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# SOIL AND WATER CONSERVATION Today

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## IN THIS ISSUE



International Decade of Soils 2015-2024

## FROM THE PRESIDENT'S DESK

Managing land degradation to meet basic human needs for food , fiber, feed and fuel is no doubt serious challenge to our ability to do so in future.

Large scale structural shifts such as climate change urbanization, population growth, large scale natural resources extraction, commercial agriculture, amongst others intensify pressures or existing land resources. In order to counteract these trends land degradation neutrality is a positive aspiration goal which entails (a) adopting sustainable land management policies and practices to minimize unsent and avoid future land degradation and (b) rehabilitating and abandoned lands. This could effectively in uses the pool of resources available while reducing detrimental impacts from environmental degradation, on health, livelihood and well being.

Everybody should emphasise the sustainable land management to save the land which is the very foundation of our lives. However we are destroying the foundation of life. Deforestation heavy use of chemical fertilizers and human activities are degrading land. Chemicals are damaging nature's productivities causing lower crop yields while unsustainable mining is turning green groves into deserts of dust. It is fact that we have treated the soil with disrespect. Any repeated use of land which does not allow it time to regenerate causes it to degrade. This includes deforestation, mining and unsustainable agriculture where you are not allowing nutrients to reduces to the soil and you are disturbing the soil structure and profile. All these activities disturb the nature balances. If we keep taking from the soil without giving back anything land degradation will finally harass us.

There are multiple ways we can all contribute. we may focus on lot of left over organic waste material is wasted which may be get composted for adding nutrients to the soil and also join tree planting initiative. These measures help protect land. We need to emphasise the important of soil in our education system as well so

that we understand how we depends on this for our very survival. Soil gives us food and enable climate regulation. We can not approach soil with sort term manner. We must treat land with greater respect. Conserve the soil will conserve the future of humanity and help with restoring soil health.

**Dr. Suraj Bhan**
President SCSI

# A STRATEGY FOR THE INTEGRATED MANAGEMENT OF LAND, WATER AND LIVING RESOURCES IN NEH REGION

Prof. Sanjay-Swami (Soil Science and Agricultural Chemistry), CPGS, Umiam

The challenges arising from global economic and population growth, pervasive rural poverty, degrading natural resources in agriculture land use, and climate change are forcing ecological sustainability elements to be integrated into agricultural production intensification. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It requires adaptive management to deal with the complex and dynamic nature of ecosystems. It is a unique option to bring the sustainability in agriculture production through application of various eco-friendly techniques; however, there is no single way to implement the ecosystem approach, as it depends on local, provincial, national, regional or global conditions.

The North Eastern Hill (NEH) Region of India has several unique features: fertile land, abundant water resources, evergreen dense forests, high and dependable rainfall, mega biodiversity and agriculture-friendly climate. The environment, local conditions, socio-economic and socio-cultural life of different tribal communities and the rituals associated with agricultural practices have developed many ecosystem approaches, which have in-built eco-friendly systems for conservation, preservation and utilization of natural resources. The following section deals with some important location specific ecosystem approaches followed in the NEH Region.

## 1. Rice-fish system of Apatani plateau

It is a multi-purpose water management system, which integrates land, water and farming system by protecting soil erosion, conserving water for irrigation and paddy-cum-fish culture. It has been practiced in a flat land of about 30 km$^2$ located at an altitude of about 1,525 m above m.s.l. in the humid tropic climate of Lower Subansiri district of Arunachal Pradesh. Local tribe "Apatani" which developed this system dominates the area; every stream rising from the hill is trapped soon after it emerges from forest, canalized at the rim of valley and diverted by network of primary, secondary and tertiary channels. The first diversion from the stream takes off at a short distance above the terraces. Central irrigation channel of 0.61 X 0.61 m size and embankment of the same size in each of the paddy plots are constructed. The water into the plots is drawn from irrigation channel and has a check gate made of bamboo splits (huburs) at the inlet for regulation of entry and exit of water through the outlet. The farmers drawn off the water from the rice fields twice, once during flowering and finally at maturity on an average 10 cm water level is maintained in the plots by adjusting the height of outlet pipes. For fish culture, a vertical pit is dug in the middle of the plot, so that the water remains in these pits even when it drains away from the surrounding fields. To prevent trashes or migration of fish, a semi circular wooden / bamboo net is installed at the inlet to reduce beating action of flowing water regulating in soil erosion; wooden strikes or planks are put at the outlet. The huburs are installed about 15 cm to 25 cm above the bed level. They are made of plank or pine tree trunk or bamboo stem of different diameters. The water from terraces is finally drained into the river, which flows in the middle of valley.

(1)

(2)

*Plate 1 & 2: Rice-fish system of Apatani plateau and Apatani tribal woman*

## 2. Alder based farming

In some pockets of Nagaland, the farmers use *Alnus nepalensis* (Alder) tree for agriculture. In this system the Alder seedlings are planted on the sloppy land intended for cultivation and the alder grows fast till attain six to ten years old. At this stage initially the trees are pollarded, the leaves and twigs are burnt and ash is mixed with soil to prepare it for raising crops. Subsequently, pollarding is done once every four to six years. Under this process coppice are cut except five to six on top of the main trunk and crop schedule is followed including fallow period of two to four years. The bigger branches stripped of leaves are used for five wood, while the root of the tree develop nodules (colonies of *Frankia*) responsible for fertility the soil where as spreading nature of the roots helps in preventing soil erosion in slopes. Nitrogen fixation in *Alnus nepalensis* take place through a symbiotic relationship between *Alnus* with nitrogen fixing actinomycetes of the genus *Frankia* and is, therefore, able to improve degrades *jhum* lands. The symbiotic micro-organism *Frankia* (actinomycetes) are located in specialized structures, or nodules, along the root

system of the host plants. The root nodules are analogous to those induced by *Rhizobium* in legumes, and they provide an environment where *Frankia* can grow and prosper, while providing the host-plant with fixed atmospheric nitrogen. Unlike the *Rhizobium*-legume symbiosis where most of the host plants belong to a single large family, *Frankia* can form root nodules in symbiosis with actinorhizal plants. The ability of the alder trees to develop and retain fertility of the soil has been fully utilized by farmers in Angami, Chakhesang, Chang, Yimchunger and Konyak area in Nagaland at varying altitudes.

(3)

*Plate 3: Alder tree in Jhum land*

### 3. ZABO system of farming

"Zabo" is an indigenous farming system of Nagaland. This system has its origin in Kirkuma village of Phek district of Nagaland, located at an altitude of 1270 m above m.s.l. The word "Zabo" means impounding of water. It has a combination of forest, agriculture and animal husbandry with well-founded soil and water conservation base. It has protected forest land towards the top of hill, water harvesting tanks in the middle and cattle yard and paddy fields for storage for the crops as well as for irrigation during the crop period. Special techniques for seepage control in the paddy plots are followed. Paddy husk is used on shoulder bunds and puddling is done thoroughly.

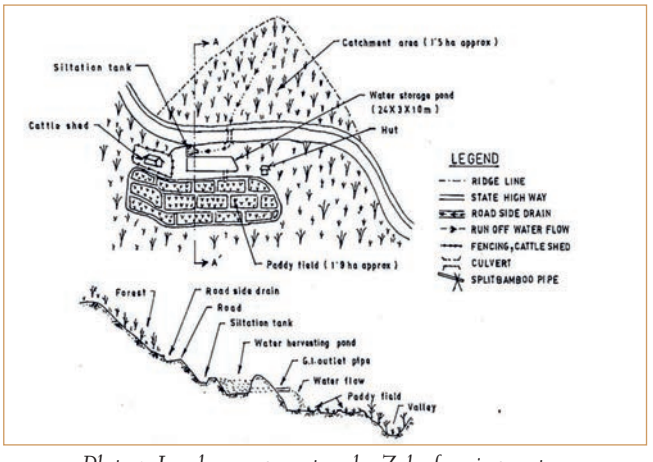


*Plate 4: Land management under Zabo farming system*

The future farming must be multifunctional and at the same time ecologically, economically and socially sustainable so that it can deliver ecosystem goods and services as well as livelihoods to producers and society.

# 2ND ASIAN WEB CONFERENCE MANAGING HILL RESOURCES AND DIVERSITIES FOR ZERO HUNGER AND CLIMATE RESILIENCE February 12-13, 2021

The two days 2ndAsian Web Conference was organized by Soil Conservation Society of India, Meghalaya Chapter, Barapani in collaboration with Central Agricultural University, Imphal, India on the theme *Managing Hill Resources and Diversities for Zero Hunger and Climate Resilience* during February 12-13, 2021. In the inaugural session on February12, 2021, Director General of the International Center for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal, Dr. Pema Gyamtsho was the Chief Guest and Dr. K.M. Bujarbaruah, Former Vice-Chancellor, Assam Agricultural University, Jorhat and Dr. Anupam Mishra, Vice-Chancellor, Central Agricultural University, Imphal were guest of honour. Dr. Suraj Bhan, President, Soil Conservation Society of India welcomed the delegates and apprised about the importance of the theme in present context. The convener of the conference, Dr. Sanjay Arora detailed the delegates about various activities of the SCSI and future strategies to fulfil the mandate. Dr. Sanjay Swami, Organizing Secretary, briefed the gathering about the 2nd Asian Web Conference. Dr. Lun Yin, Director of Center for Biodiversity and Indigenous Knowledge, Kunming, China delivered the keynote address on *Traditional Knowledge Associated to Biodiversity for Climate Change Adaptation*. Dr. C.L. Acharya, Former Director, ICAR-Indian Institute of Soil Science, Bhopal set the tone of the conference by speaking on *Soil and Water Conservation in the Himalayan Region-Must to Increase and Stabilize Crop Yields*. The Chief Guest of inaugural function Dr. Pema Gyamtsho, Director General, ICIMOD, Kathmandu, Nepal released the e-abstract book and conferred annual awards of Soil Conservation Society of India.

In the inaugural address of Hon'ble Chief Guest, Dr. Pema Gyamtsho elaborated that hill/mountain regions contain more diversity than plains: their varied landscapes and the changes in altitude have created a multitude of agro-ecological zones. The genetic variety of agricultural crops and farm animals contained in these zones has the potential to provide diversified and nutritious food for all. He advised to encourage regional, national and international networking of people's initiatives and the activities of international, regional and local non-governmental organizations working on mountain development. He congratulated the organizers for the conference theme selected for discussion and deliberations and expected that some useful recommendations of the conference can pave way for future strategies for farmers' welfare vis-à-vis agricultural and environmental sustainability in the hill regions.

During the first technical session on the theme of *Watershed and Resource Management in Agriculture for Sustainable Food and Livelihood Security*, Prof. (Dr.) S.H.R. Sadeghi as session chairman emphasized to conserve and manage natural resources available in the hilly areas for sustainability of agriculture and livelihood security of poor farmers. Dr Munish Kumar co-chaired the session and Dr. Mukesh Kumar was the convener of the session. The lead speaker Dr J.P. Sharma, Vice-Chancellor of Sher-e-Kashmir University of agricultural Sciences and Technology of Jammu emphasized the challenges and emerging opportunities of hill agriculture. He discussed about the problems facing by the farmers in hilly areas and their management like recourse conservations techniques, integrated farming systems, organic farming management systems and use of biochar for climate resilient agriculture. Other lead speaker, Dr Erica Udas, Ecosystem Analyst, ICIMOD, Nepal deliberated on sustainable food production and entrepreneurship development for resilient livelihood. She highlighted the ways for sustainable development for improving the livelihood security and also shared the success story of some farmers from Nepal in entrepreneurship development. In this session a total of 11 oral and 5 poster presentations were made. Speakers presented the soil chemical and physical characteristics as affected by soil conservation treatments, guava performance under gravity-fed drip in mid hills of Meghalaya, use of farm ponds in polyhouse crops through gravity based drip irrigation system. Another interesting presentation was made on livelihood improvement through dairying with emphasis on value addition of milk. Another presenter presented his work on influence of conservation measures on biomass, yield and socio-economic status of Madhoganj watershed in Hardoi, Uttar Pradesh.

The technical session II was on *Farming Systems, Diversification and Biodiversity Conservation.* The session was chaired by Dr. V.K. Dua with Dr. O.P. Aishwath as Co-Chair and Dr. Vijay K. Bharti as convener. In this session there were three lead talks by Dr. Madhav Prasad Dhakal, Dr. M.S. Hadda and Dr. Gurdev Chand. In the 14 oral presentations, Dr. H.N. Leua deliberated on effect of planting method and nutrient management on growth of garlic, Dr. Ramadhan discussed about the food need projection and food availability analysis in Riau, Nepal to achieve food security, Dr. Devendra Kumar talked about the climate change impact, Dr. Tarun Adak discussed the yield sustainability in guava and Dr. R.K. Bansal presented on drip irrigation technology in banana. Further, Dr A.S. Thounaojam discussed on response of *Stevia rebaudiana* in different nutrient media of hydroponic drip system. Dr. Gourav talked about the integrated farming systems for sustainable hill agriculture. Dr. D.S. Yadav deliberated about the livelihood security by diversified farming, Dr. A.V. Dahiphale showed different farming system modules for improving the livelihood security of marginal farmers and Dr. Bapsila Loitongbam shared her works on mapping of QTLs for zinc deficiency tolerance in rice. Finally, Dr. Zahid Nabi Sheikh highlighted the importance of resources conservation by her works on genetic diversity analysis of indigenous and exotic apricot cultivars in Jammu and Kashmir. Overall five presenters were made as posters during this session.

In the technical session III on the theme *Natural Disaster Mitigation, Environmental Conservation and Climate Resilience*, Dr. Jagdish Prasad chaired the session with Dr. Vikas Sharma as co-chairman and Dr. Nirmal Kimar as convenor. Two lead lectures, ten oral presentations and four poster presentations were given by the presenters. The lead lecture on integrated farming systems for sustainable agriculture developments in hill was delivered by Dr. Narender K Sankhyan, Principal Scientist, HP University, Palampur. He discussed various integrated farming system models suitable for hilly region for better and round the year income, resource recycling and nutritional security. Dr. Sunil Dadhich, Head, Department of soil Science, SKNAU, Jobner in his lead lecture emphasized upon bio gas and other organic manure production techniques and their role in sustainable agriculture and rural development. In oral presentation, work on edible insects, nitrous oxide emission, monitoring landslide using unmanned aerial vehicles, foliar application of micronutrients carried out by the researchers in different parts of the country were discussed. Further, impact of climate change on agro-ecology and biological diversity in Himalayan region, erosion in Greater Himalaya, stream bank erosion, soil and water quality in Himachal Pradesh, scope of natural farming in hills and ITKs for managing soil health, climate change and its impacts on crop production were discussed during poster session.


In technical session IV on *Human Resource and Knowledge Development and Dissemination for Agricultural Development*, three lead papers and 14 oral papers were presented. The session was chaired by M.L. Gaur and co-chaired by Dr. S. Manivannan. The convener of the session was Dr. N.K. Pareek. In the session, Dr. S.P. Vista, senior Scientist, National Soil Science Research Center, Kathmandu, Nepal in his lead presentation discussed about digital soil mapping and showed that how they have developed digital map of Nepal which is available online and anyone can get the soil related information of any particular area for better soil management. Dr Vijay Arora emphasised on the techniques for better soil fertility and nutrient management in horticultural crops to get quality fruits with bumper yield. The water resources of the Nile Basin were discussed by Dr. Prof. Attia El-Gayar from Soil, Water and Environment Research Institute, Giza, Egypt. In oral presentations, knowledge dissemination to small and marginal farmers, high density orcharding, accuracy in rainfall forecast for issuing agromet advisories, carbon sequestration and soil heath management through vermicomposting and productivity enhancement in *jhum* farming were discussed. Recent advances in Muga silkworm rearing and income generation, scope of integrating improved tools in sloppy lands, utilization of rubus fruits for nutritional security in Sikkim Himalaya, managing mountain ecosystem and diversities were the key aspects presented by various oral and poster presenters.

Technical session V was on the theme *Management of the Environment and Ecosystem Services for Social Sustenance*, Dr. M.S. Hadda chaired the session with Dr. Bipul Deka as co-chairman and Dr. Jitender Sinha as convenor. One lead lecture, eleven oral presentations and nine poster presentations were given by the presenters. The lead lecture on water resources in Indian Himalayan Region: Challenges and opportunities was delivered by Dr. P.K. Sharma, Former Vice-Chancellor, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu. He raised his concern about shrinking water resources and water availability in the hill/mountain regions for irrigating crops and advocated for conserving water and its better utilization for more crops per drop. In Oral presentation, effect of tillage practices on microbial characteristics in acid soils, integrated plant nutrient supply system, maize based cropping system for higher profitability, environmental management for social sustenance in hill ecosystem were discussed. In the poster session, soil physico-chemical changes associated with different stages of *jhum* cycles, impact of long term conservation agriculture practices on soil properties, backyard poultry as income generating agent, vermicompost as a source of nutrients were presented.

In the valedictory session on February 13, 2021, Dr Suraj Bhan, President, SCSI welcomed the Chief Guest Dr. Anil K. Singh, Secretary, NAAS & Former DDG (NRM), ICAR and gave an overview of the two days 2nd Asian Web Conference and its relevance in the present scenario. Dr. C.L. Acharya, Former Director, ICAR-Indian Institute of Soil Science, Bhopal and Dr. S. Basanta Singh, Director of Instructions, Central Agricultural University, Imphal were present as Guest of Honour. Dr Acharya congratulated the SCSI Barapani team for organizing this important event focusing on problems and prospects of hill/mountain farming. He emphasised that potential of agro-climatic diversity in hill/mountain areas ranging from productive valleys to higher elevation can be optimally utilized for the diversification and integration of agronomic or field crops, livestock farming, horticulture, floriculture, dairying, fishing, bee-keeping and forestry at watershed level. The development of value-addition products would be necessary for ensuring the sustainability of the entire integrated hill/mountain production system. Dr. S. Basanta Singh said that the Web Conference will benefit the farmers of hill regions, particularly the North Eastern Hill Region of India. Dr. Anhuman Kohli and Dr Sanjay Swami presented the proceedings of the sessions of the conference and gist of the recommendations. Dr. Sanjay Arora, Convener announced the awards for best paper and poster presentations in the web conference and congratulated the awardees. Dr. Anil K. Singh, Chief Guest of the session highlighted that the hill/mountain agriculture faces a number of constraints including inaccessibility, shorter and more pronounced agricultural seasons, ecological fragility, limited infrastructure, and distant markets. The challenges and problems are often complex, trans-boundary and difficult to be resolved by a single country, a single discipline, or single institution. He advised that all national and international partners from different backgrounds must emphasize the need to team up and continue flying the flag for supporting hill/mountain agriculture and hill/mountain people in the Asia region. Dr Lala I.P. Ray presented formal vote of thanks.

## CELEBRATION OF "WORLD WATER DAY – 2021" (Theme: Valuing water)

ICAR – Central Citrus Research Institute, Nagpur celebrated World Water Day on the theme of "Valuing Water" on 22nd March, 2021 through virtual as well as physical mode. World Water Day aims to raise awareness about how quickly the water is being depleted by human actions and to mobilize action and change against the same. On this occasion the Institute organized a lecture by renowned scientist Dr. S. N. Das (Former Director, MRSAC, Nagpur), Shri. Shyam Agrawal (Progressive Farmer, Paratwada) and Shri. Dadasheb Kale (Progressive Farmer, Katol). Dr. D. T. Meshram, Pr. Scientist (L&WME) highlighted the importance of water in agriculture/horticulture. Dr. B. S. Dwivedi, Director, ICAR-CCRI welcomed the Chief Guest, farmers and also the participants. Dr. B. S. Dwivedi emphasized the importance of the day and focused on the importance of freshwater for the sustainable management of freshwater resources. Dr. S. N. Das delivered lecture on technologies for assessment of water resources and focused on water management related technologies, importance and role of RS and GIS in agriculture. He also told about 'Jal Shakti Abhiyan: Catch the Rain' movement. Two progressive farmers from different villages also attended the program


*Dr. D. T. Meshram, Pr. Scientist (L&WME) welcoming the participants*

and delivered lecture on importance of water saving techniques in citrus crops also importance of surface and sub-surface drip irrigation system in citrus crops. Dr. D. T. Meshram Pr. Scientist (L&WME) conducted the programme and also proposed vote of thanks. A total of 74 participants attended the programme.

# APPLICATION OF JUTE GEO-TEXTILES FOR HILL SLOPE STABILIZATION

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Slope stabilization and mass erosion is the major challenges in the hill regions causing heavy land degradation, decline in the quality and quantity of water resources and disruption in the communication lines. Establishment of vegetation in the unstable slopes created due to land slide, mine waste piles, bunds of water resources and road / railway track construction is difficult due to their rickety nature and poor fertility status. Natural fibre based geo-textile (soil cover) have been most popularly used across the globe for erosion control and slope stabilization by establishing vegetation. One of the natural fibre based product in India is Jute geo-textile which is being globally used in various soil conservation applications. Wide choices of jute geo-textiles are being produced and applied in diverse purposes. However, standardization of types and specifications of jute geo-textiles suitable for slope stabilization had not been done so far. Hence, standardization of suitable jute-geo-textiles for slope stabilization and mass erosion control has been done in collaboration with National Jute Board, Kolkata through set of field studies.

ICAR – Indian Institute of Soil and Water Conservation, Regional Centre, Udhagamandalam had evaluated the various types of jute geo-textiles on runoff, soil loss, nutrient loss, soil moisture retention, nutrient build up and growth parameters of test crops and standardized the specifications of jute geo-textiles suitable for slope stabilization.

Field study on efficacy of various types of Open Weave Jute Geo-textiles namely 500, 600 and 700 GSM for slope stabilization on 22% sloppy land showed that 700 GSM for Open Weave JGT is more effective in reducing runoff and soil loss, nutrient loss and increasing soil moisture retention. However, plant height and growth of tea plants were better under 500 and 600 GSM JGT. Higher biomass of grass and other herbs in between tea plants was generated by 700 GSM JGT.

Field study on efficacy of various types of Jute Geo-textiles and Synthetic Geo-textiles on 60 and 90 per cent slopes show that Jute Geo-textiles outperformed the Synthetic Geo-textiles in reduction of runoff and soil erosion. Among the Open Weave and Non Woven JGT, Open Weave JGT are more effective in reducing runoff and soil loss, nutrient loss and also increased soil moisture retention. Growth of the grass and root characters is vigorous in the plots covered by JGT as compared to Synthetic Geo-textiles. Application of Open Weave JGT increased the plant height, number of tillers, root density, surface area coverage and volume of soil binding in both the slope categories. The study concludes that the JGT can be effectively utilized for slope stabilization as compared to Synthetic Geo-textiles. Open Weave JGT with grasses is recommended for slope stabilization in the degraded land having the slopes up to 90%.

# GROWTH OF MI IN INDIA

B Rath
Technical Expert(WM), National Rainfed Area Authority

## Background:

Agriculture sector which consumes currently more than 80% of the fresh water resources, is likely to get a much reduced share due to competitive demand, where as the demand for water to meet the pressure to produce more food, horticultural produce and raw materials for the industries would increase many fold. To meet the challenge of higher production with reduced share of water, more thrust is required on enhancing water use efficiency in agriculture sector. Water productivity enhancement is one of the most important strategies Government is adopting for meeting the growing food grain requirement in a sustainable manner amidst the challenges of climate change. Precision water use through micro irrigation technologies has shown great promise in reducing the water footprint, and increase water use efficiency at the farm level, and this has led to the government to promote schemes such as Per Drop More Crop (PDMC) under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY).

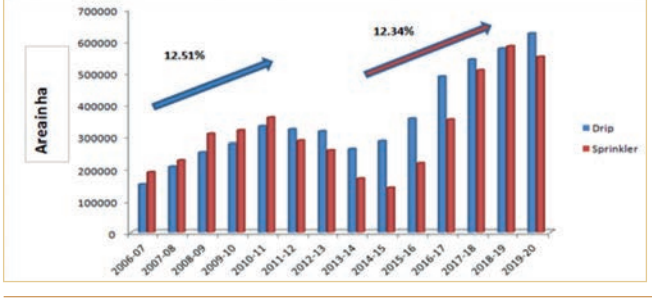
## Growth of MI

Micro irrigation in India has seen a steady growth over the years. Since 2006, area covered under micro irrigation systems has grown at year on year average growth rate of 11.76% till 2020. In the initial phase as an individual development programme for promotion of micro irrigation till the concept of comprehensive irrigation chain development under the umbrella of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) i.e till 2013-14, the growth was

observed to be 4.6%. After integration of all water related programmes under PMKSY, there has been a greater momentum in adoption of micro irrigation by farmers. During 2014-15 to 2019-20, the growth in adoption of micro irrigation has been observed to be about 20%.

## Overall Average growth rate since 2006


The total coverage of micro irrigation in the country till 2019-20 is more than 12.5 million ha. Highest growth in a financial year was observed during 2019-20 which was about 1.2 million ha. The favorable policies by Central and State governments, availability of improved technologies and awareness among farmers have resulted in the increase in rate of growth in recent years. The area coverage under micro irrigation systems includes sprinkler irrigation with 47.2 percent, and drip irrigation with 52.8 percent. Area under drip irrigation has shown a growth of 12.51%, whereas during the same time the growth in sprinkler systems has been observed to be 12.34%.




## Impact of Micro Irrigation:

With the intervention of Government to promote MI, an increase in utilization of degraded/ marginal land into cultivable land has been observed. Besides, a considerable increase in cropping intensity has been witnessed in the farms adopting MI. MI has contributed towards reduction in input cost like fertiliser, insecticides, pesticides, water, energy etc. Irrigation cost is reduced by 20%-50% with average of 32.3%. Reduction in electricity consumption by about 31% has been observed due to use of micro irrigation system. Saving of fertilizers in the range of 7%-42% (average of about 28%) was observed. The average productivity of fruits and vegetables has increased about 42.3% and 52.8%, respectively mainly because of crop spacing, judicious use of water and other inputs etc. The overall benefits accrued from the micro irrigation system are reflected in the income enhancement of the farmers. All the surveyed states reported increase in farmer's income in the range of 20% to 68%.

## Emphasis on MI in the Union Budget

Government had set up a dedicated "Micro Irrigation Fund" with National Bank of Agricultural and Rural Development (NABARD) with an initial corpus of Rs 5000 crore to facilitate the States in mobilizing the resources for expanding coverage of Micro Irrigation by taking up special and innovative projects and also for incentivizing micro irrigation beyond the provisions available under Per Drop More Crop (PDMC) component of PMKSY to encourage farmers to install micro irrigation systems. In the Budget 2021, Finance Minister has announced that this Micro Irrigation Fund's corpus will be doubled to ₹10,000 crore. The addition of Rs 5,000 crores to the micro-irrigation fund with NABARD will help increase the micro irrigation coverage in all States and achieve the government's target of one crore hectare in the coming five years.

# RURAL LANDSCAPE AND HYDROLOGY IN BIHAR AS AN INTERPLAY OF FARMS, PONDS AND STAKEHOLDERS

Anshuman Kohli, Ved Prakash, B K Vimal, Satish Kumar and S S Kukal

Indigenous village ponds known as *pokhars* or *ahars* in local parlance are a common sight in the rural hinterlands of Bihar. Since time immemorial, these have served for droght proofing and flood proofing the local ecology besides serving as an important component of the local hydrologic cycle. Several of these waterbodies now exist only in revenue records as they have been either encroached upon or converted to level fields due to siltation. Whatever remain are in desperate need for rejuvenation. Indigenously, these water bodies have been used for drinking purpose, irrigation, animal husbandry and recreation. But with the availabilityof alternate sources of water for drinking purpose, the maintenance and upkeep of the ponds has declined. The catchment of these ponds invariably consists of the farmlands, fallows and roads. Activities leadiing to littering of these sites along with the use of pesticides and fertilizers in the farmlands does lead to washing off of contaminants and unwanted garbage in these ponds. Further, due to the mechanised water distribution to each household, there is generation of sewage and sullage, which in the absence of an organized disposal system, leads to their ultimate disposal in the neighbouring village ponds without any treatment. This further aggravates the dismal state of the existing village ponds. Another peculiar characteristic of most of the ponds in Bihar is that they exist in a hydrologic sequence with the overflow of one pond contributing to recharge of the subsequent pond downstream. Often, there may also be channels or streams (callen *pynes* in local parlance) that convey runoff from the catchments or even water from distant rivers through indigeneously evolved conveyance mechanisms for these ponds. So in fact in several instnces the ecology consists not only a single pond

but a series of several ponds in the same hydrologic setting. As a consequence, the events or activities disturbing the existence and working of any one pond endangers the existence and functioning of all other ponds downstream, besides damaging the potential benefits of its immediate command area.

### Typical uses of traditional village ponds in Bihar

The traditional village ponds in Bihar, though in a state of decline, have wide and varied uses, with wide temporal and spatial variability in use. However, generally speaking, the traditional village ponds are used by rural folks for irrigation, drinking and bathing of domestic animals as well as wild / stray animals / birds, rituals and worship during festivals, fish culture and collecting rainwater and waste water of the village.

### Typical problems of the traditional village ponds in Bihar

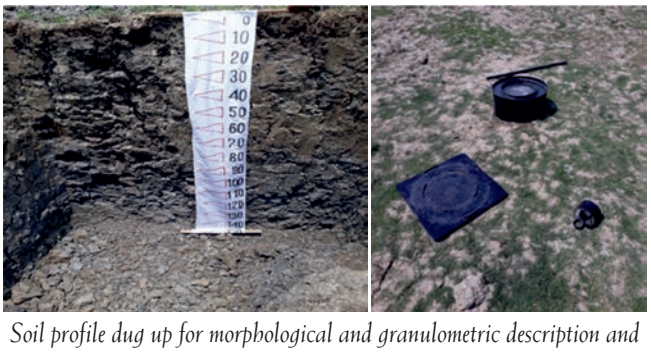
Several problems afflict the traditional village ponds of Bihar, though the extent and magnitude of these problems could vary from place to place. Usually they suffer from siltation by rainwater, flooding, water quality issues, deforestation and destruction by various anthropogenic activities. Desiltation *per se* is not the universal solution, more so because of the costs involved in this annual affair. Technically also, the pond silts will need to be tested as part of any planned removal and if heavily contaminated or enriched cannot be dumped just anywhere. Larger scale physical disturbance can lead to even worse temporary water quality problems than those existing prior to its removal. Many faunal species that live in or use the silt could be lost.

Another problem plaguing the quality of water coming in the ponds and its appropriate utilization is the existence of multiple inlet channels as well as unregulated outlets. If possible, the inflow should be directed through a single inlet channel that may be suitable designed to prevent backflow. The inlet channel may also be subjected to cost effective biological treatments such as grassed waterways and plantation on channel bunds. In the absence of any gauged outlet, the water in the ponds drains away, constraining the storage capacity of the pond. It is difficult to control the multiple outlets. If the multiple outlets are closed, the embankment of the pond may be raised by using the soil dug up from the pond bottom and increase its storage capacity. Regulated outlets may be created for withdrawing water from the pond for irrigating the command area under gravity head to the extent permitted by the local topography.

As the village ponds are on public land, the periphery of the ponds find use for open defecation. This needs to be curbed. An option for making this feasible is by developing the ponds aesthetically. The pond embankment may be planted with flowering and evergreen trees that harbour birds and other fauna. This will simultaneously strengthen the pond embankment and create a recreational spot in the village. The maintenance and upkeep may then be taken up by a user group of the village pond. The user group may be encouraged to keep a record of the inflows (including precipitation) and outflows for better planning and usage. Educational and training of the users along with other stakeholders in the village should suffice.

### Cropping systems and local water resources utilization in Bihar

These pond systems are significant sites for rain water harvesting and can contribute immensely to the irrigation potential during the dry periods. The predominant cropping systems of Bihar are rice-wheat, rice-maize, rice-mustard, rice-lentil, rice-field peas and rice-fallow, largely dictated by the availability of water during the *rabi* season. Ground water is less preferred for irrigation because power connectivity is not assured in most of the farms and operating with diesel is dearer. During the *kharif* season, rice gets irrigation from the canals as well as the farm ponds, however, during the *rabi* season, the harvested water in the ponds is the only source of irrigation. In context of revival and rejuvenation of the village ponds, an exploratory pilot study was taken up to ascertain the level of water retention capacity and the type of social and topographic constraints associated with ponds. A participatory rural appraisal by the intervening organization is a must to break the ice. Most of the village ponds are of very shallow depth resulting in the ponding of water during rainy season but drying up in the subsequent months by summer. If the storage capacity of the ponds is increased by increasing their depth, more water can be harvested and stored in the ponds. However, the pond soil profile characteristics should be considered before going for deepening of the pond. The infiltration characteristics



*Soil profile dug up for morphological and granulometric description and field view of the double ring infiltrometer being used for determining the steady state infiltration rate of a village pond of Kola Khurd village in Bhagalpur, Bihar.*

*Views of a pond inlet before and after installation of a sluice gate to prevent backflow.*

of the pond are also an important consideration in planning the scheduling utilization of the pond water. With public health concerns, the pond water quality needs to be monitored periodically to decide on permissible utilization. The catchment of the pond may be treated by planting perennial grasses and multipurpose tree species.

### Epilogue on scientific management of rural ponds of Bihar

The indigenous management of the village ponds and reservoirs is in a state of decline as the village ponds are no longer used for drinking purpose and the alternate sources of easy water availability have been thrown up with advent of technology. Indigenous technical knowledge in maintenance of village ponds and utilization and water sharing arrangements needs to be supported even in the scenario of lesser dependence on pond water. Sensitization of the inhabitants in the command area of the village ponds regarding the scientific interventions that can make water available during critical periods for irrigation and allied activities is the way forward. The scientific interventions outlined above may be extended to the numerous village ponds keeping in mind the broad scientific principles and local topography and hydrology for optimum utilization of pond water resources in Bihar. Sensitization of water users and groups should be continuously practiced and be a routine activity of the extension agencies targeting the catchments and command areas of the village ponds.

*Figure: Biological treatment of the pond embankment for strengthening and creating recreational and aesthetic value.*

# REUSABLE WHEAT FLOUR BAGS: A LOW COST AND ENVIRONMENT FRIENDLY ALTERNATIVE TO COMMERCIAL GROW BAGS?

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Scientist are often pondering and looking for solutions and/or addressing the issues like:

- How to minimize the carbon and water footprint?
- What kind of growing system is appropriate for unproductive and infertile land?
- How can we make judicious use of prime resources like land and water?
- Can we have use of reusable plastics in agriculture?
- Can we have a smart and low cost solution for marginal farmers?
- Can our technology be remunerative to the poorest of poor section of our society?
- Can we have an environment friendly technology?
- Can every individual play its role in it?

As we know the terms Carbon footprint and Water footprint define the potential impact of a product, assessed during the entire life-cycle, in terms of greenhouse gases emissions and of water resources consumption and degradation. It includes carbon dioxide — the gas most commonly emitted by humans — and others, including methane, nitrous oxide, and fluorinated gases, which trap heat in the atmosphere, causing global warming. There are 5 Ways to Reduce the Carbon Footprint, viz. refuse, reduce, reuse, rot and recycle. Also, it an established fact that going zero waste is a great step towards combating climate changes. It takes lots of energy to pump, treat, and heat water, so saving water reduces greenhouse gas emissions also. In other words reducing water footprint also reduces carbon footprints. The total carbon footprint of one 500 ml bottle of water is 828.0gmof carbon dioxide.(https://www.google.com/search?q=carbon+and+water+footprint&oq=carbon+and+water+footprint&aqs=chrome..69i57.8441j0j15&sourceid=chrome&ie=UTF-8). Recycling itself is also having associated carbon and water footprint, but **reuse** of materials can really reduce carbon and water footprint.

When it comes to grow vegetables and flowers in unproductive and infertile land, then grow bags and trough based systems looks promising (Fig. 1). Instead of ploughing the land, media in the form of coco-peat, FYM or some other porous inert material are used to provide columnar support while nutrient are provided from outside, preferably with water soluble fertilizers. These bags are suitable for growing a wide variety of vegetable and flowers (Fig 2 and Fig. 3 You tube channel Dr Jitendra Sinha https://youtu.be/33cA2EEPG-E).

As depicted in Fig. 4, some improvisation was made and drip laterals were fixed moving through the uniform wholes (Hot treatment) created in a set of reusable wheat flour

*Fig. 1 : Involvement of students in the cost effective environment friendly endeavors*

*Fig. 2 : Suitability of reusable plastic bags for Yard long bean and Chilli*

*Fig. 3 : Suitability of reusable plastic bags for leafy Onion*

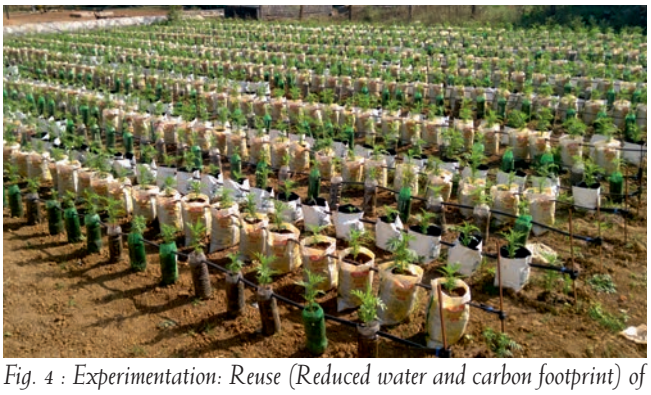

*Fig. 4 : Experimentation: Reuse (Reduced water and carbon footprint) of plastics in agriculture*

bags. The lateral is then adjusted in such a way so as to place the emitter in the centre of the bag. The system is also portable, i.e. if the same piece of land is to be used for some other purpose like as threshing floor, and then the whole system can be set aside. The system looks promising for the Badi system of cultivation in small piece of land by marginal farmers as well as urban kitchen gardening/roof terrace gardening (Fig. 5 and Fig. 6).

There is a project "Plasticulture" which promotes use of plastics in agriculture. It has been proved advantageous for the agriculture. On the other side the problem of handling of those plastic wastes is at its alarming level. There is a technology of growing plants, preferably vegetables and flowers, in grow bags and troughs with some media in it. This encourages use of plastics in agriculture. After the life span of these

Fig. 5 : Beautification with sunflower grown in reusable plastic bags

*Fig. 6 : Live bouquet: Beautiful marigold lasts this way for more than two months*

commercially produced plastic materials it finds its way into the dumping yard and creates environmental problems. On the other hand, due to widespread applications of plastic in all walks of life, every day tons of plastic waste is produced. What every individual can do is refuse, reduce and **reuse** to curb the menace of ever increasing plastic garbage. Rice, wheat flour, etc. comes in plastic bags. The question is can we utilize these used bags as grow bags in agriculture? If yes, with what degree of compromise. With this in view a study is being undertaken at Department of Soil & Water Engineering, FAE, IGKV, Raipur to develop plant growing system and compare its performance with the conventional grow bags system (You tube channel Dr Jitendra Sinha https://youtu.be/GF9Q2EfqGnA). As stated earlier "Reuse" is one of the sustainable solutions. It curbs the escalating carbon and water footprint. If we confined to those wheat flour bags, it has already serve its purpose of safely carrying flour from source to the sink. Now, suitable cutting followed by a suitable collection chain may lead to judicious use of those bags. Can these bags be sold out in the same manner as that of commercial grow-bags? It will lead to a sustainable solution and curb the menace of wide spreading used plastics.

The cost of commercially available grow bags varies from Rs 10 to Rs 50 per bag depending upon the quality and volume of the bags. The most common type of 7.5 litre capacity grow bags are available at a cost of Rs. 10 per bag. The volume of these reusable wheat flour bags is nearly 2 times that of common grow bags. Also the cost of commercial grow bags of same volume as that of reusable wheat flour bags, is Rs. 20. So, use of reusable wheat flour bags as grow bags id definitely cost effective. Being environment friendly makes it a smart solution also.

Mahatma Gandhiji has said, "I will give you a **talisman**. Whenever you are in doubt, or when the self becomes too much with you, apply the following test. Recall the face of

the **poorest** and the weakest man [woman] whom you may have seen, and ask yourself, if the step you contemplate is going to be of any use to him [her]". If we confined to the collection system of those reusable wheat flour bags (Refer: You tube channel: Dr Jitendra Sinha https://youtu.be/TzBvbZFsEbl), it has been realized that the rag pickers can be trained in only half an hour and they can provide such bags @ Rs 3-4 only. The commercial grow bags of same capacity are available @ Rs. 15-20. Suitable collection activity has tangible as well intangible benefits. Besides being environment friendly it can also be remunerative to them.

The merits of the system has been established and its definitely environment friendly for being low in carbon as well water footprint.

Most of the people do have their own concern for all such issues addressed above, but due to hectic life and other priorities they are not in a position to do so. Their inner desire of being environment friendly can be accomplished with this technique and they can also play their role in it. It is expected that the primary users of those bags will cut it properly and can have a bundle of 10, 20 or 50 such bags as per their commitment. Those bags can be handed over to the rag pickers and knowing it is going to be remunerative for the poorest of poor will bring a thought of positivity in the mind of an individual contributor.

Of course, the answer to all these questions is 'YES', if we involve ourselves into the programme entitled herein.

## ORGANIZATION OF AWARENESS CAMPAIGN AMONG SCHOOL CHILDREN ON "IMPORTANCE OF SOIL AND WATER CONSERVATION"

### at Nahalapada, Odisha during 2-7 March 2021

The Soil Conservation Society of India, New Delhi in collaboration with PipliSanskrutikaParishad, Pipli, Odisha has organized an Awareness Campaign among school children on "Importance of soil and water conservation" at Nahalapada, Pipli block, Puri district of Odisha during 2-7 March 2021. Debate and drawing competitions on central themes of 'Soil and water conservation' were conducted for school children representing 12 High Schools in Puri district of Odisha. The winners of both the competitions were presented with Mementos and merit certificates by Dr. P.S. Brahmanand, Vice President (East Zone), SCSI and Shri R.C. Mahapatra, Secretary, PipliSanskrutikaParishad and Head Masters of various High Schools in a closing function held on 7.3.2021 at Nahalapada High School, Odisha. It was followed by plantation programme. Dr. Brahmanand explained about the activities and efforts of SCSI in protecting soil and water resources and urged the teachers and students to sensitize others to take part in soil and water conservation programmes. The teachers and students of these schools have been motivated to take up the voluntary activities ensuring soil and water conservation in their surroundings. The

Secretary, PSP and Head Masters of High Schools have appreciated the efforts of SCSI and expressed their desire to felicitate President Dr. SurajBhanji and Senior Vice President Dr. T.B.S. Rajput ji during the next awareness / sensitization programme on 'Soil and water conservation' scheduled during August 2021.The news regarding this awareness campaign was published in three Odiya News Papers on 8.3.2021. This awareness campaign was coordinated by Dr. P.S. Brahmanand,Vice President (East Zone), SCSI.

# FORTHCOMING EVENTS

## INTERNATIONAL SOIL CONSERVATION ORGANIZATION (ISCO)

ISCO International Soil Conservation Organization

### Virtual Global Summit

## DEGRADED LAND MANAGEMENT TO RESTORE OUR EARTH

### 22nd April, 2021

Land, and its various bio-physical complexities, is an essential life-supporting system, critical for human survival and wellbeing. Unfortunately, a substantial amount of land and associated resources have undergone degradation mainly due to human activities such as urbanization, industrialization and intensive agricultural practices. Climate change is another key factor affecting the resilience of the land system. All of these multiple drivers of change are not only affecting the ecological integrity of the land but also affecting the social, economic, and cultural dimensions of human development. Hence, as envisioned by the United Nations, 'there has never been a more urgent need to prevent, halt and reverse the degradation of land worldwide than now' to attain the targets of UN-Sustainable Development Goals (UN-SDGs) and other international initiatives such as the 'Bonn Challenge' and the 'UN- Decade on Ecosystem Restoration (2021-2030) to restore degraded land and achieve land degradation neutrality (LDN). However, in order to fulfil these ambitions, a well-coordinated approach with strategies that operate at different scales will be essential, and must include the active support of stakeholders varying from individuals to large-scale organizations and governments. Importantly, suitable policy formulation and implementation will be key to successful land restoration worldwide, and thus for the wellbeing of both humanity and our planet. In this context, a global summit is being organized to discuss the current status of land degradation and restoration across the globe, lessons learned from various nations and biogeographical locations, to formulate global action plans and showcase some of the most innovative strategies for accelerating the restoration of degraded land worldwide, to attain UN-SDGs by the year 2030 and fulfilling the theme of International Earth Day 2021.

**International Soil Conservation Organization,**
Present address: A/G-4 National Societies Block, NASC Complex, DPS Marg, Pusa, New Delhi 110012, India
Contact: Dr. Suraj Bhan, President, ISCO, New Delhi
Website: www.tucson.ars.ag.gov/isco/, Email: presidentiscoindia@gmail.com, Phone: +91-11-21520082

## 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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