SUSTAINABLE DEVELOPMENT FORUM UTTARANCHAL

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Consultative Workshop

on

Ecosystem Based Approaches for Climate Change Mitigation and Sustainable Food Production in Western Himalaya

SARG Training Centre, Tok Sadi, Ramgarh, Nainital

August 11th – 12th, 2023

Sustainable Development Forum Uttaranchal (SDFU)

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Contents

1.0 Background

The Himalayan region, one of the global assets, biodiversity hotspots and water towers of Asia, provides numerous ecosystem services to the millions of people living within as well as outside the region. However, it is extremely vulnerable due to rapidly changing climate, land degradation, pollution, and natural disasters. Despite these challenges, coupled with typical mountain specificities viz., fragility, marginality and inaccessibility, the local communities have been managing their land resources sustainably since ages. Unlike plains of India, mountain communities have small land holdings barely sufficient to grow food grains for a few months and much of their livelihood requirements are met from the mixed farming and bio-resources from the surrounding forests Till a few decades back, the mountain communities in this region have been following cooperative farming to share manual labour for agriculture and managing soil nutrients efficiently using the organic mulch from agricultural residue or leaf-litter from the forests. However, these practices are dwindling in many areas due to out-migration to sub-urban and urban areas leading to acute shortage of able hands for agriculture. With the globalization and demands of rapid economic development the age-old bonds between the mountain farmers and natural ecosystems have disintegrated affecting equitable benefit sharing from the bio resources, sustained flow of ecosystem services and adaptability to changing climate. Decline in traditional knowledge on the management of natural and agro-ecosystems, ill planned developmental activities and faulty land use practices have direct bearing on health of ecosystems and human well-being both within and outside the Himalayan region.

The Sustainable Development Forum Uttaranchal (SDFU), a civil society led network platform, aims to mainstream concerns of Uttarakhand and its people in the development dialogue of the state. The forum takes up relevant issues of mountain development and tries to bridge the science, policy, and practice gaps. It regularly organizes focussed group discussions, brainstorming and workshops on topical issues. It also serves as a Chapter of Integrated Mountain Development (IMI) from which it draws expertise as well as collective wisdom in its programmes and activities. SDFU and IMI closely follow the vision of **'sustainable, inclusive, and transformational development of the Himalayan region for the well-being and resilience of its people and environment'**.

Aligning with the Government of India's missions and international commitments such as National Mission on Sustaining Himalayan Ecosystems, Nationally Determined Contributions (NDCs) as part of Paris Agreement of 2015, and its 2030 goal on land degradation neutrality (LDN) and a host of other interventions aimed at sustainable development and ecological restoration, the SDFU aims to facilitate the dialogues between the local communities and other stakeholders in the form of consultative workshops. It plans to organize a series of such meetings and bring various players in the society viz., scientists, forest managers, non-governmental organizations working on environmental issues and the local communities and discuss the gaps in policies and practices in achieving above goals at regional and local levels.

The first consultative workshop entitled "**Ecosystem Based Approaches for Climate Change Mitigation and Sustainable Food Production in Western Himalaya"** was organized at Sarg Training Centre, Sadi Tok, Ramgarh, District Nainital on August 11 – 12th, 2023. A total of 35 participants attended the workshop representing scientific, community-based organizations and van panchayat members (Annexure II). The detailed programme is given in Annexure I. The workshop was sponsored by The Nainital Bank. This report summarizes the deliberations of the workshop and key policy recommendations.

It is hoped that the deliberations of the workshop captured in this report would sensitize the local communities, frontline staff of various line agencies towards natural climate solutions and ecosystem-based approaches to management of natural and agro-ecosystems. It is also hoped that the policy planners and concerned agencies would find these recommendations useful and consider these for formulating the enabling policies in future.

2.0 Objectives of Workshop

Main objectives of the workshop were as follows:

i. To discuss the carbon sequestration potential of mountain ecosystems (forests and agro-ecosystems) thereby contributing to cost-effective climate mitigation strategies.
ii. To sensitize the community-based organizations (CBOs) in the Western Himalaya (Uttarakhand) in management of forest resources for carbon as well as other co-benefits and its role in agroecology.

iii. To develop standard operating procedures (SOPs) for the CBOs for baseline assessments of ecosystem services and natural climate solutions pathways such as reforestation, restoration of degraded land, natural farming and Agri-horticulture, and avoiding deforestation.

iv. To identify key stakeholders for integrative ecosystem-based planning for natural climate solutions based on strong social inclusion principles and robust safeguards including leveraging from the traditional ecological knowledge of the mountain farm

3.0 Deliberations of the workshop

3.1 Introductory session

Ms. Binita Shah, Secretary of SDFU, provided an introduction to the workshop's context. She highlighted the interconnectedness of forest landscapes and agro-ecosystems, emphasizing the challenges posed by climate change and alterations in agricultural patterns resulting from increased tourism. Furthermore, Ms. Shah presented an overview of the Sustainable Development Forum, Uttarakhand (SDFU), and acknowledged the significant contributions made by its founder, the late Dr. RS Tolia.

She provided information about the Sarg Training Centre, which encompasses an area of 5.6 hectares and was established in 2003. The primary goal of the centre was to establish a dedicated area for both work and learning in the field of organic and biodynamic agriculture. She further elaborated that the centre comprises of various horticultural practices, including the cultivation of apples, peaches, apricots and other crops, which are grown exclusively using biodynamic farming system. She also described the process of creating biodynamic preparations, involving the use of locally sourced herbs and different animal parts, and how the income generated from promoting these practices is reinvested into maintaining the centre. The centre serves as a valuable resource for numerous farmers and stakeholders who visit to acquire knowledge and adopt various organic techniques.

She indicated that the workshop had been planned to take place in a location where it would facilitate an examination of the impacts of climate change and foster interactions with local communities experiencing both positive and negative consequences. She elaborated that the workshop aimed to gain insights into the ongoing global changes, our trajectory, and the development of climate-related solutions. She expressed her appreciation for the approval of her workshop proposal by the Chairman and Vice Chairman of SDFU to host it at the Sarg Centre. Ms. Binita Shah then recounted her arrival approximately 24 years ago and the gradual introduction of biodynamic and organic agricultural practices at the Sarg Centre. She noted that during this period, the centre had seen an increase in biodiversity and wildlife populations and maintained its overall quality.

Following the introductory remarks and background of the workshop, Shri STS Lepcha, Chairman, SDFU formally welcomed all the participants. In his address, he highlighted the combined impacts of climate change, changed land use practices, and need for formulating the enabling policies and wise practices as an adaptation strategy. He added that extreme weather events and changing climate have changed structure and functioning of forest ecosystems in many parts of Himalaya. According to Shri Lepcha recent increase in the incidences of Asiatic black bear – human conflicts in the higher Himalaya is possibly due to changing climate. He clarified that a few decades ago winter months received higher snowfall and generally winter temperature dipped quite low in the cool temperate belt. Of late, natural habitats of bears have degraded and there is not adequate food for them during monsoon and autumn seasons. Moreover, there has been a deficit in winter precipitation (snowfall) during winter months and black bears continue to roam around forest fringes and human habitations. Often, bears can be seen scavanging and feeding on food waste closer to defense establishments and hill towns (e.g., Joshimath) resulting in occasional conflicts with humans. Such conflicts, according to Shri Lepcha are due to combined impacts of climate change and mismanagement of garbage. Citing another example, Shri Lepcha said that about 80% decline in apple production in the Himalayan region is due to inadequate pollination. Rapid decline in pollinators due to spray of chemicals and necessary chill factor (minimum 200 days of temperature below 6 degree Celsius) can affect bud bursting and fruit production leading to severe loss of income for farmers. He suggested that under the increasing climatic uncertainties, the farmers in the hills

have to be given proper technical support and early warning systems by the concerned line agencies as per the policies of the Central Government.

Finally, he underlined the 3Rs framework, denoting Rediscovery, Research, and Rewind. This entails rediscovering traditional agro-ecosystems, conducting research to modify them to local requirements, and reconfiguring them to address contemporary challenges.

3.2 Details of Technical Sessions

Technical Session 1: Integrated Management of Forests and Agro-ecosystems in the Himalayan region for multiple co-benefits and climate change mitigation.

Dr. G.S. Rawat, Vice President, SDFU outlined the objectives and structure of the technical sessions (Appendix – 1). He explained the commitments of India to Paris Agreement (2015) and Land Degradation Neutrality (L.D.N. 2030). He described the meaning of natural climate solutions especially protection, management and restoration of ecosystems to the local community representatives. He also clarified the meaning of greenhouse gases (GHGs), national goal of avoiding GHG emission and how increased carbon sequestration leads to mitigation of climate change and multiple co-benefits in the form of biodiversity conservation, water security, ecosystem health and livelihoods. He said that time has come when local community-based organizations and members of Van Panchayats begin to talk to the experts and policy makers in their language when it comes to getting compensation for earning Carbon credits. This would strengthen countries' ability to deal with the impacts of climate change. Planting native species, restoring degraded forests, utilizing agroforestry, and preventing deforestation could be helpful in reducing GHG emission and managing the carbon storage in the forest of Himalayan region. Good agricultural methods, management of soil organic carbon, biodynamic farming and soil-water conservation can help to mitigate climate change in the agro-ecosystem. According to him, it is vital to initiate natural solutions for sustainable storage of carbon in the Himalayan region. Using the Forest and Agro-ecosystems as examples for the deliberations during various sessions, Dr. Rawat posed the following questions to the participants for deliberations:

i. What are the problems and challenges in the integrated management of forests and ecosystems in the hills?
ii. What are the Carbon sequestration potentials of various ecosystems under different management regimes?
iii. What are the best practices for management of agro-ecosystems so that soil health and nutrients are conserved?
iv. What are the views of communities and local farmers on policies and practices advocated by the foresters and forestry scientists w.r.t. forest management?

With the above background, Dr. Rawat initiated the first session i.e., Integrated management of Forests and Agro-ecosystems in the Himalayan region for multiple benefits: Problems and Challenges. There were two lead presentations followed by discussion and questions and answers. The first presentation was made by Dr. J.C. Kuniyal, Senior Scientist, GBPNIHE, Almora on the 'Participatory management of forest ecosystems in the western Himalaya for multiple co-benefits: Problems and Challenges'. Second presentation was by Shri S.V. Sharma, Chief Executive Officer, JICA Project, Uttarakhand Forest Department on the 'REDD+ Project in Van Panchayats in parts of Uttarakhand: Key issues and challenges' Based on their experiences and specific case studies the speakers discussed the strategies for management of forests and agro-ecosystems in the Western Himalaya based on ecosystem approach and flagged the key problems and challenges faced by the concerned agencies / community based organizations.

Dr. Kuniyal provided insights into the concept of participatory forest management, formerly referred to as joint forest management in India. This approach relies on cooperative management and a mutually beneficial arrangement involving two key stakeholders: local communities and the Forest Department, working together to manage natural resources. He asserted that involving local communities in resource management has emerged as a rational strategy. Consequently, due to the increasing emphasis on participatory methodologies, local communities have gained recognition as significant contributors to the management of natural resources.

Dr. Kuniyal explained about the impact of climate change on the Himalayan region. He outlined that the region is presently encountering unusual climatic and ecological patterns, resulting in adverse economic consequences for the local population. Furthermore, policymakers are striving to alleviate the environmental stress while simultaneously addressing the requirements of the region's residents, who rely on natural resources for their livelihoods.

Optimistically, he affirmed that the forest cover in the Indian Himalayan Region (IHR) increased from 2,16,407 square kilometres in 2001 to a growth rate of 1.8% by 2021. Additionally, he conducted a comparative analysis of forest cover across the various states within the IHR over the same timeframe. Notably, states such as Jammu & Kashmir and Himachal Pradesh witnessed substantial increases in their forest cover, registering growth rates of 9.47% and 5.77%, respectively. In contrast, Uttarakhand experienced a marginal decrease in forest cover by 0.12%. Conversely, within the Eastern Himalayan region, Tripura exhibited a noteworthy 8.15% rise in forest cover, followed by Meghalaya with a 7.72% increase. Nevertheless, Nagaland and Arunachal Pradesh encountered reductions in their forest cover, with decreases of 9.56% and 4.01%, respectively.

This target, outlined by the CBD, aims to achieve the restoration of a minimum of 15% of degraded ecosystems by the year 2020, signifying the global significance of ecological restoration. Notably, the United Nations designated the years 2021-2030 as the 'Decade on Ecosystem Restoration,' and the Bonn Challenge has set forth the ambitious goal of restoring 350 million hectares of degraded and deforested land by 2030. These initiatives have served as catalysts, inspiring individuals to engage in ecological restoration efforts. Dr. Kuniyal underscored the role of community-centered forest restoration and management, emphasizing the recognition of the pivotal role played by socioeconomic and institutional factors in facilitating sustainable restoration practices.

He cited an instance of an ecological restoration initiative undertaken in the Dayara pastureland, situated at an elevation of 3501 in the Indian Himalayan Region (IHR). This endeavor, initiated by the Forest Department, has evolved into a successful on-field demonstration against both human-induced and natural degradation. The utilization of locally sourced biodegradable materials and active engagement of the local community proved particularly advantageous in this project. The ecological restoration efforts in the Dayara Bugyal area yielded tangible improvements in the vegetation profile, marked by increased

herb density, and in the soil's nutrient composition, exemplified by a soil pH of 4.96 and a water-holding capacity of 49.85%. Additionally, it effectively curbed soil erosion, preventing an annual loss of 169.64 metric tonnes of soil. Furthermore, to foster local employment opportunities, readily available resources such as pine needles and bamboo were harnessed, resulting in a 20% reduction in costs and opening up alternative livelihood avenues for 700 households."

He outlined additional eco-restoration measures implemented by NIHE, Katarmal, which are detailed below.

(i) Ecological rehabilitation efforts aimed at enhancing biodiversity conservation and promoting socio-economic development through the use of keystone tree species in three village clusters, namely Jaminikhal, Manjgaon, and Hadiya, located in Tehri district

(ii) Planning initiatives at the landscape level to facilitate ecological restoration within the Darma-Byans landscape

(iii) The establishment and development of the Suryakunj eco-restoration project

(iv) The creation and operation of a center dedicated to nature interpretation and education

(v) Strategies aimed at mitigating forest fires, including the utilization of bio briquettes and other methods employing pine needles

(vi) Comprehensive solid waste management practices, including microbial bio composting, in various Indian Himalayan towns, hill areas, tourist trekking zones, and the vicinity of the Valley of Flowers and Hemkund Sahib

(vii) The creation of environmental observatories, with one located in Mohal-Kullu, Himachal Pradesh, and another in Katarmal-Almora, Uttarakhand, for the purpose of studying climate science related to aerosols, including black carbon, and their impact

He elaborated on the potential consequences of diminishing glaciers on water availability, which may result in alterations in forest distribution. Additionally, he pointed out that shifts in precipitation patterns could have an impact on forest growth and the uphill migration of tree species, potentially causing disturbances within the forest ecosystem. To illustrate these effects, he provided several examples, including the relocation of apple orchards in response to reduced chilling hours in Himachal Pradesh, the upward movement of Pine trees in the Himalaya at a rate of 11-54 meters every decade, and the earlier blooming of *Rhododendron*

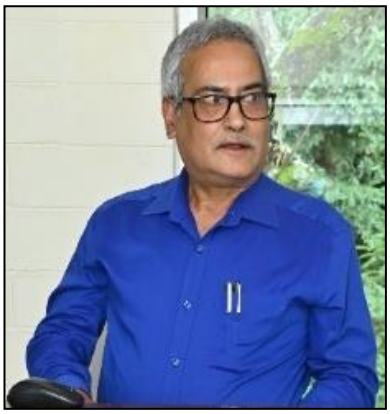
flowers by two weeks. Furthermore, temperature data revealed a 1.03°C increase, and glacial melt measuring 3.3% (between 1989/90 and 2010) was documented in Sikkim.

In the concluding remarks, Dr. Kuniyal highlighted that participatory forest management faces several challenges, which include:

(i) Current policies do not allow individuals to reap financial rewards from afforestation efforts

(ii) In many regions, local communities regard government-initiated plantations solely as a source of daily wages due to their lack of ownership over these plantations

(iii) The preferences of local communities are often disregarded when selecting species for plantation, and there can be a lack of transparency in afforestation programs



Shri SV Sharma gave a brief overview of the Uttarakhand Forest Resource Management Project (UFRMP), which has initiated a Carbon Finance Project funded by the Japan International Co-operation Agency (JICA) with a total project cost of Rs. 807 crores. He said that the project is being implemented in participatory manner involving Van Panchayats (VP) and Self-Help Groups (SHG). The major components of the project are eco-restoration (to address forest degradation/ afforestation, water conservation), livelihood development and disaster mitigation within forested area achieved through a Technical Cooperation Project. The project's geographical scope extends across nine hill districts of Uttarakhand and encompasses 839 VPs spanning 36 forest ranges within 13 Forest Divisions.

As per his explanation, the assessment of greenhouse gas (GHG) emissions involves converting all GHGs into CO_2 equivalents, which are then traded in Carbon Markets. These carbon markets function similarly to financial markets, with the distinction that the currency of exchange is carbon credits. There are two primary categories of carbon credits:

1. Compliance Carbon Markets (CER): These markets are established and regulated by mandatory international, regional, and sub-national carbon regulation schemes under the Kyoto Protocol. Countries committed to limiting GHG emissions under the Climate Change Convention can earn CER credits, equivalent to 1 ton of CO_2, by initiating Clean Development Mechanism (CDM) projects in developing countries. These credits are earned

through the validation of emission reductions by a Designated Operational Entity (DoE) and registration by the CDM Executive Board, ensuring the verification of additional emission reductions attributable to the project.

2. Voluntary Carbon Markets (VER): In contrast, the Voluntary Carbon Markets operate independently of government obligations and are primarily driven by businesses, NGOs, and individuals seeking to voluntarily offset their emissions. These markets are often associated with corporate social responsibility (CSR) initiatives. Given the expiration of the Kyoto Protocol, there is ongoing discussion about the future of compliance markets, while Voluntary Carbon Markets offer greater potential for carbon finance. The carbon financing projects for Van Panchayats (VPs) in the UFRMP specifically utilize VER credits.

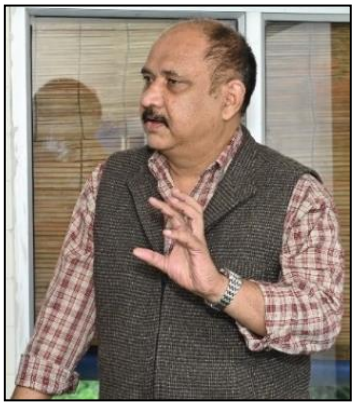
Shri Sharma stated that forests of Uttarakhand contain 5.26% of the country's carbon stock and 9.14% of its growing stock. He noted that India's per capita GHG emissions stand at 2.4t CO_2e, compared to the global average of 6.3 t CO_2e, with China, the USA, and India being the largest contributors to GHG emissions, accounting for 42.6% of the total. The global emission of GHGs annually amounts to around 50 billion tons measured in CO_2 equivalents, with the top sectors contributing to Energy (Electricity, Heat, and Transport) at 73.2%, Direct industrial Processes at 5.2%, Waste at 3.2%, and Agriculture, Forestry, and Land Use at 18.4%.

Furthermore, Shri Sharma explained that those who reduce emissions or sequester carbon can receive payments, while those required to decrease emissions can purchase carbon credits for offsetting purposes, a practice known as carbon offsetting. The issuance of any CER or VER necessitates verification and validation to meet specific standards. Various voluntary carbon standards exist, including VERRA (formerly VCS), Plan VivoGold Standard, and CCBS. For the carbon finance projects within UFRMP, the VERRA standard has been adopted. While the precise credits to be issued will be determined upon the validation of project documents listed in the VERRA registry, an initial estimation of expected credits and financing has been conducted by TERI. TERI, the institute commissioned by UFRMP for these two carbon projects, has calculated the anticipated credits and financial outcomes based on the documented information. The first expected credit for the entire project is projected to be achieved by March 2024, amounting to Rs. 22,16,02,500/-.

Regarding the anticipated finance-sharing mechanism from the sale of VERs, an institutional framework has been proposed. This framework includes a "Van Panchayat Level Carbon Finance Committee" with the Sarpanch as the Chairperson, Executive Committee members as members, and the Forest Guard as the Member Secretary. Additionally, a "Division Level Carbon Finance Committee" is proposed, with the Divisional Forest Officer as the Chairperson, Sarpanch from selected VPs and Range officers as members, and the Assistant Conservator of Forests as the Member Secretary. The finances will be received by the respective Divisional Forest Officers, who will then allocate them to selected VPs based on a divisional committee's decisions. The VP-level committee, in accordance with existing VP Rules, will determine how to utilize these funds once received.

Technical Session 2: Carbon Sequestration Potential of Forest ecosystems in the Western Himalaya and Natural Climate Solutions

In the second session, Dr. Rajesh Thadani, Senior Fellow at CEDAR initiated proceedings by delving into the topic of. 'Carbon Sequestration Potential of Forest Ecosystems in the Western Himalaya and Natural Climate Solutions.' Within this session, three presentations were delivered, followed by subsequent discussions. The inaugural presentation was conducted by Dr. Kapil K Joshi, who serves as the APCCF for Environment in the Government of Uttarakhand, focusing on the subject of 'The Sustainable Utilization of Pine Needles in Uttarakhand as a Mechanism for Natural Climate Solutions and the Generation of Sustainable Livelihoods.' The second presentation was given by Dr. Vishal Singh, a Senior Fellow at CEDAR, centring on the theme of 'Carbon Credits and Natural Climate Solutions within the Region: Addressing the Gap between Policy and Implementation.' The concluding presentation was delivered by Dr. Rajesh Thadani, a Senior Fellow at CEDAR, elucidating 'The Carbon Sequestration Potential of Diverse Forest Types in the Western Himalaya under Varied Management Regimens and Strategies for Realizing this Potential.' Based on their experiences and specific case studies the speakers discussed about forest-centric natural solutions to mitigate the impacts of climate change in the Western Himalaya.



Dr. Joshi elucidated the profound impact of forest fires, which result in tree mortality and substantial losses in timber and carbon on a global scale. Forest fires release carbon into the atmosphere, influencing climate and air quality. These emissions have far-reaching effects on global processes, including radioactive forcing and hydrological cycles. Furthermore, he added that the smoke produced from the combustion of biomass contains a range of chemicals that pose severe health risks to humans, contributing significantly to the high mortality rates observed worldwide.

Dr. Joshi emphasized that the risk of forest fires is particularly elevated in the Indian Himalayan subtropical region. Here, chir pine trees shed their dry needles annually during the months of January, February, March, and April. These dry needles have a volatile matter content of approximately 70%, rendering them highly susceptible to ignition. During the summer season, these fallen needles are often unintentionally or intentionally burned by local villagers, leading to the release of substantial quantity of GHGs into the atmosphere. In the outer Himalayan region, millions of tons of pine needles accumulate on the forest floor each year, ultimately igniting and causing significant environmental harm. This results in CO_2 emissions, soil erosion, soil fertility loss and regeneration failure, leading to environmental degradation. It is estimated that approximately 5 lakh hectares of chir pine forest area in the state of Uttarakhand generates around 2-3 million dry and fallen pine needles annually.

He conveyed that the Himalayan people with the dual challenges of meeting thermal energy needs while struggling with the depletion of vital natural resources like water, soil fertility and forest products. To address both the imperative of long-term energy sustainability and climate change mitigation, a solution was conceived - the utilization of waste forest bio residue for energy conversion. Specifically, the abundant chir pine forest residue was recognized as a significant potential source of forest-based bioenergy. The central driving force behind this innovation was the transformation of environmentally detrimental waste into a valuable energy resource, culminating in the development of a manually operated chir pine bio briquetting machine. Recognizing the severity of the problem, the extent of chir pine forests, and the fact that a substantial number of forest fires were initiated by local residents, social entrepreneurship played a pivotal role in this innovation.

Dr. Joshi highlighted that in 2013, IIT Roorkee engineered an eco-friendly chir pine bio briquetting machine designed to convert hazardous, dried and fallen pine needles into valuable high-calorific fuel briquettes. The underlying concept behind this device involved densifying biomass by subjecting it to heat while simultaneously applying physical pressure through a lever-fulcrum mechanism. The potential commercial production of this machine not only offers protection to the Himalayan Forest against the menace of forest fires but also presents a livelihood opportunity for local villagers.

He emphasized the need for the initiation of a sustainable value chain program, supported by villagers residing in areas dominated by chir pine forests. Under this program, villagers collect harmful forest bio residue and deliver it to designated value addition centres. Villagers could establish these value addition centres themselves, equipped with manually operated bio briquetting machines. These manual machines are capable of directly converting dry pine needles into briquettes weighing between 30 to 50 grams. These briquettes match coal in terms of calorific value and have a significant market demand in various industries. Interested villagers transport dry and fallen pine needles to the value addition centre, where they receive compensation at a rate of 2 Rupees per kilogram for the pine needles they bring. At the centre, villagers have the option to convert the pine needles into briquettes themselves. Once the briquettes are produced, they can be sold for 10 Rupees per kilogram. This innovative approach serves as an additional income source for villagers and has already been successfully implemented in neighbouring villages, generating income for the local communities. Villagers can explore the potential for developing a comprehensive value chain for these briquettes and consider enhancing their value through additional processing. Such initiatives are poised to effectively reduce the risk of forest fires in the immediate vicinity of villages by reducing the fuel load on the forest floor.

Dr. Vishal Singh emphasized the growing recognition of ecosystem-based strategies to adapt to the rapidly changing climate conditions in the Himalayan region. Despite the Himalayas' vital role in providing ecosystem services to a significant global population, several challenges have emerged. These challenges include a warming climate, shifts in rainfall patterns, the insufficient incorporation of community and traditional knowledge in problem-solving, a preference for

large technology-driven solutions, and inadequate legal and policy frameworks. These factors have had adverse effects on both Himalayan ecosystems and the livelihoods reliant upon them.

Dr. Singh informed the complexity of addressing climate change in the Himalaya, noting that it encompasses economic, environmental, social and even spiritual dimensions. Successful handling of these multifaceted issues requires careful preparation. Researchers must consider how to approach these intricate or 'wicked' problems. While scholars have traditionally offered new insights within their specific domains of expertise, resolving stubborn problems often necessitates interdisciplinary collaboration. In this context, researchers from diverse disciplines must unite, leveraging their distinct skills and sharing their findings to address challenges collaboratively. This multidisciplinary approach not only enhances their understanding within their respective fields but also expands the applicability and impact of their work through integrated and critical thinking.

Furthermore, Dr. Singh emphasized the importance of transdisciplinary research, which goes beyond interdisciplinary collaboration to connect knowledge, comprehension and technical innovations. This approach aims to address various needs and mitigate multiple risks, often involving engaged scholarship. Numerous opportunities exist, such as utilizing carbon credit mechanisms to conserve and enhance forest cover. However, it is crucial to view forests holistically, considering more than just their carbon stocks. Implementing agroecological approaches, for instance, can yield greater benefits without compromising associated advantages.

Dr. Thadani stated that Western Himalayan forests possess the potential to sequester varying amounts of carbon, ranging from 12 to 20 tonnes per hectare annually, with significant variability. Forest types like sal (*Shorea robusta*) and chir (*Pinus roxburghii*) exhibit higher productivity in terms of carbon sequestration, while oak forests, for instance, often sequester comparatively lower amounts. However, factors such as the forest's location (slope and aspect) and soil moisture, a limiting factor in these ecosystems, play a pivotal role in determining sequestration rates. Human disturbance also holds a crucial influence, as degraded forests

exhibit notably low sequestration rates, typically below 3-5 tonnes per hectare per year. Similarly, mature forests display lower sequestration rates.

Dr. Thadani cautioned against excessive focus solely on carbon sequestration, emphasizing that Himalayan forests offer numerous ecosystem services. In his perspective, a forest's ability to prevent soil erosion holds equal or greater importance. Other biodiversity values, such as providing alternative host plants for critical fruit-pollinating honeybees, also warrant significant attention. A forest's value encompasses numerous ecosystem services, and many current carbon-centric programs have oversimplified its value to carbon sequestration alone. This perspective could mistakenly deem exotic plantations as more valuable than natural forests, which is not the case. Forests like banj oak (Quercus leucotrichophora), which provide a range of ecosystem services, may have relatively limited carbon sequestration potential.

Dr. Thadani expressed a less optimistic view compared to some other speakers regarding the benefits of carbon credits obtained through sequestration. He questioned projects that rely heavily on external subsidies and lack scalability. He explained that carbon credit projects would need to be sufficiently large, covering a dozen or more villages, to keep certification costs low. Even under these conditions, at carbon prices of approximately $40 per tonne of CO_2e, revenues of about 12,000-15,000 Rs/ha were feasible if monitoring costs remained minimal. While significant, this revenue alone might not justify forest protection, and there is a need for clear regulation on who benefits from these funds, whether it be the village panchayat, the forest owner or the forest department's share of the revenue. He also mentioned organizations like the Acorn fund and livelihoods.eu, which work with smallholder farmers and integrate practices such as afforestation, agroforestry, and energy conservation/alternative energy. These projects typically span a 20-30 year timeline while minimizing handling and monitoring costs.

Upon the Chair's request, Dr. Thadani discussed the Forest Conservation Amendment (FCA) Act of 2023, recently notified through the Gazette. He explained that the FCA of 1980 had taken a protective stance towards India's forests, resulting in time-consuming and arguably bureaucratic forest clearances. However, these processes provided a layer of protection to forested areas. The amendment introduced a revised definition of forests that could exclude areas outside legally designated and forested regions recorded after 1980. This might lead to the removal of protection from large forested areas, including those near towns and cities

critical for their well-being, potentially opening them up for commercial development. Dr. Thadani also addressed other categories of lands excluded under the new FC amendment, which could leave many vulnerable ecosystems, particularly high-altitude grasslands and timberline forests, without protection. He argued that while concerns existed about the broad definitions provided by the 1980 Act and interpreted through the Godavarman judgement of 1996, what was needed were systems that streamlined development and forest clearances, particularly when national security was at stake, and dismantling these systems might not necessarily be the best solution.

Technical Sessions 3: Biodynamic Agriculture and Carbon sequestration

In the third session, Dr. JC Kuniyal commenced the proceedings by exploring the topic of 'Biodynamic Agriculture and Carbon Sequestration.' In this session, two presentations were delivered, followed by question and answers. The focus of this session revolved around biodynamic agriculture in mountainous regions and its significance in Natural Climate Solutions. The opening presentation was led by Ms. Binita Shah, Secretary of SDFU, which centred on 'Biodynamic Agriculture and Carbon Sequestration.' The second presentation was delivered by Dr. Rajendra Koshyari, Coordinator of Himmotthan, and revolved around the theme of 'Climate-Smart Agriculture.'

This session revolved around the practice of biodynamic agriculture in mountainous regions and its role in Natural Climate Solutions. Ms. Shah provided information about the SUPA Agriculture Research Group (SARG), a voluntary organization that has been promoting Organic and Biodynamic Agriculture Systems in India since 2003. She emphasized the poor health of Indian soil due to deficiencies in both major and minor nutrients, low carbon content, imbalanced pH levels and the scarcity of soil micro and macro-organisms caused by the excessive use of agrochemicals each year. The primary culprits of soil and water pollution are the excessive leachates and residues. This degradation of the agricultural landscape and natural habitats has a direct impact on agricultural production. According to the Indian Soil and Water Conservation Institute, Dehradun alone loses one millimetre of topsoil annually, totalling 5334 million tons lost each year due to soil erosion, at a rate of 16.4 tons per hectare annually.

Ms. Shah explained that biodynamics involves working with the life energies responsible for creating and sustaining life. It is founded on the rhythms of celestial bodies, particularly the moon and the sun, which are used to create farming calendars to enhance agricultural productivity. Additionally, Himalayan endemic herbs grown in the farm are utilized in biodynamic preparations, functioning like homeopathic compost. For example, in 1.5 tons of barnyard manure, only 6 grams of this preparation are used, resulting in compost that is 20 times superior in quality. The biodynamic preparation 500 is created inside a lactating cow horn and applied to the soil. It promotes soil carbon content, enhances topsoil microbial life, improves soil porosity and boosts seed germination. Similarly, preparation 501 is also prepared inside a cow horn with quartz crystal, which contains minute particles of quartz silica that support photosynthesis, making plants sturdier, harder and more likely to mature. This solution is applied on top of the crops after being spirally stirred. In this way, biodynamic farming can transform depleted and chemically damaged soils into fertile ones.

Ms. Shah noted that biodynamic farmers not only achieve greater cost-benefits compared to those using chemicals but also contribute significantly to carbon sequestration. This is primarily due to a 30–40% reduction in production costs rather than an increase in output. As a result, biodynamic technology is increasingly adopted in both lowland and mountainous regions. She cautioned against turning everything, including carbon credits, into a commodity, as this might divert farmers from organic practices to focus solely on financial gains. Lastly, she shared the findings of a biodynamic organic chemical (DOK) trial conducted in Switzerland. The trial revealed that, in contrast to organic and chemical farming plots, biodynamic plots had the highest population of arthropods and the lowest energy consumption. The biodynamic plots also boasted the highest humus content, containing up to 450 kg/ha of carbon, surpassing all other farming methods. In light of these findings, she underscored the importance of biodynamic farming as a forward-thinking approach.

Dr. Koshyari discussed the significant impact of different agricultural practices on climate change, particularly on small-scale farmers in Uttarakhand. He highlighted the cultivation of kidney beans, a high-value cash crop in the Indian Central Himalayan region, as an example. He said that the Himmotthan identified various issues with the traditional methods employed by kidney bean farmers in Munsyari. Farmers were densely

planting their crops to combat pest attacks, particularly from cutworms, but this practice led to reduced seed and seedling quantities and compromised produce quality due to inadequate sunlight. Furthermore, they relied on forest-sourced poles for support, resulting in narrow row and plant spacing that hindered farmers' mobility.

To address these challenges, vertical nets were introduced for support, reducing dependence on forest resources. Farmers were advised to increase row-to-row and plant-to-plant distances, significantly reducing the number of seeds required. Dr. Koshyari also explained another innovation: the implementation of ridges and furrow planting, which effectively reduced cutworm attacks, as pests tend to move in straight lines. These agronomic practice modifications had a profound impact on kidney bean cultivation, resulting in a substantial increase in yield and improved quality, along with reduced production costs. The adoption of this technique led to up to a 40% increase in yield, and many farmers have since embraced this technology. Importantly, this intervention, the net trellis system, alleviated pressure on forests and the environment.

Dr. Koshyari emphasized the high market demand for pulses, millets and traditional crops grown in mountainous areas, but the availability of suitable seeds remains a significant challenge. To address this issue, he proposed the establishment of a company or entity dedicated to producing local and improved seed varieties suitable for mountainous environments.

Regarding beekeeping, Dr. Koshyari highlighted its value in promoting pollination services and honey marketing. Himmotthan initiated beekeeping to support pollination and biodiversity conservation in the face of climate change. Over 1000 beekeepers and farmers from different mountain districts of Uttarakhand joined a Farmer Producer Organization (FPO) called Pahaadi Utpaad Self-Reliant Cooperative. The FPO members raised two species of honey bees, *Apis Indica* (Higher Himalaya) and *Apis Mellifera* (Lower Himalaya). These bees fed on diverse wild flora, resulting in nutrient-rich and distinct honey.

He mentioned that beekeeping offers an additional income source for farmers with limited land. To increase the revenue of marginal farmers, Dr. Koshyari suggested promoting mud hives, bee breeding centers and biodiversity. Encouraging at least one honey bee box per acre would enhance diversity and pollination. In the middle and upper Himalaya, mud hives were

found to be ideal for promoting *Apis cerena indica*. He emphasized following organic approaches in agro-ecosystems and conducting flora studies to encourage beekeeping.

Dr. Koshyari proposed interventions to ensure mountain farmers have access to climate-resilient seeds, as many currently rely on plains-specific seeds, depleting local seed banks. He noted that mountain-specific seeds are often limited to research institutes and lack commercial production uptake.

Additionally, he discussed the mixed crop-livestock farming techniques practiced in the Himalayan subtropical regions, where local cows (Badri) are raised to produce milk with the prized A2 beta-casein protein. However, selling milk from remote villages is challenging, and there is a growing premium market for such milk in metropolitan cities due to its medicinal properties. To increase product value, Himmotthan organized milk producers in the Badrinath valley to establish a Farmer Producer Organisation (FPO)-led Ghee enterprise. They adopted a unique model for collecting butter from remote villagers and processing it centrally. Currently, *ghee* is packaged and marketed at rates ranging from Rs. 1200 to 1500 per kg, highlighting the need to focus on promoting the Badri cow breed.

Technical Session 4: Community mobilization for soil-water and natural resource management in Kumaun Himalaya/ contribution from local Van Panchayat

In the third session, Dr. Kapil K Joshi initiated the discussions by delving into the theme of 'Mobilizing Communities for Soil-Water and Natural Resource Management in the Kumaun Himalaya, with a Focus on the Contributions of Local Van Panchayats.' This session placed significant emphasis on the effective engagement of local communities in the formation of VPs and their vital role in addressing current and future climate change challenges. The inaugural presentation was delivered by Shri Rajendra Bisht, Chairman of the Himalayan Gram Vikas Samiti, who spoke on the topic of community mobilization for soil, water and natural resource.' The subsequent presentation was by Dr. Badreesh Mehra, Executive Director of CHIRAG, focusing on the 'Socio-Hydrogeological Approach for Management of Springsheds.'

Shri Bisht provided insights into the conservation efforts aimed at forests and water resources in the Himalayan region and their profound influence on the livelihoods of rural communities. He also discussed the repercussions of climate change on the region's precipitation patterns. While the average annual rainfall in the mountains has remained consistent, he pointed out that reduced snowfall and alterations in winter rainfall have had severely detrimental effects on the area's water sources and agricultural and fruit production. Moreover, he noted that excessive rainwater, due to climate change, flows swiftly through the mountains, unable to be absorbed by the hill slopes.

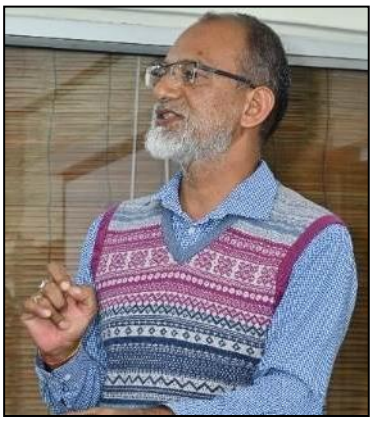
According to his observations, chir forests in the mountainous regions contribute to groundwater recharge by approximately 15%, whereas oak and broadleaf forests replenish groundwater by more than 30%. Discussing the significance of snowfall, he explained that snowmelt, which lingers on mountain peaks for several days, contributes to groundwater recharge by up to 60%. In contrast, rivers become inundated with water within a matter of minutes after rainfall ceases. Consequently, snowfall plays a unique role in replenishing groundwater. He underscored the urgent need to prevent the expansion of chir forests and the privatization of water resources, agriculture, and animal husbandry. Mr. Bisht also made several recommendations:

i. Identification of water sources in mountainous areas is essential for securing water resources. The Forest-Water Resource Department and Gram Panchayats should collaborate to create a comprehensive water source atlas, guided by state-level institutions. Given the substantial forest cover in the region, the Forest Department's involvement is pivotal.
ii. Responsibility for groundwater recharge and water management should be delegated to Panchayats, ensuring the stability of water supply and conservation projects. Furthermore, enhancing their capacity is crucial to hold them accountable for these tasks. Projects related to joint village schemes and pumping should be entrusted to Jal Nigam and Jal Sansthan.

iii. High-altitude areas in the Himalayan region are particularly delicate and water conservation efforts in these regions should be approached with caution, seeking expert guidance to avoid exacerbating landslides.

iv. Rainwater harvesting above 1500 meters above sea level should be promoted to address the drinking water needs of higher-altitude residents. Prioritizing rainwater collection can boost participation from these communities.

v. Encouraging the construction of small reservoirs and water conservation structures on mountain peaks in the Central Himalayas can bolster water conservation efforts. Preserving dense oak and broadleaf forests in high-altitude regions is crucial, while the expansion of pine forests in banj areas should be curtailed. Incorporating traditional ecological knowledge and practices of the Himalayan region into the school curriculum is essential.



Dr. Mehra addressed the mounting water scarcity crisis experienced by many Himalayan villages in recent years. This crisis has resulted from the gradual but consistent decline in natural springs, which serve as the primary source of water for these communities. The diminishing springs, attributed primarily to alterations in rainfall patterns and land use, have disrupted the delicate balance of groundwater recharge. Springs play a unique role in hill regions as they are natural outlets for groundwater. Therefore, changes in precipitation and land use directly impact spring discharges. This reduction in spring flow has downstream consequences, notably affecting streams and rivers, particularly during the summer months, and impacting both local communities and the surrounding ecology.

Dr. Mehra pointed out that in the Himalayan region, around 90% of communities rely on spring water for their domestic needs. Data from the Indian Meteorological Department (IMD) for Uttarakhand over the past century indicates a 12-17% decline in rainfall, accompanied by a significant reduction in the number of rainy days. This trend has caused many Himalayan springs to shift from being perennial to seasonal or even dry up entirely. Consequently, long lines at public taps and hours-long waits for water tankers have become common, negatively affecting not only the population but also agriculture, livestock farming, and tourism, a crucial economic sector in the state. Women in rural areas face even greater

hardships, as they must spend considerable time fetching water, often from distant sources, due to the drying up of local water sources.

Dr. Mehra emphasized that households reliant on Himalayan springs spend an average of 184 minutes daily, particularly during summers, collecting water. Financial constraints and the remoteness of these villages make accessing water tankers challenging. The physical toll of this water-fetching task leads to medical complications, particularly among women, including severe gynaecological issues. Additionally, mothers cannot devote sufficient care and attention to their children due to the time-consuming struggle for water access.

To address these challenges, various government and non-government organizations have attempted to assist these communities. The Central Himalayan Rural Action Group (CHIRAG) has been involved in water sector initiatives since 1986, collaborating with mountain communities to tackle these issues. In 2006, they launched the 'springshed development and management' initiative, designed to recharge and rejuvenate Himalayan springs using advanced scientific knowledge and methods. This targeted approach identifies spring catchment areas based on hydrogeological factors and employs engineering and vegetative measures to treat the catchment area, facilitating groundwater recharge for mountain aquifers, and thus reviving springs and maintaining stream and river flows. The initiative prioritizes community involvement through village-level institutions called 'Jal Upbhokta Samiti' or 'Water User Groups/Committees.' These groups exemplify a sustainable initiative firmly rooted in inclusive local groundwater governance. The social aspect of the process has gained prominence, evolving into a landscape management initiative and garnering support from NITI Ayog and the Ministry of Jal Shakti.

Dr. Mehra highlighted Uttarakhand's rich natural resources, with local communities heavily reliant on water, forests and other ecosystem services. Balancing the judicious use of these resources while prioritizing economic development, social progress and poverty reduction is a formidable challenge. To enhance climate change resilience and adaptation, he stressed the growing importance of aligning incentives for natural resource conservation with management strategies that motivate users to sustainably maintain ecological equilibrium. This approach calls for strengthening the interconnection between springs and the daily lives of mountain communities, given their dependency on spring water. Moreover, it delves into the hardships faced by women and girls related to water availability.

Dr. Mehra firmly advocates for community involvement in every intervention, from the planning stage through project implementation and post-project maintenance. He underscores the need to establish robust community institutions and provide continuous support to these organizations, advocating for replication and scaling up at the state and national levels."

4.0 General Discussion and Policy Recommendations

In this session comments and suggestions were invited from the community-based organizations, representatives of womens' self-help groups (SHGs), farmers involved in organic farming and horticulture, members of the Van Panchayats (VPs) and experts including members of SDFU. The participants were encouraged to share their views on issues and challenges pertaining to management of forests and agro-ecosystems in the Himalayan region. General discussion was followed by formulation of policy recommendation facilitated by Shri S.T.S. Lepcha, Chairman, SDFU.

4.1 General Discussion:

The following issues were raised and discussed:

i. Decline in crop production and millet farming

Ms. Heera Madan Bohra, member of women's self-help group from Champawat pointed out the challenges faced by the hill farmers due to loss of agricultural productivity, shortage of water for irrigation and crop damage by wildlife such as wild pigs and monkeys. Citing the case study from the rural areas of Champawat (Uttarakhand), she explained how the local farmers in recent decades had given up cultivation of traditional crop varieties especially millets. The farmers were finding it difficult to get adequate income from agriculture and most of them didn't have seeds of traditional food crops, especially millets. With the declaration of year 2023 as International Year of Millets, the Government of India and Uttarakhand Government have taken several initiatives to revamp millet farming in the state. By highlighting the benefits of millets both for human health and soil environment, Mrs. Bohra's group has distributed seeds of various millets in some pilot villages of Champawat and encouraged the farmers to cultivate them. Villagers know that millets can be grown easily in rain-fed areas and these crops do not require much fertilizer. Also, in a mixed cropping loss due to wildlife is less as some of the millets such as fox-tail millet is not damaged much by wild animals. She informed the house that millet farming (organic agriculture), coupled with home-stay eco-tourism in some villages is picking up gradually and several farmers would be able to sustain their livelihood. As of now there are 75 sales centres for the sale of millets and pulses, several home stays and shops for the local handcrafts in the project areas of Champawat. Around 8-10 families in the village with old stone cottages have been registered and enrolled under the community homestay program. During the organization of fairs, garbage is dumped on the banks of the rivers, due to which the people associated with the rivers are affected. The government should develop a strategy for the waste disposal. She believes that people who are associated

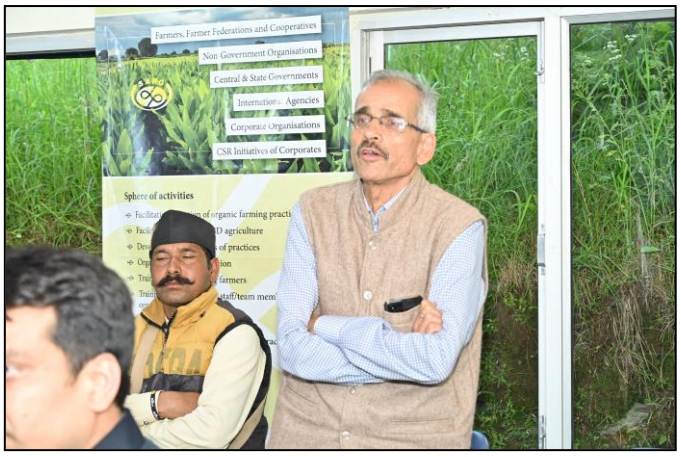
with the forest can never harm the forest as they are dependent on forest resources. Further, Mrs. Bohra suggested that Gram Sabhas in the state of Uttarakhand need to address problem of drinking water collectively under the Jalaj program of the Government of India.

ii. Lack of land suitability assessment and soil testing facilities

Shri Mahesh Galiya, retired teacher from Ramgarh and farmer shared his experience of working at Supa nursery for more than 22 years (1988 to 2010). He said that earlier agriculture did not specifically provide any advantages for sustaining life. So, he ran several experiments on apple nursery for its solution. In mountain area, farmers do not get fair price for their harvests. Additionally organic crops are not recognized in the market place. Due to the overuse of new crop species, the old species have reached on the verge of extinction. He said that there are more than 100 varieties of potato in the centre but only 5 varieties are remained in the village. He informed that soil which is not suitable for specific crop would not be successful if grown. Therefore, soil testing is important before growing any crop in the field. He suggested that there should be some alternative for the pine briquettes and packing material. In his opinion, he does not wish to initiate bio farming because it is risky owing to crop diseases and market conditions.

iii. Need for special policy to protect pollinators (honey bees)

Shri Vinod Pande, a veteran forester and conservationist from Nainital highlighted the importance of honey bees in production of agricultural and horticultural crops. He expressed concern over rapid decline of honey bees in recent decades. Following is the summary of remarks made by Shri Pande:



Bees are part of the biodiversity on which we all depend for our survival. They provide high- quality food—honey, royal jelly and pollen. As the landmark 2019 report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) notes, "Sacred passages about bees in all the worlds' major religions highlight their

significance to human societies over millennia." Beekeeping also provides an important source of income for many rural livelihoods. According to IPBES, the western honey bee is the most widespread managed pollinator globally, and more than 80 million hives produce an estimated 1.6 million tonnes of honey annually. And pollinators contribute directly to food security. According to bee experts at the Food and Agriculture Organization (FAO) of the United Nations, a third of the world's food production depends on bees. When animals and insects pick up the pollen of flowers and spread it, they allow plants, including many food crops, to reproduce. Birds, rodents, monkeys and even people pollinate, but the most common pollinators are insects, and among them, bees. Thus protecting pollinators requires special policy.

iv. Need to promote good environmental deeds and implement Green Credit Programme in Uttarakhand

Shri Akhilesh Singh, Programme Officer, GIZ, Delhi informed the participants that the Green credit scheme encourages 'environment-friendly' behaviour, but needs strong regulation to work. India's environment ministry has proposed a Green Credit Programme under which individuals, organisations and industries can earn and sell credits for certain environment-friendly activities, which can then be traded. The Green Credit Programme covers a wide range of activities, including sustainable agriculture, forestry, water conservation, air pollution reduction, waste management, as well as sustainable building and infrastructure, and eco-labelling initiatives. The authorities of Uttarakhand should be informed about good environmental practices. He suggested integrated planning to bring all the sectors together. At last, he underlined how to bring funding for climate finance.

Other suggestions and recommendations given by the participants were as follows:

(a) The farmers practising organic agriculture and following the wise practices of conserving soil nutrients in their fields should be incentivised by the Department of Agriculture. Government also needs to establish outlets for the organic produce at various points and appropriate schemes are needed for value addition and market linkages.

(b) Areas vulnerable to acute human-wildlife conflicts due to crop damage by wild animals need to identified and mapped. Appropriate mitigation measures (species specific) to minimise human-wildlife conflicts need to be evolved on priority basis.

(c) Many areas in the hills have tremendous potential for agro-forestry. Research Institutions such as Forest Research Institute (FRI) Dehradun or Forestry Departments of the Universities in the IHR need to take up pilot projects to implement agro-forestry packages in the region.

(d) Proper inventory and protection of springsheds is critical for sustained flow of drinking and irrigation water. Proper incentives must be given to the communities who are protecting the springsheds.

(e) Areas under pine forests in the Himalayan region are quite vulnerable to forest fires. Repeated fire in pine forests lead to drying of slopes and rapid run-off of rain water. Standard SOPs are required for the integrated management of pine forests in the region.

4.2 Policy Recommendations

Based on the general discussion on various issues raised above, the following policy recommendations are made collectively by the group:

1. In order to scale up the carbon projects in the state of Uttarakhand, especially within VPs, it would be mandatory to establish the baseline data on the present state of Carbon

stock. Subsequent to implementation of carbon projects in these forests in the form of protection, ecological restoration, avoided deforestation, a clear-cut target on carbon gains for the given time period should be fixed and agreed by the VPs as well as Forest Department. All the carbon gained within the given time period should be given the status of **Non-timber Forest Produce** earned by Van Panchayats. The amount of Carbon thus gained can be converted in monetary terms for compensation to Van Panchayats. Similarly, improved hydrology and enhanced flow of spring water from the well managed Van Panchayat Forests should be valued and due benefits should be given to the concerned Van Panchayats. The accrued carbon (black bonus) and water (blue bonus) should be appropriately brought into state level policy and practiced.

2. In order to incentivise the Van Panchayats for carbon sequestration it is recommended to follow a standard formula for estimation of carbon sequestered by way of fire protection, and controlled livestock grazing, and other biomass extraction. The Van Panchayats following such practices may be compensated as per the market rate from the Capital Head of the state budget directly through Divisional Forest Officer. As of now there is no such provision to incentivise the Van Panchayats for protection of the forests

3. Currently there is no clear policy on protection of pollinators especially honey bees, butterflies, and moths in agro-ecosystems. It is recommended that the state agriculture and horticulture departments develop appropriate policies to protect these pollinators especially in the localities which are known for organic farming and fruit protection. It is to be noted that sources of such pollinators are Van Panchayats and surrounding forest ecosystems. Thus, the pollination services in agro-horticultural lands flow from the forest ecosystem. Therefore, appropriate policies and provisions should be made to compensate Van Panchayats for providing pollination services.

4. There is a need for amendment in the Van Panchayat Rules so that Van Panchayats can receive funds directly from the carbon financing projects. Further, provision should also be made to enable VPs to utilize such funds for carrying out forestry and conservation related works within the VP area.

5. All the hill farming in the state of Uttarakhand depends on integrated management of soil nutrients, soil moisture, fuel, fodder, and leaf litter supplies from the surrounding forests. According to one study nearly seven units of forests are required to sustain one unit of agriculture in the hills. However, there is no quantitative study to analyse the value of ecosystem services flowing from forests to agriculture. Therefore, all the carbon stored in the agro-ecosystems as well as village forests / Van Panchayat Forests should be bundled and applied for Carbon market. This will require policy level intervention.

6. There are many pockets of traditional agriculture in the hills where farmers have inherited immense traditional knowledge on sustainable farming especially on millet farming and processing of food grains for storage, use etc. Such farming practices have highest potential for climate change resilience. Efforts are needed to identify such farmers (Bare-feet Scientists), incentivise them and give due recognition in the form certificates so that they can serve as resource persons for extension services in hill farming.

7. It is recommended that Government of India's Green Credit Programme (under MoEFCC) be implemented in the state of Uttarakhand especially in Van Panchayats and Biodiversity Management Committees. This would require amendment of State Van Panchayat and Biodiversity Rules.

8. In order to mitigate the crop losses incurred due to extreme weather events and as an adaptation to changing climate the state governments need to initiate crop insurance schemes and establish funds to meet various needs of the farmers.

Shri Mahesh Galiya

Smt. Heera Madan Bohra

Shri Vinod Pande

Shri Akhilesh Singh

Vote of Thanks

The workshop concluded with an expression of gratitude by Ms. Binita Shah, Secretary of SDFU. She extended her thanks to all the Session Chairs, Keynote Speakers, Panellists and Participants for their active engagement. She also conveyed special appreciation to the Nainital Bank for their support in organizing the workshop.

6.0 Field visit

Background The ‘Sansakt Project’

The SUPA farm started with the conversion into biodynamic practices since 1998 and started the promotion of the BD system for other farmers in 1999 from the farms very neighbours. At that time the micro valley comprising of 65 ha and about 100 farmers were not aware on the

different Organic practices. The usage of agro chemical was high and each farmer used 1 – 2 bags of DAP (Di Ammonium Phosphate) on his field each year. That is around 200 bags of DAP was being used in the valley. As the SUPA farm started to develop, initiatives were taken with the neighbouring farmers to adopt Organic / Biodynamic practices. Some of the areas were also linked with different programs going on in the state with guidance from SUPA farms. After years of perseverance the SANSAKT project has taking shape into a contagious patch of area where Organic /Biodynamic Farming is being practiced. The farmers' fields are also certified under third party certification as well as PGS systems. Some of the produce like kidney beans, herbs etc are bought back by SUPA farms and some are linked to other buyers.

After conducting a preliminary survey of the Sarg Training Centre, the participants were given the opportunity to visit the villages and engage with local farmers practicing organic agriculture. Shri Jaman Singh Dangwal and Shri Gopal Singh Bisht shared their perspectives on organic farming and its relationship with climate change as follows:

1. **Shri Jaman Singh Dangwal**- He mentioned that the cultivation of peas and indigenous potatoes is prevalent in the area, with peas being a significant cash crop. Traditional bullock-driven farming practices have been replaced by machinery. Hybrid seeds have gradually supplanted the use of traditional seeds, which have become scarce in the region. Shri Dangwal emphasized the importance of transitioning back to organic farming practices. He has adopted organic farming methods to enhance soil fertility, employing up to 90 percent organic compost in his fields. Additionally, he discussed the successful development of *22 nali* land for organic apple cultivation, highlighting the absence of pollination issues in apple flower growth. He also noted that farmers previously faced severe crop pest problems, akin to epidemics in the region. However, the adoption of organic farming has eliminated the need for chemical pesticides due to the absence of pest attacks in their crops.

2. **Shri Gopal Singh Bisht**- He reported that Rajma (kidney beans) production has been adversely affected by insufficient snowfall. This year, the yields of apricots (Aadu) and apples were also lower. Comparing this year's harvest to the previous year, he noted a 50 percent decrease in his yields and attributed this decline to the impact of climate change.

Organic apple orchard at Sari village

Field Survey

Field survey

Meeting with Shri Gopal Singh Bisht

Interation with Shri Jaman Singh Dangwal

Dr. GS Rawat and JC Kuniyal with an organic farmer

	
Collection of oak leaves for the Agro-ecosystem economy	Organic compost at the Sarg Training Centre
	
A villager is planting seeds in the agricultural field	Local transportation currently has a minimal carbon footprint

	
Lichen and mosses play a vital role in conserving water	Women are the cornerstone of the hillside agroeconomy

ANNEXURE I

Workshop on

Ecosystem Based Approaches for Climate Change Mitigation and Sustainable Food Production in Western Himalaya

August 11th-12th, 2023
Venue: SARG Training Centre, Tok Sadi, Ramgarh, Nainital

Programme

Time	Particulars	Speakers / Resource Persons
Day 1 (11th August 2023)		
10:00 hrs	Welcome	Shri STS Lepcha, Chairman SDFU
10:15 hrs	Background, objectives and expected outcome of the workshop	Dr. GS Rawat, V Chairman SDFU
Technical Session – 1:		
10:30 – 11:30 hrs Chaired by: Dr. GS Rawat, V Chairman SDFU	1. Integrated Management of Forests and Agro-ecosystems in the Himalayan region for multiple co-benefits 2. Challenges and issues in Agro-Ecosystem with special dependence and forest in Himalaya Case Study: Carbon credit program in Van Panchayat Discussion	Dr. JC Kuniyal, GBPNIHE Shri SV Sharma, JICA, REDD Project
Technical Session – 2:		
11:30 – 13:00 hrs Chaired by: Dr. Rajesh Thadani, CEDAR	1. Prevention of Fire from Pine Needles as Natural Climate Solutions 2. Natural Climate Solutions Pathways and Baseline Assessments of Carbon sequestration through participatory approaches	Dr. Kapil K Joshi, APCCF, Environment, Govt of Uttarakhand Dr. Rajesh Thadani, CEDAR Dr. Vishal Singh, CEDAR

	Discussion	
13:00 – 14:00 hrs	**LUNCH**	
Technical Session – 3		
14:00 – 15:00 hrs Chaired by: Dr. JC Kuniyal, GBPNIHE	1. Biodynamic Agriculture and Carbon sequestration 2. Climate Smart Agriculture Discussion	Ms. Binita Shah Dr. Rajendra Koshyari, Himmotthan
Technical Session – 4		
15:00 – 16:00 hrs Chaired by: Dr. Kapil K Joshi, APCCF, Environment, Govt of Uttarakhand	Community mobilization for soil / water and natural resource management in Kumaun Himalaya/ contribution from local Van Panchayat Discussion	Shri Rajendra Bisht, Himalayan Gram Vikas Samiti (HGVS) Dr. Badrish Singh Mehra, ED, CHIRAG
16:00 – 16:15 hrs	**Tea Break**	
16:15 – 17:00 hrs Chaired by: Shri STS Lepcha, Chairman SDFU Moderated By: Ms. Binita Shah	Panel Discussion on Policy environment and the sustainability of the agroecology of the Indian Himalaya Panellists – Shri Akhilesh Singh, GIZ / Mahesh Galiya / Vinod Pande/ Smt. Heera Madan Bohra	
Day 2 (12th August 2023)		
09:00-13:00 hrs	Field visit Venue**:** Organic Sansakt Project, Sadi	

ANNEXURE II

List of Participants

S. No.	Name	Institutions
1.	STS Lepcha	Chairman, SDFU
2.	Dr. GS Rawat	Vice Chairman, SDFU
3.	Binita Shah	Secretary, SDFU
4.	Dr. Rajesh Thadani	Senior fellow, CEDAR
5.	Dr. JC Kuniyal	Senior Scientist, GBPNIHE
6.	Dr Badrish Mehra	Executive Director, CHIRAG
7.	Rajendra Bisht	Chairman, HGVS
8.	SV Sharma	Chief Executive Officer, JICA, REDD Project
9.	Kapil K Joshi	APPCF, Environment, Govt. of Uttarakhand
10.	Akhilesh Singh	Program Officer, GIZ, Delhi
11.	Dr. Rajendra Koshyari	Coordinator, Himmotthan
12.	Dr. Vishal Singh	Senior fellow, CEDAR
13.	Heera Madan Bohra	Millet Social Worker
14.	Vinod Pande	NGO based in Nainital
15.	Mahesh Galiya	Member, Jan Maitri Sangathan
16.	Rajeshwari Devi	Member, Jan Maitri Sangathan, Sadbunga
17.	Hema Nayal	Member, Jan Maitri Sangathan, Sadbunga
18.	Durga Singh Bisht	Jan Maitri Sangathan, Bana
19.	Gopal Singh Bisht	Farmer, Bana
20.	Laxman Singh	Farmer, Gangolihat
21.	Kailash Chandra	Farmer
22.	Hem Chandra	Ex-Pradhan, Chaukhuta
23.	Jagat Singh	Farmer, Munsiyari
24.	Soban Singh Bisht	Farmer, Supi
25.	Basant Upadhyay	Farmar (Sari)
26.	Suresh	Farmer
27.	LM Bhaset	Farmer
28.	Nupur Sarkar	Secretariat, SDFU
29.	Soni Bisht	Rapporteur
30.	B. Lepcha	Individual
31.	Anita Kuniyal	Individual
32.	Sandeep Singh	Individual
33.	Sunom Lepcha	Individual
34.	NC Upadhyay	Individual
35.	Yogesh Mehta	Individual

Glimpses of the Event

विषय विशेषज्ञों ने दी पश्चिमी हिमालय में जलवायु परिवर्तन के प्रभावों की जानकारी

- व्यावहारिक और नीतिगत कदम उठाने की आवश्यकता पर दिया जोर
- सतत विकास फोरम उत्तराखंड व सर्ग की पहल पर हुई कार्यशाला

आज समाचार सेवा

नैनीताल। पश्चिमी हिमालय में जलवायु परिवर्तन प्रभाव के शमन और सतत् खाद्य उत्पादन के लिए पारिस्थितिकीय आधारित समाधानों पर विशेष कार्यशाला का आयोजन नैनीताल जिले के रामगढ़ में किया गया। कार्यशाला में 35 से अधिक प्रतिभागी उपस्थित थे। प्रतिभागियों में वन विभाग, कई स्वैच्छिक संगठनों के प्रतिनिधि तथा वन पंचायतों और ग्राम पंचायतों के सदस्य समेत कई वरिष्ठ वैज्ञानिकों तथा विशेषज्ञों और सतत विकास फोरम उत्तराखंड (एसडीएफ्यू) के सदस्यों ने भाग लिया।

इससे पूर्व कार्यशाला की शुरुआत बिनीता शाह सर्ग ट्रैनिंग सेंटर की संस्थापक ने स्वागत भाषण से किया। उसके बाद सतत विकास फोरम के अध्यक्ष एस .टी. एस. लेपचा (सेवानिवृत प्रमुख वन संरक्षक उत्तराखंड) ने कार्यशाला की पृष्ठभूमि और जलवायु परिवर्तन के प्रभाव से हिमालायी क्षेत्र में हो रहे प्रभाव से निपटने हेतु व्यावहारिक और नीतिगत कदम उठाने की आवश्यकता पर बल दिया जबकि सतत विकास फोरम के उपाध्यक्ष डॉ. जी. एस. रावत ने कार्यशाला के उद्देश्य और संभावी निष्कर्षों पर प्रतिभागियों को अवगतकराते हुए विभिन्न सत्रों के बारे में जानकारी दी। कार्यशाला में पारिस्थितिक तंत्रों के समेकित प्रबंधन से संबंधित समस्याओं और चुनौतियां,जलवायु परिवर्तन के प्रभाव के शमन हेतु वन एवं कृषि पारिस्थितिकी तंत्रों में कार्बन संचयन एवं प्रकृति आधारित समाधान, बायोडायनिमिक एवं जैविक कृषि के लाभ एवं उचित विधियाँ तथा समुदाय आधारित संगठनों का जलवायु परिवर्तन शमन एवं मृदा तथा जल के संरक्षण में भूमिका विषयों पर सभी प्रतिभागियों द्वारा खुली चर्चा की गयी। कार्यशाला में कई मुद्दों पर व्यावहारिक एवं नीतिगत सुझाव दिए गए। कार्यशाला के प्रमुख सुझाव उत्तराखंड एवं भारत सरकार के कई नीतियों को भेजे जाएंगे। कार्यशाला में वरिष्ठ वैज्ञानिक डॉ.जे.सी. कुनियाल, एस.वी. शर्मा, डा. कपिल जोशी, राजेश थडानी, विशाल सिंह, बिनीता शाह, राजेन्द्र कोश्यारी, राजेन्द्र बिष्ट, बद्रीश मेहरा, अखिलेश सिंह, महेश गलिया, विनोद पांडे तथा नूपुर सरकार व सोनी दफौटी आदि उपस्थित थे। बता दें कि दो दिवसीय इस कार्यशाला का आयोजन सतत विकास फोरम उत्तराखंड और सर्ग की ओर से सर्ग प्रशिक्षण केंद्र तोक सदी रामगढ़ में किया गया।

SUSTAINABLE DEVELOPMENT FORUM UTTARANCHAL

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