



# SOIL AND WATER CONSERVATION

Today

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## FROM THE PRESIDENT'S DESK



Amidst the global threatening COVID-19 pandemic, First of all, on behalf of Executive Council of the Soil Conservation Society of India (SCSI), I wish you all safe and healthy life and to follow precautions and guidelines to stay safe during corona pandemic.

The COVID-19, a global pandemic that caused many casualties and infected millions people worldwide, make us to rethink how governments, organizations, and societies around the world can work with minimum or without physical contact. Technologies like Artificial Intelligence, Big Data, GIS and Mapping, Location Technology and autonomous machines are playing a important role in responding to COVID-19 pandemic. In this war against this invisible enemy, drones plays a key role by helping authorities and people by surveillance, broadcast messages and information about lockdown measures, disinfect public spaces, delivering medical supplies and transport samples from hospitals to laboratories and many more uses in different ways to prevent further spread of the coronavirus outbreak.

Natural ecosystems and protected species are at risk during the coronavirus crisis. In many countries, environmental protection workers at national parks and land and marine conservation zones are required to stay at home in lockdown, leaving these areas unmonitored. Their absence has resulted in a rise of illegal deforestation, fishing and wildlife hunting. The stoppage of ecotourism activity has also left natural ecosystems at risk of illegal harvesting and encroachment. In addition, as ecotourism is often a major economic mainstay in many destinations, rising unemployment caused by the crisis may lead many households to harvest resources from fragile ecosystems unsustainably as they seek alternative means to provide their households with food and income. Many of the environmental challenges caused by the coronavirus crisis will gradually resolve on their own once the crisis comes to an end and previous levels of economic activity resume.

This pandemic has left us to re-orient our strategies for conservation of natural resources which we have exploited to large extent during last five decades. "Nature is sending us a message with the coronavirus pandemic and the ongoing climate crisis" The global tragedy of COVID-19 necessitates a paradigm shift in the thinking of the daunting challenge of the sustainable management of finite and fragile natural resources. The global



soil resource, and its management for food and nutritional security through adoption of nutrition-sensitive agriculture, is an example of the need for protecting and managing a precious resource, which must never be taken for granted. Not only should food be produced by using conservation-effective strategies of "producing more from less," the waste must also be minimized. The sustainable management of soil is essential to achieve sustainable developmental goals like Zero Hunger, Good Health and Wellbeing, Clean Water and Sanitation, Climate Action and Life on Land.

During the last three months under pandemic, the days like World Earth day, World Environment day and Biodiversity day are engulfed forcing us to re-think of the environmental degradation and re-pace developmental projects to match with the ecological situations.

COVID-19 is the most urgent threat facing humanity today, but we cannot forget that climate change is the biggest threat facing humanity over the long term, as per UN. Carbon dioxide remains in the atmosphere and oceans for centuries. This means that the world is committed to continued climate change regardless of any temporary fall in emissions. Climate change scenario will call for change in

the practices to mitigate the adverse effects. It is a proven fact that soil function improves with soil carbon and soil carbon sequestration is beneficial for the environment as a whole. Carbon sequestration is important in climate change adaptation efforts as it is directly related to agriculture productivity. Leaders and experts around the world are calling for a profound, systemic shift to a more sustainable economy that works for both people and the planet.

At this juncture we should also think of soil health as health of human, animals and plants is directly dependent on healthy food from healthy soils. This demands a holistic management policy for soil and water conservation by linking social and economic development while protecting the natural ecosystem.

It is expected that every citizen, associations and government as well as non-governmental organizations should learn from the present situation and act for conservation and protection of natural resources and habitats for sustaining ecological balance to avoid such situations to reoccur.

Dr. Suraj Bhan  
President SCSi

## THE WORLD FOOD PRIZE



Dr Rattan Lal, native of India and a citizen of the United States, received the 2020

World Food Prize for developing and mainstreaming a soil-centric approach to increasing food production that restores and conserves natural resources and mitigates climate change.

Over his career spanning more than five decades and

four continents, Dr. Lal has promoted innovative soil-saving techniques benefiting the livelihoods of more than 500 million smallholder farmers, improving the food and nutritional security of more than two billion people and saving hundreds of millions of hectares of natural tropical ecosystems.

Soil Conservation Society of India extends heartiest congratulations to Dr Rattan Lal on this achievement. The Society feels proud as Dr Lal has been associated with the Society activities.

## "TIME FOR NATURE" WORLD ENVIRONMENT DAY CELEBRATED

On 5th June, 2020, The World Environment Day was celebrated by the Meghalaya Chapter of Soil Conservation Society of India with full zeal and enthusiasm. While informing the gathering, Dr. Sanjay Swami, Professor (Soils) & Chairman of the SCSi-Meghalaya Chapter, elaborated that the World Environment Day was taken by United Nations in 1974 to spread awareness among the people and encourage them to take some actions to protect the environment. Since its inception, this day is celebrated every year on 5th June. The occasion provides an opportunity to broaden the "basis for an enlightened opinion and responsible conduct by individuals, enterprises and communities in preserving and enhancing the environment." Every year, the campaign is raised around a theme in order to draw attention towards pressing environmental issues. The year's theme "Biodiversity" with the slogan "time for nature" urges us to appreciate and celebrate our rich biodiversity and reflect on our association with nature. He said that people depend on biodiversity in their daily lives, in ways that are not always apparent or appreciated. Human health ultimately depends upon ecosystem products and services such as availability of fresh water, food and fuel sources which are requisite for



good human health and productive livelihoods. Biodiversity loss can have significant direct human health impacts, if ecosystem services are no longer adequate to meet social needs. Indirectly, changes in ecosystem services affect livelihoods, income and local migration. He further stressed that the North Eastern Hill (NEH) region is home to many tribal communities who are directly dependent on nature for food, fodder, fuel, medicine, and other means of livelihoods. We all know that NEH region is threatened by habitat degradation and biodiversity loss. These threats have been exacerbated by the current complex challenges of COVID-

19 pandemic and we need to garner all resources to promote nature-based solutions that can help us build back better in a post-pandemic world.

A plantation drive was also initiated by the members of SCSI-Meghalaya Chapter in the College of Post Graduate Studies in Agricultural Sciences Campus, Barapani. Around

100 fruit plant sapling were distributed in and around the campus. Member also took pledge to save the resources and reconnect with nature. Dr. Swami congratulated SCSI-Meghalaya Chapter team for organizing such a wonderful programme involving students, faculty members and farmers.

## Brain Storming Virtual Session on “Combating Desertification and Drought for Food, Feed and Fiber”, 17 June 2020 organized by ISCO & SCSI

On the occasion of UN World Day to Combat Desertification and Drought, on June 17, 2020 a virtual brain storming session on “*Combating Desertification and Drought for Food, Feed and Fiber*” was organized by International Soil Conservation Organization (ISCO) and Soil Conservation Society of India (SCSI), New Delhi with its main focus on changing attitudes to the leading driver of land degradation and desertification vis-à-vis humanity’s relentless production and consumption. UNCCD has this year emanated the theme as ‘Food, Feed and Fiber’ emphasizing on sustainable production and consumption from the land resource.

This virtual brain storming session was inaugurated by Prof (Dr) Rattan Lal, World Food Prize 2020 laureate & Director, Carbon Management and Sequestration Centre, The Ohio State Univ., USA. Initially Dr. Suraj Bhan, President ISCO & SCSI welcomed the speakers and expressed gratitude to Dr Rattan Lal and other dignitaries for joining the session. In his welcome address Dr Bhan emphasized on management of land and the need of land consolidation policy with proper guidelines involving all stake holders for better adoption of climate resilient practices. Further, proper land management through site specific techniques are needed to avoid land degradation and desertification vis-à-vis combating droughts.

In his inaugural address Dr Rattan Lal emphasized on Food security in South Asia stressing on soil-centric approach through integration of advanced climate resilient techniques resulting and rejuvenating soil health. Prof. Ildefonso Pla Sentis, Ex-President ISCO from Spain in his Keynote presentation elaborated on the Land Desertification Processes under the New Extensive Agricultural Developments for Industrial Crops. Dr. O.P. Yadav, Director, ICAR-CAZRI, Jodhpur emphasized on Sand dunes stabilization and ecosystem services –An experience in arid zone towards combating desertification. Dr. Anil K. Singh, Secretary NAAS & Ex-DDG(NRM), ICAR gave an overview on Link consumption and Land - Regenerative Agriculture: Heal the land –Heal the

people. Dr. B. Venkateswarlu, Ex-Director ICAR-CRIDA, Hyderabad shared his experiences on Drought Management in India – Issues and Way Forward. Dr. P.R. Ojasvi, Director, ICAR-IISWC, Dehradun presented on Breaking the Land Degradation and Desertification Nexus. Dr. C.R. Hazra, Ex-VC IGKV, Raipur & Director ITSL, stressed on crop diversification in mitigating drought for sustainable farming. Prof. S.H.R. Sadeghi, President, WMSI, Iran presented on Proper Soil Conservation Strategy. In the discussions, it was summarized as to overcome existing myopia in management of soil and water resources, adequate, efficient and promising scientific gatherings are vital to bring as many as scientists, NGOs, societies, academicians and even individuals around a table to elucidate scientifically based practical perceptions as well as solutions to convince politicians, decision makers, planners, practitioners and even end users for appropriate fulfillment of their needs and expectations to holistically conserve soil and water resources as precious heritage for the next generations.

Now is the time when we all have to follow UNESCO’s motto said many years ago that we had to think globally and act locally. Towards achieving sustainability in soil and water resources management, close monitoring of ecosystem behavior and detailed evaluation of the outcomes; meeting the immediate food needs of the vulnerable populations; boosting social protection plans; increased efficiencies and improved productivity through 1) monitoring based approaches, and 2) adaptive management of the resources at watershed scale is recommended.

In the Virtual Brain storming session, participants viz. Dr Anshuman Kohli, Dr. K.S. Reddy and Dr A.K. Bhardwaj expressed their views and exchanged ideas with the speakers and other participants in the Open discussion session. Overall there were 87 participants and the during the end of 4 hour long session, Dr. Sanjay Arora, Organizing Secretary and moderator of the Session proposed vote of thanks to all the participants.

## SOIL AND WATER CONSERVATION WITH REFERENCE TO CLIMATE CHANGE

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United Nations Framework Convention on Climate Change (UNFCCC) defines “climate change” as: ‘a change of climate which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere and which

are in addition to natural climate variability observed over comparable time periods. It is any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer.

Main reason for climate change is the change in gaseous composition of earth's atmosphere. It is happening mainly due to increased emissions from different sectors viz. energy, industry and agriculture sectors. Widespread deforestation, changes in land use, land cover and land management practices are also responsible for climate change. It is to be noted that climate change is not a myth; it is happening. It is significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. When we talk about climate change we really need to be concerned on the fact that **climate change affects development and development affects the climate**. So, we need to revisit, rethink and possibly redesign the parameters of development especially from the point of view of environment. We really need to have a relook at our technologies whether carbon emitting or sequestering, and to what magnitude?

The consequences of climate change could be variation in temporal and spatial water availability (Surface Water as well as ground water), frequent occurrence of flood and drought (Intensity, Frequency and Magnitude), higher glacier retreat rates, reduction in snow precipitation, sea level rise (sea water intrusion in coastal areas) etc. Global warming is leading to change in climate. As temperature increases so does the process of evaporation. In addition the moisture holding capacity of the atmosphere increases with temperature. For every 1°C increase in global temperatures there is a 7% increase in the moisture holding capacity of the atmosphere. Now, rainfall intensity should increase at same rate as increases in atmosphere moisture (7% / degree C), hence, more moisture in the atmosphere ultimately leads to changes in rainfall patterns (<http://www.waterandclimatechange.eu/evaporation>). More rain is expected over high-latitude land areas while less over equatorial regions. Tropics and subtropics regions are expected to receive less runoff. This coincides with the existing water stress in tropical and subtropical regions. Overall less frequent but more intense floods and droughts will occur, which will lead to water shortage. In Chhattisgarh, the climate in many districts is becoming semi-arid. In general the state is moving from a wet to dry climate (Department of Agrometeorology, IGKV). The situation may put additional pressure on already overexploited aquifers due to want of irrigation water. One of the solutions to these problems is Storage (Ground water or Surface water) through adoption of soil and water conservation measures. Government has taken suitable measures by creating series of anicuts and check dams in the nallahs and rivulets. Another solution could be the wetland conservation and its judicious management.

Climate change is also responsible for extreme weather events, which is creating environmental hazards, accelerated rate of soil erosion, and also threatening the agricultural production. Increase in soil erosion rates will reduce productivity. Climate change, in addition to the ever bursting population threatens the food security and presents one of the biggest challenges before agriculture. Looking to the alarming situation Indian Council of Agricultural Research (ICAR) has launched a major network project, National Initiative on Climate Resilient Agriculture (NICRA) during

February 2011 to undertake strategic research on adaptation and mitigation, fill critical research gaps, and demonstrate technologies on farmers' fields to cope with current climate variability and capacity building of different stakeholders. Interventions under NICRA leading to Soil and Water Conservation are in-situ moisture conservation, biomass mulching, residue incorporation instead of burning, brown (Animal) and green (Plant) manuring, water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage, artificial ground water recharge and water saving irrigation methods.

Current estimate of soil loss in the country is around 5000 M tons yr<sup>-1</sup>. This will account for loss of millions of rupees when converted in terms of nutrient. Now, with more intense floods due to climate change this estimate is further going to increase and agriculture situation going to worsen. Additionally, climate change can increase the potential for higher erosion rates, which is also of concern because erosion has been reported to lower agricultural productivity by 10% to 20% (Quine and Zhang 2002; Cruse and Herndel 2009). Since there is direct relationship between soil and water conservation practices and agriculture productivity, it is confirmed that without the application of appropriate soil and water conservation measures, it will not be possible to increase the agriculture productivity to feed the growing population. Solution lies in the soil and water conservation measures; which can be broadly classified based on land slope as agronomical/biological measures and engineering/mechanical measures. In agronomical measures (when slope is less than 2 percent) efforts are made to conserve soil by crop rotation, inter cropping, mixed cropping etc. The vegetative measures may include use of cover crops, diversification in cropping systems, shift from annual crop to perennial crops, use of organic soil amendments (brown and green manure), grazing field management etc. Climate change scenario will call for change in the practices to mitigate the adverse effects. It is a proven fact that soil function improves with soil carbon and soil carbon sequestration is beneficial for the environment as a whole. Carbon sequestration is important in climate change adaptation efforts as it is directly related to agriculture productivity.

In engineering/mechanical measures, suitable structures are designed and constructed at suitable sites utilizing locally available materials. These structures could be temporary or permanent depending upon the slope to be stabilized for having a check on soil erosion and water harvesting. The design consists of hydrologic design, hydraulic design and structural design. Hydrologic design is carried out by considering a rational recurrence interval (R.I.) of a particular magnitude-frequency-duration of rainfall. Based on that hydrologic design the peak flood and time to peak to be handled by the structure is ascertained. Now, with changing climate scenario, more intense floods are being expected. This may call for higher recurrence interval than the standard to mitigate the consequences of climate change. Higher recurrence interval will lead to have hydraulic and structural design on higher side for additional factor of safety. With enhanced dimensions and strength, the cost of soil and water conservation is definitely going to increase. On the

other hand, in hilly areas the life of existing bench terraces and other structures is also going to be shortened as it will not be able to accommodate more intense precipitation. This establishes the fact that **climate change affects development and development affects the climate.**

The challenges of climate change mitigation and adaptation can be met by maximizing soil and water conservation. This will also enable to develop sustainable systems. Soil and water conservation needs for climate change mitigation and adaptation includes prevention of soil erosion, creation of irrigation infrastructure, adoption of modern irrigation practices for increasing irrigation efficiencies, soil and crops management to increase water-use efficiencies,

diversification of cropping systems, developing drought-tolerant crop varieties, developing secondary storage at farmers field (Small farm reservoir), resynchronization of agricultural operations matching with the shifts in rainy season, carbon sequestration, awareness and valuation of agricultural produce with their respective water and carbon footprint and precision agriculture. To conclude, a sound scientific approach incorporating the concepts of agronomy, soil science and soil water conservation is needed to build and maintain sustainable agricultural production systems.

## HYDROPONIC PRODUCTION TECHNOLOGY – A POSSIBLE WAY TO ENSURE LIVELIHOOD SECURITY BY FODDER PRODUCTION IN WATER RESOURCE POOR AREAS

Sanjeev Kumar Gupta, Anshuman Kohli and S. R. Choudhary

At present, the country faces a net deficit of 35.6% green fodder, 10.95% dry crop residue and 44% concentrate feed ingredients. The demand of green and dry fodder will reach to 1012 and 631 million tonnes of by the year 2050 (*Vision document-2050, ICAR-IGFRI, Jhansi*). About 143 M ha an area is under cultivation in India but only 8.4 m ha (5.1 %) area of the total cropped area under forage cultivation. There is no shortcut to sustain livestock husbandry without focusing the issue related to the development of fodder and feed resources in the country. At the current level of growth in forage resources, there will be 18.4% deficit in green fodder and 13.2% deficit in dry fodder in the year 2050. India's livestock sector is one of the largest in the world, livestock population is around 529.7 million. Only large farmers (< 5 %) grow any fodder, small and a marginal farmer depends on crop residues for feeding the livestock. Forages are considered to be the most palatable, economical and nutritious animal feed resource for livestock particularly for dairy animals (*Iqbal, 2015*). Fodder production and livestock feeding are the two important aspects for the sustainability of products and productivity in animal husbandry. Feeding goats according to their requirement and avoiding wastage is the basic point in exploiting the production potential for economic growth and sustainability since feed costs are the dominant parts of production that accounts more than 70%. To resolve livestock's nutrient deficiency, supplementation of inferior quality roughages with hydroponic green fodder coming up as a practical approach for improving roughages utilization and digestibility. In India, a limited research has been done on feeding value of hydroponic fodder for small ruminants. Therefore, the Nutritional benefit and economic values of feeding hydroponically grown maize and barley fodder for livestock. As green-fodder is an integral part of the dairy ration, in situations, where fodder cannot be grown successfully or the modern progressive dairy farmer, who wants in his dairy fodder production along with elite dairy herd, green-fodder can be produced hydroponically for feeding animals.

In India, production of various food items has increased many folds during the last five decades. However, a substantial part of the Indian population still faces challenges of malnutrition and of under nutrition related chronic diseases, which are acute among infants, children and women. India, being a country in the developmental transition, faces dual burden of pre-transition diseases like under nutrition and infectious diseases, as well as post-transition, lifestyle-related degenerative diseases such as obesity, diabetes, hypertension, cardiovascular diseases (CVDs) and cancer. According to the National Family Health Survey (NFHS) and UNICEF Reports (2006), 46% of the pre-school children and 30% of the adults in India suffer from moderate to severe protein-calorie malnutrition, as judged by the anthropometric indicators. Presently available health foods or nutritional supplements in the country are expensive and beyond the reach of the common man. Under such circumstances, there is a need to develop foods for health promotion from the locally available raw materials. These foods when routed through public distribution system will reach masses and will resolve for a long-term the prevailing problem of malnutrition and food-related health issues. Prior to promoting the developed health foods, it is important to conduct clinical trials to ascertain their safety and efficacy, and for that an appropriate regulatory framework needs to be established in the country. Taking into consideration all these facts, to undertake research on the development of health foods through consortium- mode by



networking related institutes and departments. It is expected that research efforts would help development of safe and cost-effective health foods to strengthen national nutritional security at the household level.

### What is Hydroponic Technology?

Hydroponics technology involves growing of plants without soil. Hydroponics green fodder is being regularly produced in greenhouses under the controlled environment. For maize-seeds, soaking time of 4-8 hours is sufficient. Hydroponics green-fodder looks-like a mat, consisting of roots, seeds and plants. About 5.5 kg and 6.5 kg hydroponics green-fodder was produced from each kg of yellow maize and white maize, respectively. Hydroponics green-fodder contained more crude protein (14.6 V/s 10.7%) and less crude fibres (14.1 V/s 25.9%). Intake of hydroponics green-fodder by dairy animals was up to 18-20 kg/ animal/ day. Dry matter digestibility of the hydroponics green-fodder maize based ration was higher than the conventional green-fodder (Hybrid Napier)-based ration in dairy cows and heifers. We used the seeds of barley and wheat, barley is considered the seed of choice for production of hydroponic fodder. Seeds of this crop are inexpensive and freely available in the Indian market. We also used wheat seeds with interesting results. The seeds of these crops (around 1 kg each) were placed in small plastic trays which were arranged in a shelf system made of bamboos. The choice of bamboo instead of aluminum or steel was to make this economically viable and adaptable by any Indian farmers.



### Why Hydroponic Fodder?

Today, hydroponics is an established branch of agronomy as well as soil science. There are two chief merits of the soil-less cultivation of plants. First, hydroponics may potentially produce much higher crop yields. Also, hydroponics can be used in places where in-ground agriculture or gardening is not possible. In natural conditions, soil acts as a mineral nutrient reservoir but the soil itself is not essential to plant growth. When the mineral nutrients in the soil are dissolved in water, plant roots are able to absorb them. When the required mineral nutrients are introduced into a plant's water supply artificially, soil is no longer required for the plant to thrive. Almost any terrestrial plant can grow like this. This method of growing plants using mineral nutrient solutions, in water, without soil is known as hydroponics. It is possible by Hydroponic techniques to achieve better than normal farm production, immune to natural weather variations, as well as organic and more nutritive, in just about 5% of the space & 5% of the irrigation water. Some of the reasons why hydroponics is being adapted around the world for food production are the following:

- No soil is needed
- The water stays in the system and can be reused; thus, lower water costs.
- Stable and high organic production.
- Immune to weather
- Pests and diseases are easier to get rid of than in soil because of the container's mobility
- Energy and labour saving
- It is easier to harvest

### Production of Conventional green fodder V/s. Hydroponic green fodder *Benefits of Hydroponics Technology*

Adequate attention is not being given to production of fodder crops due to increasing pressure on land for production of food grains, oil seeds and pulses. In order to meet this increasing demand for green fodder, the next best alternative is Hydroponics Fodder to supplement the meager pasture resources. Some of the benefits of hydroponic fodder production being-

1. Gives grower effective control over the environment, yields are very predictable and root zone aeration as well as adequate porosity of medium is ensured.
2. Hydroponic nutrient solutions can be tailored to the plant's requirements, whereas in the field there is a tendency to over or under-fertilise.
3. Hydroponic produce has all the macro-micronutrients that are needed by the human body.
4. Hydroponics can reduce irrigation water usage by 70 % to 90 % by recycling the run-off water.
5. As water becomes scarce, and important as a resource, the use of hydroponics and other water saving technologies is needed now and is poised to increase in time.
6. Fungal disease can be significantly reduced through controlled humidity.
7. Hydroponics eliminates the possibilities of root diseases by allowing sufficient porosity for drainage of excess water as well as increases oxygen availability to the root zone.
8. Weeds are a major problem in Soil cultivation and calls for the use of harmful herbicides. Most farmers spend an enormous amount of money on labour for weeding.
9. All labour inputs associated with soil management, such as digging and weeding are eliminated with hydroponics.
10. The use of Integrated Pest Management (IPM) in protected environments is ideally suited to hydroponic growing techniques, especially when carried out in a protected environment such as a glasshouse or plastic/polythene tunnels.

The challenge here is to produce a system viable and adaptable throughout the year in a cost effective and energy sustainable manner. Producing green fodders under controlled conditions is economical and suitable for adoption by this country. There exists a great need for scientists and engineers across the globe to take up research in this challenging and interesting field for application in hydroponics. With increased pressure on farm lands to produce increasing needs of food grains, providing green fodder and vegetables by hydroponics growing is a necessity for the Indian farming community.

## NATIONAL SEMINAR ON LANDSLIDE MITIGATION AND SLOPE MANAGEMENT ORGANIZED

### Inaugural Session

The two days National Seminar on Landslide Mitigation and Slope Management has been inaugurated by Dr J Radhakrishnan, IAS, Principal Secretary & Commissioner of Revenue Administration, Disaster Management & Mitigation, Government of Tamil Nadu on 28.02.2020 at 10.30 AM in Hotel Preethi Classic Tower, Ooty. The Chief Guest released the Book of abstract cum souvenir of the national seminar and the Policy paper on Application of Jute Geo-textiles for sustainable management of hill slopes published by IISWC. In his inaugural address he emphasized the need of research on landslide prone areas to evolve early warning system using the latest technological advancements. He also said that a detail study is needed on the land use pattern, conversion of farm lands for construction of hubs, erecting buildings in steep slopes, storm water drainage, sub soil water flow and the slope stability factors in vulnerable areas to control the landslides or minimize the effects. He appealed the scientist to ensure the community participation along with administration for landslide mitigation and slope management and the recommendations of the Seminar should be shared with all organizations for their Research and Development action plan for landslide mitigation. He also appreciated the efforts of IISWC, RC, Udthagamandalam for organizing the seminar.

Smt. J. Innocent Divya, IAS, District Collector, The Nilgiris, in her address informed that the land slide prone areas has shot up to 283 now from 101 a decade ago. She added that stopping of slope destabilization and conserving soil texture are vital for slope management and land slide mitigation. She further said that Nilgiris which is the core centre of the Nilgiris Biosphere Reserve, the first of its kind in the country, has a complex eco system that is vital for water sources, nature, air quality, horticulture and wild life conserving the ecology of Nilgiris is very crucial which is also a challenging task. Steps should be taken to prevent slope destabilization as weak slopes would lead to landslides and other related disasters while geo-jute technology, vegetative measures and other technological aides are being used to stabilize the slopes. Shri Amitava Kundu, DDG, Geological Survey of India, Chennai has delivered the Key note address during the occasion and gave presentation on the land slide susceptibility mapping being done by GSI across the country and the need to study the geo-dynamics and geo-stability of the slopes



for better understanding to develop a region specific early warning system to evaluate people during landslide. Dr S.K Dubey, Head IISWC, RC, Agra delivered special address in the inaugural function.

Dr. S. Manivannan, Convener and Chairman of Tamil Nadu State Chapter of SCSi briefed about the back ground and themes of National Seminar. He said landslide is one of the common natural as well as manmade hazards in mountainous terrains, which happen without any warning and cause huge loss of life and property across the world. Unplanned developmental activities make a hillside unstable and thus trigger landslides during heavy rains. On other hand, managing the slopes in landslide prone areas is a complex affair that requires systematic and advanced technologies. He further informed that about 41 research papers including lead papers on landslide mitigation and slope management will be presented during the Seminar under four technical sessions. He added that Scientists, Academicians, NGOs, Policy makers, Farmers representatives, Extension functionaries and Research Scholars from various a part of the country are participating in this seminar and seminar will provide platform for national interaction, visioning and developing a pragmatic roadmap for sustainable ecological development in Indian hill regions. The inaugural function was ended with vote of thanks proposed by Dr. K Kannan, i/c Head, ICAR-IISWC, Regional Centre, Udthagamandalam.



### Outcome of the Technical Sessions

Oral presentations and poster presentations on various topics related to landslide occurrence, mitigation and slope stabilization measures. In four technical sessions, deliberations were carried out.

**Theme 1:** Land slide Assessment and Impacts

**Theme 2:** Land slide mitigation, Slope Mechanisms and

## Geotechnical Engineering

**Theme 3:** Soil and Crop Management in Sloppy and Plateau Region

**Theme 4:** Policy issues on land slide mitigation and management

### Recommendations

- Identification of No construction / green zone and prepare the map and to be made available with all departments. Maximum slope to be permitted for construction should not exceed 30 % in land slide hazard zones and areas falling on spring lines
- Vertical cutting in hill slopes for construction of buildings and roads should not be allowed without adopting suitable measures. Slope while road construction should not exceed 42.5 to 45 degree.
- Encroached drainage networks in hilly regions or landslide prone areas needs to be rehabilitated to facilitate free surface flow during extreme event of rainfall
- Desilting of drainage network has to be done at original capacity in all hill regions
- Policy intervention required to construct the new roads and suitable mechanism to be derived to get the clearances from expert institutions before implementing new road projects.
- 20 Metre buffer zone needs to be maintained with vegetation on either side of roads and drainage lines.
- Introducing corporate social responsibilities for larger industries in drainage line treatments works.
- Pre or early warning system of disaster to prevent risk using mobile based modern techniques
- Centralized early warning system needs to be developed in all landslide prone areas
- Reviewing the design considerations of landslide mitigation structures based on current climate change impact needs to be addressed (i.e. high intensity of rainfall over short span of time).
- For slope stabilization processes suitable grasses are to be established along the slope to arrest landslide with the support of Jute geo-textiles
- Necessary of incorporation of application of natural fibre based or Jute geo-textiles in the schedule of rates for concern states is recommended.
- Identification of landslide vulnerable areas using remote sensing and GIS in micro scale is need of the hour.
- Low cost mechanical slope stabilization measures needs to be standardized.
- Rehabilitation of land slide affected areas in pilot scale project needs to be established in all representative locations in various states.
- Eco friendly housing systems needs to be developed and

recommended for hill zones

- There is the need for identifying risk transfer mechanism in case of land slide disaster
- Creating awareness among the masses about the ensuing disaster if the regulations are not followed (i.e. construction nearby steep slopes, improper farming along the slopes)
- Regional level capacity building needs to be imparted for all stake holders

### Valedictory Session

National Seminar on Landslide Mitigation and Slope Management organized jointly by Tamil Nadu state Chapter of SCSi and ICAR – Indian Institute of Soil and conservation, Regional Centre, Udthagamandalam was concluded on 29<sup>th</sup> February 2020. The valedictory function of the seminar was held on 29<sup>th</sup> February 2020 at Hotel Preethi Classic Tower, Udthagamandalam. The Chief Guest Smt. J Innocent Divya, IAS, District Collector, The Nilgiris distributed the awards to the winners of best oral and poster presentations and delivered valedictory address. In her valedictory address she appealed all the scientists that the research findings not only preserved in the organisation and scientists must transfer to the various stakeholders for its adoptability. The complicated science behind landslide should be converted in easy understandable by common people which will bring awareness among the stakeholders. The collector emphasized that there is the need to amend the existing acts in various aspects to protect the biodiversity of Nilgiris Biosphere and the district administration is taking all the measures to identify the land slide susceptible areas and declared as green zones.

Dr B Sridhar, Dean, Agricultural Engineering College & Research Institute, TNAU, Coimbatore was guest of honour and deliver the special address. He appealed that the Nilgiri District is the vegetable cultivated areas and needs to be adopted proper soil and water conservation measures to prevent landslide and mass erosion.

Dr S Manivannan, Chairman – Tamil Nadu State Chapter of SCSi had briefed the proceedings and recommendations of the seminar. He informed that totally there were 31 oral presentations and 15 poster presentations on various topics related to landslide occurrence, mitigation and slope stabilization measures. He further informed that the recommendations were arrived under broad categories namely policy issues, researchable areas and advanced technologies for land slide mitigation and slope management and these recommendations will be submitted to central and state government agencies for its wide application. Dr. K Kannan, I/C Head IISWC, RC, Ooty welcomed the gathering. Dr V Kasthuri Thilagam, Organizing Secretary proposed vote of thanks.

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Dr. Suraj Bhan, Dr. Sanjay Arora and Dr V.K. Bharti

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