degradation but also to increase its availability through reclamation. Nearly 30% of the surface of the Earth is terrestrial land, and 71 % Earth's terrestrial land is habitable. It has been estimated that, the world population will reach around 10 billion by 2050. This rapidly increasing population, coupled with rising levels of consumption, is placing ever-larger demands on land-based natural capital. The competition between the demands for land, land uses and its provisioning of goods and services is escalating. In India, 29.32 % of its total geographic area is undergoing the processes of land degradation. The cost of loss due to land degradation in our country is estimated around Rs. 3177.40 billion which accounts for 2.5% of India's GDP. Tackling land degradation required multi-dimensional preventive / combating methods with co-beneficial activities focusing on major land use sectors of our country which are significantly related to land degradation. In this context, it may be mentioned that, while plantation of suitable species could a major solution in forest and some part of scrublands, increasing soil quality by crop rotation/organic fertilizer treatment appropriate irrigation etc. would be a major combating method in agricultural land. Intrinsic to these measures, proper drainage treatment, conserving/ increasing ground water and water level etc are also key factors in preventing and mitigating soil and land degradation.

The global community has long recognized that land degradation / desertification is a major economic, social and environmental concern to many countries around the world. In view of increasing pressure on land resources and depleting quality of land, air, water and biodiversity, halting reversing land degradation became extremely important and the concept of Land Degradation Neutrality (LDN) evolved. Land Degradation Neutrality (LDN) is a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems. Sustainable Development Goals of Target 15.3 aims to achieve Land Degradation Neutrality (LDN) worldwide by 2030. The United Nations Convention to Combat Desertification (UNCCD) adopted LDN as the principle target of the Convention at COP12, in October 2015. This project supports 75 countries to establish national voluntary targets for LDN as a mean to sustainably increase food security, reduce biodiversity losses, and contribute to climate change adaptation and mitigation. Being a country party to UNCCD, India expressed its intention to join Land Degradation Neutrality Target Setting Programme (LDN-TSP). India hosted the 14th session of the Conference of the Parties to the UN Convention to Combat Desertification (UNCCD COP 14), during September 2-13, 2019. Hon'ble Prime Minister of India addressed the High Level Segment (HLS) of this Conference on 9th September, 2019 and announced Country's inspirational goal to achieve Land Degradation Neutrality and to restore 26 million hectares of degraded land by 2030. It is now at utmost importance of Govt. of India to strategies and figure out the way out to achieve this goal in the given time. Thus, being the Nodal Ministry from Govt.of India to carry out the activities related to UNCCD and to being responsible for monitoring, reporting and facilitating policy decisions related to Land Degradation issues to the Government, Ministry of Environment, Forest Climate Change has initiated to develop a National Action plan for Achieving Voluntary Land Degradation Neutrality Targets. As per the latest statistics, the area of degraded land of our country is 96.40 Mha which has been considered as the base line for measuring the progress towards achieving the national commitments related to land restoration. Base line year for measuring the progress of our Country towards achieving the land restoration related target is 2015. It has also been observed that, the area of degraded land in our country was 94.53 M ha in 2003-05. Thus, there occurred a cumulative increase of 1.87 M ha of degraded land in 8 years. Following the same trend, the projected area of degraded lands in India would be 100.37 M ha in 2030. It indicates that achieving above commitments involves halting the projected increase in degraded land area of 3.97 M ha (100.37-96.40 M ha) and restoration of additional 26 M ha by 2030. Thus, to meet its voluntary Land Degradation Neutrality target, India needs to reduce, restore and reverse land degradation in an area of approximately 30 M ha, i.e. 2 M ha per year from 2015 to 2030. It indicates that achieving above commitments involves halting the projected increase in degraded land area of 3.97 M ha (100.37-96.40 M ha) and restoration of additional 26 M ha by 2030. Thus, to meet its voluntary Land Degradation Neutrality target, India needs to reduce, restore and reverse land degradation in an area of approximately 30 M ha, i.e. 2 M ha per year from 2015 to 2030. To achieve this target, it is very important to strengthen the bottom up approach by enhancing and utilizing the indigenous and nature based solutions. This would help in reducing and reclaiming the degraded land in lesser time and more heterogeneous and discontinuous patches of lands which could facilitate a larger area to be restored. I hope that India will achieve the LDN target by 2030 by the integrated approach by integrating vast expertise in scientific and technical knowledge and experience in the field of conservation and restoration of land and ecology, soil-water and plant management coping up with extreme climate, developing livelihood options etc.,

Dr. Suraj Bhan
President SCSI

"Thang Bun": Indigenous practice of crop production in acid soils through *in-situ* biochar preparation cum application in North East India

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"*Jhum* cultivation" (SLASH-AND-BURN agriculture) is the most ancient and traditional system of subsistence farming practice followed by the ethnic communities. The *jhum* practice involves clearing and burning of vegetation followed by crop cultivation for two or more years before abandoning the land for restoration of soil fertility and resiliency, and moving to new site to repeat the same practice. *Jhum* system are predominantly practiced in most of the acid soils regions (basically humid regions), which ensures fast conversion of nutrients from plant biomass in the soil. This improves the availability of essential nutrients to a greater extent and reduces soil acidity during next cropping season, thus paving the way for better crop production. Hence, this might be one of the reasons that *jhum* cultivation became a common agriculture practice for acidic soils in the NEH region and some pockets in Eastern Ghats region of India. To overcome the low crop production difficulties,

temporally and spatially *jhum* system has undergone many local modifications, mainly soil and crop management

practices for improving soil fertility and to maintain crop productivity in *jhum* sites.

Thang Bun and in-situ biochar preparation cum addition

Thang Bun is an indigenous or traditional ancient agricultural method of land preparation and crop production system practiced by the ethnic communities in the Meghalaya, India, which helps in sustaining soil fertility while maintaining optimum crop productivity in the degraded *jhum* lands. This method produces and incorporates biochar to the soil on raised bed from slashed plant biomass during cultivation. During *jhumming*, the dried plant biomass obtained is heaped or pilled at 0.8 to 1.2 m width and 4 to 7 m length and this biomass is smeared with soil layer at top to give the shape of raised beds. The biomass is burnt under limited oxygen environment to convert (through thermo-chemical processes) it into charcoal (biochar). Before sowing/planting of crops, biochar is mixed in the soil beds. All dried plant biomass basically consist of small branches leaves, shrubs, herbs, grasses and pine needles (except wood logs and larger size branches) having less than 20mm diameter, obtained during clearing (slashing) of secondary forest for *jhum* cultivation are used for preparing raised beds. The plant biomass covered soil as a shield against oxygen supply and in the partial absence of oxygen (symbolises pyrolisis) plant biomass are converted into charcoal through carbonization process. During this method, unknowingly biochar is prepared and added in the raised beds for crop cultivation during 1st year *jhum* land preparation. This method of land preparation followed by burning is carried out from many centuries by the ethnic tribal communities (in Meghalaya, India) and locally called *Thang Bun*. For this method of bed preparation, biomass arrangement and burying process require highly skilful and experienced person, more man power as well as this method consume more time than the open burning practice. Hence, this practice is limited to small patch of land where recovery of soil fertility is not up the required level or less productive land (around 0.1 to 0.4 ha). Even though this process is laborious, currently this method is adopted in a large extent in short *jhum* cycles sites. Tribal farmers customarily carryout this method during the first year of the *jhumming* and many of them repeat this method during the next *jhumming* cycle. The repetition of this method in the second *jhumming* cycle depends on the period of *jhum* cycle. All tribes who conduct short *jhum* cycle (5-6 years) they opt this practice to get more yield than the long cycle (above 12 years).

Improved crop performance and soil properties

In the *Thang bun* method, the quantity of biochar added in the raised bed varied between 1.8 - 3.2 t ha^{-1} and depends on the fallow period duration. Under this cultivation the yield of zinger, potato and up land paddy was increased by 37, 29 and 72 %, respectively in comparison to open burnt *jhum* cultivation. The biochar prepared and incorporated into *jhum* soils and acts as an acid neutralizing agent and drastically improves physio-chemical properties in acidic soils. During *Thang bun* practice, the improved physio-chemical properties of soil like pH, CEC, bulk density, and essential soil nutrients showed significantly positive effects on crop yield and erosion control. The practice of *Thang bun* (addition of biochar) significantly improved the soil pH. Although the overall pH remained in the acidic range (4.73-5.52) but the improvement over control was significant. Under this burning method, significant improvement of the soil fertility parameters such as SOC, CEC and essential nutrients were recorded. In first year after burning, the net improvement observed in N,P,K and SOC was to the tune of 53, 187, 237 and 69%, respectively. The improved availability of essential nutrients in soil is a result of nutrient conversion from the plant biomass to soil media and changes in soil materials from heating. CEC also showed a significant improvement by 46% in first year of biochar treatment and thereafter slight downward trend (non-significant decrease).

Thang bun method applicability

In many other studies it is reported that crop residues become a good biochar. Hence, large scale adoption of this technology in acid soils of remote areas can effectively utilise the localised crop residues and saves energy and transportation costs. This practice shows that, ethnic communities knowledge on biochar preparation, soil acidity, soil fertility and their management using locally available resources for improving crop performance. This low cost ancient technology can be used to convert surplus slashed biomass into biochar through which soil can be enriched with nutrients specially potassium and large quantity of carbon could be sequestered annually in addition to achieving good yield. This traditional practice is the best example for the carbon negative technology and effective utilization of locally available resource for better crop production. This practice thrived many centuries due to multifunctional value, minor degradative effects and more productive technology. Presently, scientifically modified version of this practice can be taken for acid soil management. This information provides linking folk knowledge of *jhum* to scientific group in order to enhance more lights on acid soil management.

Nano Urea : New Revolution in Indian Agriculture

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SKUAST-J, Jammu

The production of more food to bridge the gap between the growing population and the declining cultivable land is the need of the day. To achieve the same farmer using various types of advanced technology and chemical fertilizers and especially urea to get maximum production. This leads to imbalance in mineral content of the soil's and decrease soil fertility. Large-scale use of chemical fertilizers causes irreparable damage to the soil structure and soil microbial flora and creates soil pollution, water pollution and air pollution and great damage to our eco-system. The annual consumption of urea in India is approximately 33 million tonnes. Generally a farmer uses two urea bags per acre. Keeping in view this, The Indian Farmers Fertilizer Cooperative Limited (IFFCO) launched the world's first nano-liquid urea (Nano urea) on May 31. It will serve as an alternative to traditional urea for plant nutrition. Nano urea is a revolutionary change in agriculture sector through increased in yield, water use and decrease pollution and huge saving in government subsidies. One bottle (500 ml) of nano urea is as effective as a 45 kg sack of traditional urea. While traditional urea has proved effective in delivering 30-40% nitrogen to plants, the rest goes waste due to evaporation and chemical changes between water and soil flow and erosion etc and the effectiveness of the nano urea liquid is over 80 per cent. Nitrogen present in nano urea can effectively meet the requirements of crops and thus increase crop yields by an additional 8%. Nano urea is also very beneficial from an environmental point of view. Traditional urea reaches the atmosphere or water sources and pollutes them and damages biodiversity, soil as well as human health. While nano urea protects the environment from damage by promoting efficient use and also makes crops healthy. Nano urea will also reduce India's import cost. The total production in the country in lieu of consumption of 3.36 lakh mT of urea in 2019-20 was 2.44 lakh MT. Thus, the balance was met by imports. If nano urea is used by farmers, it will help in reducing dependence on imports. In this way, it can also realize the slogan of **self-reliant agriculture and "Self-reliant India"**.

Nano technology is being used in all sections of development so the agriculture sector is also not untouched to it. Now, by using the same technology, IFFCO agricultural scientists have created a product that is now getting a sack of urea in liquid form in a bottle (500 ml). Nano materials improve the productivity of crops and efficiently regulate the delivery of nutrients to plants and targeted sites, guaranteeing the minimal usage of agrochemicals.

To improve the efficiency of the nutrients of crops, the urea produced by nanotechnology is called nano urea. Nano urea is the liquid (liquid) form of solid urea a bottle of 500 ml contains 40,000 ppm nitrogen, which provides nitrogen nutrients equivalent to a bag of normal urea. A nano urea liquid particle is 32 nano meters in size and and compared to the conventional granular urea it has about 10,000 times more surface area to volume size. Due to the ultra-small size and surface properties, the nano urea liquid gets absorbed by plants more effectively when sprayed on their leaves. As per weight one particle urea is equal to 55000 nano urea particles. **The size of the nano is** '1 nano meter' which is 'one billionth' of 'one meter'. And 1 inch has 25.4 million nano meters.

Features of Nano Urea

1. IFFCO Nano Urea is easily absorbed by plants by spraying on leaves due to its ultra-fine shape and superficial characteristics. These particles reach the parts of plants that require nitrogen and provide a balanced amount of nutrients.
2. Nano urea is available at a lower price than solid urea. The price of a bottle of nano urea has been fixed at Rs 240 (500 ml) which is 10 per cent less than the price of a bag of normal urea.
3. This liquid urea has been found to be effective and efficient for plant nutrition, which increases production with improved nutritional quality.
4. Reduces the requirement of urea by at least 50% .
5. Its transportation and storage is cheap and easy.
6. It improves the quality of crops.
7. Nano urea helps in improving the quality of ground water.
8. Plays an important role in reducing global warming.
9. The use of nano urea can lead to an additional increase in crop yield by 8 %.
10. It increases the Fertilizer use efficiency.
11. Easy to Use, miix with water and spray on the leaves of the plant .
12. Improve the quality of the produce.
13. Safe for soil, water and environment
14. Safe for flora, fauna and human being also.
15. Plants can absorb and use more efficiently due to very small size (nano size)
16. Controlled use and equal distribution in plant cells.
17. Increase farmers income
18. This will make India self-reliant in the field of urea.
19. Plays an important role in reducing the effects of global warming.

How to use nano urea

Nano urea is available in liquid form, so it is used in the same way as we use the pesticides. As per requirement 2 ml Nano urea mix with one litre of water and apply on plants at their critical stages. It can be used on types of plants.

Urea consumed in the country

Urea ranks first among fertilizers used in India and 82% Nitrogen consumed through urea in the country and is increasing year after year. Urea consumption is expected to reach 37 million tonnes during 2020-21. The country has consumed 33.536 million tonnes of urea in 2019-20. Out of this, 24.45 million tonnes of urea was produced in our country while 9.123 million tonnes were imported . Today, government pays a subsidy of ₹15,000 (approximately) per tonne of Urea . If 15 million tonnes of nano urea is used instead of conventional urea, the savings in fertiliser subsidy will be around ₹22,500 crore. This means a 28% reduction in the budgeted fertiliser subsidy of ₹79,530 crore in year 2021-22 which is a huge amount. IFFCO have plan to replace 13.7 million tonnes of granular urea with nano urea by year 2023 Now India will play a lead role in a new global green revolution.

The efficacy and productivity trials of nano urea were conducted under the National Agriculture Research System (NARS) at 20 Indian Council of Agricultural Research (ICAR) Research Institutes, State Agricultural Universities and Krishi Vgyan Kendras (KVKs). The successful trials were conducted over 11,000 farmer fields on more than 94 crops across India.

Jute Agro Textiles

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A geotextile is defined as any permeable textile material that is used with foundation, soil, rock, earth, etc. to increase stability and decrease wind and water erosion. A geotextile may be made of synthetic or natural fibers. Geotextile are mats composed of natural material or synthetic fiber that are used to cover bare soil and reduce erosion. Mats or net may be to stabilize soil for the establishment of vegetation. A geotextile is designed to be permeable to allow the flow of fluids through it or in it, and a geomembrane is designed to restrict the fluid flow (Mitchell *et al*., 2003).

Current research suggests that the composition of the geotextile does not dramatically affect performance capabilities. But advantage of the product is that due to its biodegradable in nature, the materials are more stable than mulching, (Benik *et al*., 2003). Geotextiles will most suitable on alfisol soil for moisture conservation and erosion control.

Natural fiber geotextiles degrade to form organic mulch and help in quick establishment of vegetation. Fiber options for biobased geotextiles include cereal fiber, coco coir, jute, flax, sisal, hemp, cotton, palm leaf, wood fiber and others. Different fibers will degrade at different rates e.g. coir geotextiles degrade in 1-2 years while jute degrades in 6 months -1years. Coir is therefore useful in situations where vegetation will take longer to establish, and jute is useful in low rainfall areas because it absorbs more moisture. Coir or jute can be used for water and wind erosion control, dust control, sand dune formation and stabilization. Jute is particularly useful for dust control because of the hairiness of the fibers (Adhikari *et al*., 2016).

Jute agro textiles are textile like materials of natural product of eco-friendly and biodegradable in nature and act as useful ameliorative towards alleviating soil related constrains of crop production and improve soil structural performance. Bio deterioration of cellulose fibre results from reduction at the polymerization leading to loss textile strength (Sarkar *et al*,. 2018). It also helps to protect the most vital natural resources of soil and water from various degradation processes by erosion of soil and runoff water. It plays a vital role in weed suppression, increasing moisture holding capacity in soil, improving water uptake and drainage capacity. It contains natural substances for plant growth and helps to serve and release of essential plant nutrients through lignin decomposition (Pine *et al*, 2013; Adhikari *et al*,.2018 and Sarkar *et al*,. 2018 & 2019).

Crop productivity in India remains unstable due to aberrant weather and soil related constants. Experimental evidence from research, however, shows the Indian soils are capable of producing more productive with appropriate soil and water management practices. Application of suitable ameliorative thus necessitates for improving the soil conditions towards increasing the crop productivity. In order to assess the effectiveness of jute agro textiles on the improvement of soil quality and enhancement of crop productivity,

Use of Jute Agro Textiles to improve water use efficiency and crop productivity and reduce erosion in alfisols under rainfed agro-ecosystem: Efficiencies of different strength of jute agro textiles on the improvements of soil

Fig. 1. *Jute Agro textiles Management on Maize, Groundnut, Green gram and Chilli crops.*

properties attributing yield of ground nut-bengal gram-green gram and maize-bengal gram-green gram cropping sequence have been investigated in the present study. Each of the each strength increased the higher yield associated with much increase of organic carbon and availability of phosphorous and potassium. Sharp improvements of bulk density, porosity, moisture use efficiency as well as better aggregation and well stabilization of soil aggregates as well as reduce erosion.

Fig. 2. *Jute Agro textiles Management on Brinjal, Tomato and papaya crops.*

Evaluating jute agro textiles as soil conditioner for vegetable and fruit production, water use efficiency under entisol and Inceptisols soil in India : Jute agro textiles could be effectively utilized for making favorable soil structure along with other soil properties towards yield component and better utilization soil moisture facilitating in yield of vegetables and fruits. So jute agro textiles found most efficient to keep the soil in favourable condition towards improving physical and chemical and biological condition, increasing nutrients and water availability in soil thus influencing improvement of crop production.

Vermiremediation of Soil Pollutants: An Innovative Approach for Converting 'Wasteland' into 'Wonderland'

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Earthworms have been found to remove heavy metals, pesticides and lipophilic organic micropollutants like the polycyclic aromatic hydrocarbons (PAH) from the soil. Vermiremediation using chemical tolerant earthworm species is emerging as a low-cost and convenient technology for cleaning up the chemically polluted/contaminated soils in the world. It is a self-promoted, self-regulated, self-improved, self-driven, self-powered, self-enhanced, low or no energy requiring zero-waste technology, easy to construct, operate and maintain. Any vermiculture technology involves about 100-1000 times higher 'value addition' than other biological technologies. Obtaining earthworms from vermiculture farms would be one-time cost in any vermiremediation technology as the earthworms multiply rapidly creating huge army of worms which further promote and enhance the process.

The earthworm assisted bioremediation (vermiremediation) approaches include direct application of earthworms to contaminated soils; co-application of earthworms to contaminated soils with another organic material, such as compost; application of contaminated media (soils) to earthworms as a part of feeding regime; indirect use of earthworms through its digested (composted) materials (vermicompost). Vermicast is high in degrader microbes and thus high in catabolic activities. It contains 32 million bacterial counts per gram as compared to 6-9 million/gram in surrounding soils.

Earthworms Species Suitable for Soil Remediation

Certain species of earthworms such as *Eisenia fetida, Aporrectodea tuberculata, Lumbricus terrestris, Lumbricus rubellus, Dendrobaena rubida, Dendrobaena veneta, Eiseniella tetraedra, Allobophora chlorotica and Pheretima Spp*. have been found to remove heavy metals, pesticides and lipophilic organic micro-pollutants from the soil. Keeping many advantages in view, the School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences of Central Agricultural University has already started research on vermiremediation technology by utilizing native earthworm species coupling with phytoremediation to enhance the efficiency of reclamation of heavy metals in the coal mined polluted soils of Jaintia Hills of Meghalaya.

Mechanism of Worm Action in Vermiremediation:

Within the soil environment, an earthworm's sphere of influence is known as the 'drilosphere system'. This incorporates the burrow systems, surface and belowground earthworm casts, internal earthworm gut and process, the earthworm surface in contact with the soil, and associated biological, chemical and physical interactions, in addition to the soil microorganisms.

Earthworms have both 'abiotic' and 'biotic' effects on contaminated soils in the remediation process. Abiotic effects are burrowing actions and the resulting burrows acts as inputs points and preferred pathways for water and particle movement, nutrient flow and aeration. This also results into mechanical breakdown of soil particles exposing greater surface areas for biotic action. During burrowing, worms ingest and digest large amount of contaminated soils. By digestion the size of the soil organic matter containing contaminants is reduced significantly thus exposing more surface area of contaminated soil for microbial action and remediation. The biotic effects are proliferation of degrader microbes (bacteria, fungi and actinomycetes) by the earthworms by their excretion in contaminated soil which includes urine, intestinal mucus, glucose and other nutrients. There are also direct biotic effects of earthworms in the form of 'feeding behaviours' upon contaminants fates in soil. Studies indicate that earthworms increase their oral intake of soil particles when driven by 'hunger stress.' There were total petroleum losses in contaminated soil where earthworms were not provided with any food. Hydrophobic organic contaminants are taken up by the earthworms in two ways: by passive diffusion from the soil solution through the worms' outer membrane; and by intestinal re-sorption of the compounds from the soil while it passes through the gut (by digestion) and then their degradation by enzymatic activity called 'Cytochrome P 450' system. This enzymatic activity have been found to operate particularly in *Elsenia fetida* which survive the benzo(a)pyrene concentration of 1,008 mg/kg of soil.

Earthworm uptake chemicals from the soil through passive 'absorption' of the dissolved fraction through the moist 'body wall' in the interstitial water and also by mouth and 'intestinal uptake' while the soil passes through the gut. The passive diffusion is driven by the difference between the pore water in soil and within the earthworm's tissues. The accumulation increases when the concentration of PAHs in their surrounding soil water or in their food increases Earthworms may take PAHs up through absorption by the body surface and also by feeding and ingestion, since PAHs sorb to the soil organic detritus, which the worms feed on. Earthworms apparently possess a number of mechanisms for uptake, immobilization and excretion of heavy metals and other chemicals. Earthworm either biodegrade or bio-transform the chemical contaminants rendering them harmless.

Advantages of Vermiremediation Technology

There are several advantages in using earthworms for bioremediation of chemically contaminated soils. Earthworms improve total quality of soil in terms of physical, chemical and biological properties. They have been shown to both 'retard the binding of chemical compounds with soil particles' and also 'increase compound availability' for microbial action while also enhancing the population of degrader microbes within the system.

Earthworms have the potential to be employed not only in the recovery of contaminated soils as a part of bioremediation strategy, but also in the subsequent improvement of that soil and the land as a whole, for other beneficial uses. Significantly, vermiremediation leads to total improvement in the quality of soil and land where the worms inhabit. Earthworms significantly contribute as soil conditioner to improve the physical, chemical as well as the biological properties of the soil and its nutritive value. They swallow large amount of soil every day, grind them in their gizzard and digest them in their intestine with aid of enzymes. Only 5-10 percent of the chemically digested and ingested material is absorbed into the body and the rest is excreted out in the form of fine mucus coated granular aggregates called 'vermicastings' which are rich in NPK, micronutrients and beneficial soil microbes including the 'nitrogen fixers' and 'mycorrhizal fungus'. The organic matter in the soil undergoes 'humification' in the worm intestine in which the large organic particles are converted into a complex amorphous colloid containing 'phenolic' materials. About one-fourth of the organic matter is converted into humus. The colloidal humus acts as 'slow release fertilizer' in the soil. During the vermi-remediation process of soil, the population of earthworms increases significantly benefiting the soil in several ways. A 'wasteland' is transformed into 'wonderland'. Earthworms are in fact regarded as 'biological indicator' of good fertile soil. One acre of wasteland when transformed into fertile land may contain more than 50,000 worms of diverse species.

(Vermiremediation of heavy metals from coal mined polluted soil in Jaintia Hills of Meghalaya)

SCSI-Meghalaya Chapter Observed World Environment Day

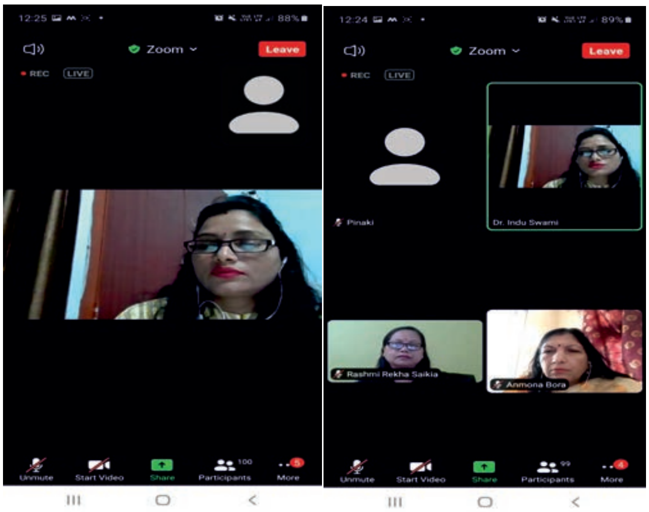
The Meghalaya Chapter of Soil Conservation Society of India observed 'World Environment Day' on 5th June, 2021 virtually by arranging a serious of lectures by eminent speakers. Dr. Sanjay Swami, Professor (Soils) & Chairman of the SCSI-Meghalaya Chapter, while welcoming the participants and resource persons informed that the Covid-19 pandemic has compelled them to organize this event in virtual mode. He added that the chapter is celebrating World Environment Day every year on 5th June to spread awareness among the people and encourage them to take some actions to protect the environment. This year's theme is "Ecosystem Restoration" with the slogan "Reimagine. Recreate. Restore", therefore, we need to prevent, halt and reverse the degradation of ecosystems in NEH region, including our farmlands and forests; our rivers and hills. More efficient, inclusive, resilient and sustainable agri-food systems can help restore ecosystems and safeguard sustainable food production, leaving no one behind. To dwell more upon the theme, the chapter has invited Dr. V.K. Khanna, Former Dean of the College of Post Graduate Studies in Agricultural Sciences, Barapani and Dr. Indu Swami, from Assam University, Diphu Campus.

Speaking on this occasion, Dr. Khanna highlighted the significance of celebrating environment day in present scenario. He said that the Covid-19 pandemic which we are facing with for almost 1.5 years now has shown how disastrous the consequences of ecosystem loss can be. By shrinking the area of natural habitat for animals, we have created ideal conditions for pathogens – including corona viruses – to spread. The fact remains that only with healthy ecosystems can we enhance people's livelihoods, counteract climate change and stop the collapse of biodiversity. He expressed his gratitude to Meghalaya Chapter of SCSI for inviting him to interact with the participants.

Continuing the series of lectures, Dr. Indu Swami emphasised the role of women in ecosystem restoration. She added that for too long, humans have been exploiting and destroying the planet's ecosystems. 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. Restoration can happen in many ways – for example through actively planting or by removing pressures so that nature can recover on its own. All kinds of ecosystems can be restored, including forests, farmlands, cities, wetlands, and oceans.

Historically, women played key roles in using and managing environmental resources. They are the primary users and managers of land, forest, water and other natural resources. Indigenous women have a special relationship to natural resources. Their cultures and practices promote a balanced, respectful use and preservation of natural resources so that future generations can meet their needs. Women and men use natural resources in different ways to meet their gendered roles and responsibilities, but they do not have the same access to decision making. Many women are unable to exercise their full potential in natural resource and environmental management due to discrimination, given their lack of training, status, land and property rights and capital. Moreover, women and girls are often excluded from efforts to restore planetary ecosystems. This despite the huge roles they play in agriculture, food security, nutrition, land management and all other uses of nature.

Looking at today's degradation through a social lens can help explain why biodiversity is declining and ecosystems deteriorating. More importantly, adopting this social perspective in the design of future restoration initiatives can help ensure that women and men, rich and poor, old and young, can all participate in and benefit from them. By restoring ecosystems, we can drive a transformation that will contribute to the achievement of all the Sustainable Development Goals.



Dr. Swami congratulated SCSI-Meghalaya Chapter team for organizing such a wonderful programme involving students, faculty members and farmers and inviting her to be a part of this.

The programme ended with the vote of thanks proposed by Dr. N.J. Singh, Secretary of the Meghalaya Chapter of SCSI, Barapani.

FORTHCOMING EVENTS

30th NATIONAL CONFERENCE ON "SOIL AND WATER MANAGEMENT TECHNOLOGIES AND CLIMATE RESILIENCE FOR AGRICULTURAL SUSTAINABILITY"

Dates : 18 (Thursday)-20 (Saturday) November 2021

Venue: Bhubaneswar, Odisha, India

	Themes
I	Soil and water management for enhancing productivity
II	Climate Change Impact on soil and water resources and mitigation strategies
III	Suitable measures for control of soil and water erosion
IV	Water conservation and water harvesting techniques for agriculture, horticulture and forestry
V	Smart conservation agriculture techniques for watershed management and socio-economic development for livelihood security
VI	Technological options for enhancing water use efficiency in irrigated agro-ecosystems
VII	Resource management and environment sustainability
VIII	Conservation agriculture techniques and integrated coastal Ecosystem for sustainable agriculture
IX	Policy issues for management of resources to ensure food, nutritional and livelihood security
X	Integrated nutrient management, soil health and organic farming to achieve sustainable agricultural goals
XI	Environmental and social impacts on soil, water and biodiversity conservation and management
XII	Innovative ICT applications and effective decision support systems to combat climate change, disasters and droughts

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