



Making India Proud of our Mountains

SUSTAINABLE MOUNTAIN DEVELOPMENT SUMMIT SMDS XII

“Changing Agroecological Landscape and Disasters in the Himalaya: Resilience Building and Policy Imperatives for Viksit Bharat”

26-27 September 2025

Venue: Dr. Nityanand Auditorium, Doon University,
Dehradun, Uttarakhand



www.mountaininitiative.in

सुबोध उनियाल
मंत्री
SUBODH UNIYAL
Minister



वन, तकनीकी शिक्षा, भाषा एवं निर्वाचन
उत्तराखण्ड सरकार, देहरादून-248 001
Forest, Technical Education
Language & Election
Govt. of Uttarakhand, Dehradun-248 001

Message

It gives pleasure to know that the Integrated Mountain Initiative (IMI) is organizing the 12th edition of Sustainable Mountain Development Summit (SMDS) during 26th-27th September, 2025 in Doon University campus, Dehradun.

The themes are of utmost importance and relevant considering the present scenario of Climate Change and its direct impact of the valuable bio-diversity and agro-ecology of the Indian Himalayan Region. Given the spate of continued water disasters in the Hill terrain, a well thought dialogue among the stakeholders is the need of the hour. Active participation in Summit by number of delegates from mountainous Indian states and as well as from Nepal, is a welcome initiative.

I take this opportunity to congratulate Integrated Mountain Initiative (IMI), the organizer of the event and extend my Good Wishes for fruitful deliberations & result oriented sessions.

|| Subodh Uniyal ||

Dated : Dehradun
September 22, 2025.



Message

**Hon'ble Vice-Chancellor Prof. Surekha Dangwal,
Doon University, Dehradun**

It is with immense pleasure that I welcome all the distinguished delegates, policymakers, academicians, and community representatives to the Sustainable Mountain Development Summit (SMDS) 2025, hosted here at Doon University. The theme, "Changing Agroecological Landscape & Disasters in Himalaya: Resilience Building and Policy Initiatives for Vikshit Bharat," is both timely and critical for the future of our magnificent Himalayan region.

The Indian Himalayan Region (IHR), a global biodiversity hotspot and the water tower of Asia, is facing unprecedented challenges. The impacts of climate change are increasingly pronounced here, threatening our unique agroecological landscapes, indigenous food systems, and the very livelihoods of mountain communities. The increasing frequency of climate-induced disasters makes it imperative for us to forge collaborative pathways toward resilience.

Academic institutions have a pivotal role in this endeavor. At Doon University, particularly through our Dr. Nityanand Himalayan Research and Study Centre, we are deeply committed to addressing these challenges head-on. We are fostering skill-oriented education and cutting-edge research to build a deeper understanding of Himalayan geology, hydrology, and climate science. Our advanced GIS, Hydrology, and Engineering Geology labs are not just academic facilities; they are hubs for developing innovative solutions for disaster mitigation and sustainable resource management. By nurturing a new generation of researchers, including a notable 70% female enrollment in our geosciences departments, we are building the human capital required for a sustainable mountain future.

This summit is a crucial platform to bridge the gap between scientific research and policy action. The knowledge and strategies developed here will be vital for informing sensitive policies and ensuring that the agroecological pathways of the IHR are integral to the Viksit Bharat 2047 vision.

I wish the summit great success in its deliberations and hope it culminates in a clear roadmap for a resilient, prosperous, and sustainable Himalayan region.



Message

President IMI

Mr. Ramesh Negi

I welcome all the delegates, experts, govt officials and political leaders to 12th SMDS at Doon University, Dehradun, Uttarakhand.

Himalayas have been in past decades adversely affected by CLIMATE CHANGE, and in last five years the situation is getting critical and out of control, be it GLOF or cloudbursts or massive landslides resulting in ever increasing loss of human life and property. Ecological degradation is never quantified and remains beyond public as well as experts notice.

I sincerely hope that SMDS 12 will deliberate on the issues of water borne disasters and the impact of climate change on agro-ecology of our fragile Himalayan region.

I thank all our sponsors as well as collaborators without whom this gathering could not have been possible. With the large gathering of scientific, social, civil as well as political communities we hope to bring about a meaningful dialogue and productive output.

Best wishes

Ramesh Negi



Preface

The Sustainable Mountain Development Summit XII at Dehradun comes at an important juncture for the people and ecology of the Indian Himalayan Region where we revisit and reflect on our development trajectories.

The Sustainable Mountain Development Summit (SMDS) is the annual flagship event of Integrated Mountain Initiative, a civil society platform with a vision to make India proud of her mountains. SMDS is the space for multidisciplinary conversations highlighting the need for mountain sensitive policies and practices with appropriate resource allocation.

The SMDSXII will bring in community representatives, elected representatives, officials, practitioners and academia from across the Indian Himalayan Region and beyond to deep dive into “*Changing Agroecological Landscape and Disasters in Himalaya: Resilience Building and Policy Initiatives for Viksit Bharat*”. The reflective conversations at the SMDSXII come at an important time when the Himalaya have been ravaged by disasters as well rapid changes in the diverse agroecological landscapes that threaten the wellbeing of the socio-ecology of the IHR requiring urgent interventions with a long-term vision that is people and environment friendly.

The SMDSXII is spread out over two days 26 and 27 September 2025 with the inaugural session focusing on water-based disasters in the IHR. This will be followed with greater detail at the Mountain Legislators Meet with key elected representatives of the IHR dwelling on ‘*Ever Increasing Disasters in the Indian Himalayan Region*’ on day 2. Experts will explore the subject in further detail in the ‘*Beleaguered Waters of Himalayas: Blessings and a curse*’ session’.

The Changing Agroecological Landscape of the IHR will be deliberated in sessions that are titled: ‘*Agro Ecology Resilience for Climate Change; Changing Agroecology: Voices from the Community; Biodiversity and Agro ecology in Himalaya; Changing Patterns in Livelihood and Food and Nutrition Security*’. These sessions will look at the agroecological changes in the IHR in depth through a diversity of voices, lived experiences, peoples movements, policy development as well as academic endeavors.

Critical analysis of agroecological changes will be followed by solution-oriented sessions under this session: ‘*Climate Change Adaptation & Resilience: Good Practices in the Himalayan States; Financing Solutions for Building Resilience in the Agroecology of IHR;*

Fireside Chat: Experiences in generating carbon credits for community projects in the Himalayas: Opportunities and Pitfalls'.

SMDSXII will also have visual narratives that document the disasters in the IHR, stalls that showcase agroecology of the IHR and posters on agroecology of the IHR from early career researchers.

The valedictory session will summaries the proceedings of SMDSXII with an emphasis on the way forward and policy implications that are necessary in the challenging times we live in the Himalaya.

SMDSXII has been made possible with the generous partnership and support of: CPPGG, State Planning department, Government of Uttarakhand; National Mission on Himalayan Studies (NMHS); Doon University (Geography & Geology Dept.); Government of Arunachal Pradesh; Uttarakhand State Council for Science and Technology (UCoST), Government of Uttarakhand HIMMOTTHAN Society; Sustainable Development Forum Uttaranchal (SDFU); SARG India; Uttarakhand Forest Development Corporation (UAFDC); International Centre for Integrated Mountain Development(ICIMOD)

Mr. Roshan Rai, Secretary IMI

Inaugural session: 26 Sept 2025

1100 hrs

Key Note Address:



Prof. Anil Kumar Gupta, ICARS (Integrated Centre for Adaptation, Disaster Risk Resilience & Sustainability)

Dr. Anil Gupta is an internationally recognized leader in disaster risk reduction (DRR), climate change adaptation (CCA), environmental resilience, and sustainable development, with over three decades of impact across government, academia, industry, and global cooperation.

A founding architect of India's National Institute of Disaster Management (NIDM), he served for 19 years as Professor and Director of Projects, driving major agendas in policy, climate risk management, and international cooperation. His work shaped national and global programs on risk governance, capacity building, and climate-resilient strategies.

Currently, he is Full Professor at IIT Roorkee and Principal Investigator of the Government of India's Integrated Centre for Adaptation to Climate Change, Disaster Risk Resilience and Sustainability (ICARS). He also leads the AdaptDMIR initiative under India's National Adaptation Plan, and is Senior ICIMOD Fellow-DRR, Expert Member of the Sikkim Commission on Glacial Hazards, and Scientific Advisory Board Member of GB Pant National Institute of Himalayan Environment.

He has been instrumental in drafting India's National Disaster Management Plan, the National HR Plan on DRR, and frameworks like the Chemical Disaster Management Plan and National Drought Manual. He also led India's positions in global platforms such as SFDRR, HFA2, ASEM, and EAS.

From Fragility to Foresight: Strategic Pathways for Resilient Himalayan Futures

Prof. (Dr.) Anil Gupta

Professor – ICARS,

IIT Roorkee – Gr. Noida campus (NCR) India 201310

Senior ICIMOD Fellow – DRR, India Focal Point – HKH DRR Knowledge Hub

ABSTRACT

The Indian Himalayan Region (IHR), with Uttarakhand at its heart, stands as both a sanctuary of ecological and cultural wealth and a frontline of climate-induced vulnerabilities. From glacial retreat and erratic weather patterns to landslides and seismic risks, the region faces cascading hazards that threaten lives, livelihoods, and heritage. Uttarakhand, emblematic of these challenges, also exemplifies the urgent need to move beyond fragmented disaster responses toward a holistic resilience paradigm. This keynote underscores the imperative to embed disaster risk reduction (DRR) and climate adaptation into the core of regional development planning, especially in ecologically fragile and densely populated mountain states. It calls for a mission-mode transformation that respects local contexts while aligning with national and global frameworks.

Drawing on lessons from Uttarakhand and other Himalayan states, the talk introduces the Integrated Risk-Resilience (IRR) Model and CAPP-RES (Capacity and Public Policy for Resilience) pathways as strategic tools for systemic change. These approaches emphasize the fusion of advanced scientific tools—such as satellite-based monitoring and predictive analytics—with traditional ecological wisdom and community-based knowledge. In Uttarakhand, for instance, local observations of shifting rainfall patterns and indigenous coping mechanisms offer critical insights that complement macro-level data. The talk highlights successful pilots in nature-based solutions, community-led early warning systems, and participatory risk mapping, showcasing how multi-stakeholder collaboration can yield culturally resonant and technologically sound outcomes. Anchored in national missions like Vision 2047, Mission LiFE, and the New Education Policy, these strategies offer scalable models for resilience across the HKH region.

The way forward demands a bold reimagining of development—one that is inclusive, anticipatory, and rooted in local agency. This includes establishing a Himalayan DRR Knowledge Hub in Uttarakhand, mainstreaming science and innovation into district-level planning, and institutionalizing capacity-building platforms that empower communities as

co-creators of resilience. The keynote proposes a comprehensive DRR and Climate Resilience Policy tailored to the Indian Himalayan context, with Uttarakhand as a demonstration site for regional and global learning. Ultimately, the vision is to transform the IHR into a lighthouse of resilience—where tradition and innovation converge, and where sustainable futures are shaped through joint action, strategic foresight, and empowered local leadership.

Keywords: Indian Himalayan Climate and Disaster Risk Reduction, Integrated Risk-Resilience Model (IRR), S&T and Innovation Synergy with Traditional Knowledge, Policy-Science-Practice Interface.

Session -1 Agro Ecology Resilience for Climate Change

Changing Agro-ecological Landscape & Disaster in Himalayas



Ms. Binita is an Organic/Biodynamic Farmer, Social –Entrepreneur & Agriculture Development Professional. Early in life Ms. Binita realized the significance of the natural environment and made Biodynamic Agriculture (a specialized kind of Organic Agriculture), a life mission. She came to live in remote ancestral Orchard in village Supi, Nainital in her late twenties to and set up SARG India and SUPA Biotech P Ltd, organizations dedicated for the promotion of organic agriculture. Was the Prime Mover for the Organic Agriculture Policy for Government of Uttarakhand in 2002 and headed the Organic commodity Board (2003 - 2015). SARG India is a national player in Organic /Biodynamic Agriculture Development and has the credit of making 1.5 million composts among farmers of four states. The other vertical SUPA Biotech P Ltd makes biodynamic preparations for thousands of farmers and markets organic products by the brand HOI (Himalayan Organic India).

Founder SUPA Biotech P Ltd/ SARG India (not for profit)

Is Board member in PDKV Jaivik Kheti Mission, State Government of Maharashtra

Independent Director, The Nainital Bank

Secretary, SDFU

Treasurer IMI



Name: Mr. Rajendra P. Gurung

Designation: Chief Executive Officer

Organization: Ecotourism Conservation Society of Sikkim (ECOSS), Gangtok

Professional Involvement: Active member of the Integrated Mountain Initiative (IMI)

Area of Work: Ecotourism, conservation, and sustainable development in the Himalayan region

Changing Agro-ecological Landscape & Disaster in Himalayas

Context

The Himalayan Region, recognized as one of the global biodiversity hotspots and water towers of Asia, provides numerous ecosystem services to the millions of people within as well as downstream, in the Indo-Gangetic and Brahmaputra plains, yet not fully acknowledged and compensated. The region is also home to diverse farming practices, agroecological and unique cultural landscapes. While the region has a strong influence on the regional climate, it is also highly vulnerable to global climate change. Impacts of climate change are reported to be much more pronounced in the Himalaya, especially at higher altitudes. Empirical data indicate that this region is experiencing a more rapid warming trend compared to others.

Of the various factors, climate change has the most profound effects on agriculture and food production. In a recent assessment by IPCC (2022) it has been projected that climate change would jeopardize agricultural productivity thereby exacerbating food insecurity, rural livelihoods and diminishing ecosystem services globally. Global projections indicate extreme weather events, which, in the absence of climate resilient farming practices and proper mitigation measures will have serious socio-economic implications. Increased temperatures, unpredictable rainfall, diminished snow cover and duration, along with heightened aridity at the higher altitudes, are anticipated to impact agroecological landscapes of the Himalaya. While much existing literature regarding climate change effects on Himalayan ecosystems and local livelihoods relies on a limited number of models and perspectives, it is evident that water scarcity for irrigation in numerous regions will adversely influence cropping and indigenous food systems.

The Indian Himalayan region (IHR) with its diverse environmental, biological, socio-cultural, and economic features exhibits distinctive indigenous food production systems that utilize a variety of crop species and livestock. However, these systems are increasingly threatened by changes in land use practices, climate change, introduction of exotic crops and out-migration of youth to urban areas that leaves rural areas with inadequate hands to work in the agricultural fields. In addition, changes in dietary preferences, mono-cropping, commodity crops, soil degradation, and weakening markets threaten Himalayan agroecological systems. The mountain food cultures are fast eroding with the onslaught of the food industry, globalization and homogenization of food and taste which are impacting agrobiodiversity, traditional knowledge and practices of food, loss of dietary diversity and nutritional security. Dietary shifts that are highlighted by “packaged and processed food markets have doubled in India in 2018” have deep ramifications on health and livelihoods across the IHR. This change is corroborated by the Himalayan Clean-up data since 2018 which have consistently shown that plastic packaging amounting to 84% plus of all plastic cleaned and audited come from food and beverage packaging. Thus, this shift contributes to the Himalayan waste crisis too.

Achieving sustainable food and nutrition security in the IHR requires readiness for climate resilient agricultural practices that encompasses discourses and departments of agriculture, water, biodiversity, forest and National and State Action Plans for Climate Change. It is also fundamentally important that the IHR agroecological pathways are integral to the Viksit Bharat 2047 vision to drive the mission of making India a completely developed nation by its 100th anniversary of independence in 2047.

Presentation by

Dr Ishweri Singh Bisht, Sr. Consultant Himalayan Agroecological Initiative



In 2018, Dr. I.S. Bisht completed his tenure as Principal Scientist and Professor at the ICAR–National Bureau of Plant Genetic Resources in New Delhi, as well as at its regional station located in Bhowali (Nainital), Uttarakhand. After his retirement, Dr. Bisht has engaged in freelance research, focusing on traditional agricultural practices and food systems, particularly emphasizing indigenous food sovereignty, eco-nutrition, and community empowerment within Uttarakhand.

From 2018 to 2023, he served as a consultant for a UNEP-GEF (India) Project, which was collaboratively overseen by the Alliance of Bioversity International and CIAT, in partnership with the Indian Council of Agricultural Research (ICAR).

At present, Dr. Bisht serves as the National Consultant for the Himalayan Agroecology Initiative (HAI): Towards a Common Roadmap for Sustainable Food Systems. This initiative is a collaborative effort involving regional governments and a wide range of stakeholders from the Agroecology Himalaya Task Force, the World Future Council (WFC), and IFOAM – Organics International (IFOAM-OI), supported by prominent implementing organizations in India, Nepal, and Bhutan.

Ecological literacy and transitioning to agroecological food systems: A pathway for sustainability, resilience, and social equity in mountain farming

Ishwari Singh Bisht*

ABSTRACT

Ecological literacy and agroecology are essential in steering mountain agriculture in India towards sustainability, resilience, and social equity by enhancing the understanding of local ecosystems and advocating for farming practices such as crop diversity, agroforestry, and organic methods. This strategy empowers local communities, honours traditional food systems, ensures equitable access to resources, and establishes more resilient, self-sufficient food systems capable of addressing the unique challenges posed by mountain environments, thereby safeguarding food security, livelihoods, and the environment.

Ecological literacy serves as the cornerstone for agroecological transitions, allowing mountain communities to comprehend the complex natural systems that underpin their livelihoods. It encourages a comprehensive perspective, acknowledging that farming practices are linked to wider social, economic, and environmental dynamics. An ecologically literate approach equips farmers to adjust to local conditions and challenges, nurturing a more sustainable relationship with their surroundings.

Agroecology offers a framework for the transformation of food systems, particularly effective in varied mountain environments. Practices such as mixed farming of crops and livestock, crop rotation, intercropping, and the incorporation of trees through agroforestry enhance biodiversity, which in turn improves soil health, manages pests, and creates diverse habitats. It emphasizes the co-creation of knowledge with local farmers and recognizes the significance of their traditional practices and food cultures, which are vital for resilience. By promoting resource recycling, integrating natural cycles, and optimizing local resources, agroecology cultivates resilient farming systems that rely less on external inputs. Agroecology champions inclusivity, empowers marginalized communities, and encourages responsible resource governance, thus contributing to social equity.

Agroecological practices possess the ability to alleviate environmental degradation, enhance soil health, and conserve vital water resources in mountainous regions. Varied farming systems, integrated pest management, and the safeguarding of local seeds bolster a community's resilience against shocks from climate change and market volatility. As a grassroots, participatory method, agroecology empowers mountain communities by fostering inclusive decision-making and honouring traditional knowledge. This approach fortifies social capital and collective action. By supporting local markets and streamlining food supply chains, agroecology generates new income opportunities for mountain communities, especially for marginalized groups such as women and youth. The transition promotes responsible governance that guarantees equitable access to land,

resources, and markets for all farmers, which can aid in addressing historical injustices and marginalization.

Inadequate policy support, limitations in resources and infrastructure, as well as barriers to knowledge transfer, are some of the challenges faced during the effective transition to agroecology. Governments must implement policies that encourage agroecological practices and allocate funding for research, infrastructure, and capacity-building initiatives specifically tailored for mountain agriculture. There is also a pressing need for inclusive community-based governance models that engage farmers, researchers, and policymakers in the decision-making process. Additionally, promoting ecological literacy through educational and training programmes that integrate scientific knowledge with traditional wisdom is essential to cultivate a new generation of 'ecoliterate' farmers and communities.

*Independent researcher; Bithoria No.1, Unchapul, Haldwani (Uttarakhand)-263139, India; bisht.ishwari@gmail.com; Mob: 09873425491; Tel: 05946-297219

Formerly: Principal Scientist & Professor, ICAR-National Bureau of Plant Genetic Resources, New Delhi-110012, India

Dr Ghanashyam Sharma, Head, The mountain Institute, Sikkim



Dr. Ghanashyam Sharma, Head of The Mountain Institute India, is a distinguished mountain ecologist and agroforestry expert. He holds a Ph.D. in traditional agroforestry systems of the Indian Himalayas and completed a postdoctoral fellowship at the United Nations University, Tokyo, with specialization in Sustainable Land Management. Over a career spanning more than three decades, he has advanced knowledge and practice in mountain ecology, traditional and organic farming systems, watershed and spring shed management, biodiversity conservation, climate change adaptation, and policy development for fragile Himalayan ecosystems.

Dr. Sharma's academic contributions include over 80 peer-reviewed research papers in high-impact international journals, more than 30 book chapters with leading publishers, the authorship of three books, and the editorial stewardship of two scientific volumes. His research outputs are widely cited and applied in the fields of agrobiodiversity conservation, community-based resource management, and ecosystem services in mountain environments. He has delivered presentations and keynote addresses at over 90 scientific and policy forums, including 57 international/global conferences, spanning 21 countries, thus influencing both global and regional discourse on sustainable mountain development. Beyond academia, Dr. Sharma exemplifies the integration of science with practice. As a practicing traditional farmer, he cultivates indigenous landraces of rice (*e.g.*, Krishnabhog), millets, pulses, and tubers, thereby reinforcing the importance of on-farm conservation of genetic resources. His work bridges local ecological knowledge with cutting-edge research, making him a leading voice in promoting resilient, community-driven approaches to agriculture and biodiversity management in the Himalayas.

Climate Resilience, Seed Sovereignty, and Food Security in the Traditionally Managed Farming Systems of the Eastern Himalaya

Ghanashyam Sharma
The Mountain Institute India
Tadong Daragaon, Gangtok Sikkim 737102, INDIA
Email:banstolag@gmail.com; +91 9800 491 599

Abstract

The Eastern Himalaya, encompassing Sikkim and adjacent mountain ecosystems, constitutes one of the most ecologically fragile yet agriculturally productive regions of the world. Traditional organic farming systems, deeply embedded in the socio-cultural fabric of indigenous communities, offer significant opportunities for ensuring food security, ecological sustainability, and livelihood resilience. With Sikkim recognized as India's first fully organic state, the region exemplifies how low-input, ecologically sound practices can be integrated into mainstream agriculture. Agroforestry diversity, with large cardamom as the primary cash crop, provides substantial potential for income generation through product development and agro-tourism.

Despite these strengths, challenges persist in sustaining productivity, safeguarding seed sovereignty, and addressing the vulnerabilities of mountain farming communities. Rapid population growth, in-migration from the plains and outmigration from the mountains, and the impacts of climate change further exacerbate these issues. Frequent road blockages, landslides, and transportation disruptions destabilize supply-demand dynamics, while the diversion of traditional farmlands to non-agricultural uses—such as hydropower projects, pharmaceutical industries, and other commercial enterprises—threatens the long-term viability of mountain agriculture. Consequently, food security in the Eastern Himalaya is constrained not only by production deficits but also by inadequate storage and distribution infrastructure, particularly evident during crises such as the COVID-19 pandemic or prolonged infrastructural disruptions.

Seed sovereignty remains critical, requiring the establishment of community seed banks, participatory plant breeding initiatives, and the conservation of diverse local landraces. Advances in cryogenic preservation of plant and animal genetic resources, coupled with the documentation of digital sequence information (DSI), hold great promise for safeguarding the immense genetic diversity of indigenous cereals, pseudocereals, tubers, legumes, oilseeds, and medicinal and aromatic plants (MAPs). Emerging technologies such as the Internet of Things (IoT), artificial intelligence (AI), climate information systems, and data-driven decision-support systems offer new avenues to enhance productivity on marginal lands. Innovations in real-time soil monitoring, automated irrigation, precision nutrient application, blockchain-based traceability, and carbon sequestration can optimize resource use, reduce environmental impacts, and empower smallholder producers. However, climate change continues to impose severe risks, including altered rainfall regimes, shortened growing seasons, and declining crop

yields. Although traditional agroecosystems demonstrate inherent resilience, these must be strengthened through climate-resilient agriculture, soil health management, and integrated nutrient and pest management strategies. Simultaneously, the region offers substantial opportunities in value addition, niche organic markets, agro-ecotourism, and nature-based solutions that harmonize traditional ecological knowledge with modern scientific approaches. This paper highlights the dual trajectory of opportunities and challenges inherent in the traditionally managed farming systems of the Eastern Himalaya. It underscores the urgent need for legal protection of agricultural landscapes through appropriate Acts and Rules, alongside robust policy support, innovative research, and disaster preparedness through community-driven initiatives. Such integrated efforts are essential to preserve ecological integrity, enhance adaptive capacity, and ensure food and nutritional security for mountain communities.

Keywords: Eastern Himalaya; Traditional farming; Food security; Seed sovereignty; Climate resilient agriculture; Indigenous landraces; Cryogenic preservation

Mr. Amba Jamir, Member, IMI



Amba Jamir is a seasoned policy and development strategist with over 30 years of experience in

sustainable development, particularly in mountain and indigenous regions. Trained in environmental law and development communication, he is recognized for bridging traditional agricultural

practices, such as shifting cultivation and mountain agroecology, with global and national policy frameworks. He has contributed to drafting state agriculture policies, as well as, the design, monitoring, and evaluation of rural, environmental, and agriculture-based projects for international development clients and state governments. He has also worked in policy think tanks such as the Institute for Global

Environmental Strategies (IGES), Japan. His work focuses on fostering resilient food systems,

strengthening community livelihoods, and advancing biodiversity conservation. Amba Jamir is a founding member and former Vice President of IMI.

Abstract

Reclaiming Agroecology – Insights from Northeast India

This paper presents a grounded perspective on agroecology through the lens of traditional land-use systems in India's Northeast. Often wrongly characterized as primitive or unproductive, systems such as jhum (shifting cultivation), alder-based agroforestry, and wet rice cultivation in Nagaland, or rice–fish integrated systems in Arunachal Pradesh, are in fact deeply agroecological. They embody co-evolutionary knowledge systems that balance cultivation with conservation, maintain agrobiodiversity, and ensure food and nutritional security.

The region's farming systems reflect generational wisdom, adaptability, and a sophisticated understanding of soil, water, forest, and seed management. However, these systems face existential threats from externally imposed models focused on market-oriented productivity, narrowly defined profitability, and fragmented development schemes.

Agroecology offers a transformative lens—one that goes beyond yield to center resilience, equity, and ecological regeneration. The paper highlights the erosion of customary institutions, the undervaluation of uncultivated foods, and the weakening of communal tenure systems. It argues for a whole-food-systems approach that includes wild and foraged food, community seed banks, and traditional governance.

Drawing from field-based initiatives such as NESFAS' Agroecological Learning Circles in Meghalaya or NEN's farm schools in Nagaland, the paper calls for policies that value local knowledge, regenerate ecosystems, and support intergenerational learning.

Agroecology must not be treated as an external solution, but reclaimed as a lived reality already embedded in Northeast India's food systems. For it to thrive, state policies and development interventions must align with community-rooted practices and uphold the region's ecological and cultural integrity.

Dr. Lal Singh, HAI



Originally trained as a botanist, Sir transitioned into the voluntary sector to apply scientific knowledge for the benefit of remote mountain communities in Himachal Pradesh. In 1997, Sir founded the Himalayan Research Group (HRG) with like-minded professionals. Since 2005, HRG has been recognized as a core group by the Department of Science and Technology, Government of India, and has completed over 50 research and development projects with support from national and international agencies.

Under Sir's leadership, HRG developed community-oriented technology models in areas such as wild edible mushrooms, medicinal plant cultivation, vermicomposting, solar energy utilization, and revival of native crops. These initiatives, designed to be simple, cost-effective, and accessible, directly impacted 750–900 households annually, generating benefits worth Rs. 40–45 lakhs. Notably, artisans earned Rs. 15 lakhs through mountain solar water and room heating systems. Several models, including clean solar energy and vermicomposting, have been recognized and replicated by government and international agencies.

Sir's work spans biodiversity conservation, livelihood improvement, and research on forest diseases, climate change mitigation, fungal biotechnology, and bioprospecting. He has collaborated with leading institutes and participated in international exchanges in the USA, UK, Canada, Thailand, and Finland. Guided by a strong belief in community empowerment,

Sir emphasizes using modern science and technology to promote self-reliance and sustainable rural development, with special focus on women's participation.

Himalayan Agroecology Initiative - Towards Common Roadmaps for Sustainable Food Systems Prem Mathur, Jai C Rana, Lal Singh, Ingrid Fritsche and Madhur Gandhi

Abstract

The Himalayan Agroecology Initiative is a strategic endeavour that works closely with governments and with the support of a broad group of stakeholders, to support the emergence of multi-stakeholder processes that develop, build capacities and facilitate the implementation of agroecological food systems roadmaps. Its main aim is to improve livelihoods and sustainability in India, Nepal and Bhutan, and to empower farmers, farmer producer organizations and other key stakeholders so they better benefit of public policies, including those that support organic and natural agriculture, food processing and consumption. Over the past decade, policymakers in India, Bhutan, and Nepal have increasingly recognized the imperative of transitioning towards sustainable agricultural systems to safeguard natural resources and enhance the livelihoods of rural communities. This recognition has manifested in varying degrees of political commitment, with the implementation of policies and programmes that allocate specific budgetary resources to support organic farming and agroecology initiatives. Rapid climate change, biodiversity, water and soil loss, socio-economic developments but also geopolitical developments, have further increased the urgency thereof, as they threaten the very fundamentals for present and future generations to thrive, even to survive.

Agroecology is an internationally recognized pathway to transform food systems towards sustainability as it offers a systemic approach that addresses the environmental, social, cultural, and economic dimensions of agriculture, and more and more countries and stakeholders become official members of the Agroecology Coalition. Together with the World Future Council and IFOAM – Organics International, renowned organizations are paving the way for this ambitious undertaking at the national level, including the Alliance of Bioversity International-CIAT and the United Nations Development Programme (UNDP) in India, Local Initiatives for Biodiversity, Research and Development (LI-BIRD) in Nepal and the Tarayana Foundation in Bhutan. The roadmap is being developed with collective participation of various ministers, policy makers, researchers, extension services, civil society and private players from the three countries.

In the Indian context, the proposed road map will be focused on the Indian Himalayan Region (IHR). We have selected four representative states viz Himachal Pradesh, Uttarakhand, Meghalaya and Nagaland. High level advisory and scientific committees have been formed to guide the road map preparation. Based on state level consultations and committee inputs, a draft road map is being developed. The draft road map includes seven strategic pillars viz. (i) Stepping up food system governance; (ii) Ensuring access to land, water and healthy soils; (iii) Climate-Resilient, Healthy Ecosystems; (iv) Promoting sufficient, healthy and sustainable diets for all (hence including food security); (v) Building fairer, shorter, and cleaner supply chains; (vi) Reducing food loss and waste and (vii) Putting trade in the service of sustainable development. Each strategic pillar has various smart objectives. Few of them include (i) Strengthen Policy Frameworks for Agroecology-Based Governance; (ii) Reform Agricultural Subsidies to Support Agroecological Practices; (iii) Enhance Farmer Access to Agroecological Resources; (iv)

Establish Agroecology Education and Training Programs; Allocate Funding for Agroecological Research and Development Services; (v) Strengthen Land Tenure Security for Smallholder Farmers and Indigenous Communities; Expand Access to Sustainable Land Water Management Systems; (vi) Disseminate Climate-Resilient Crop and their Varieties; (vii) Promote Agroforestry Practices to Enhance Soil Carbon Sequestration and reduce greenhouse gas emissions; (viii) Strengthen Local Food Systems through Agroecological Market Support and improve consumer awareness and demand for sustainable and nutritious food especially women and children; (ix) Establish Localized Agroecological Market Hubs and reduce food loss and waste; and (x) Develop Value-Added Processing Units and storage facilities to reduce post-harvest losses.

Session 2

Financing Solutions for Building Resilience in the Agroecology of IHR

Context

The Indian Himalayan Region (IHR), spanning 11 states and 2 union territories, is both ecologically fragile and socio-economically diverse. As the headwaters of India's major river systems, it sustains nearly half the country's population through water and ecosystem services while harboring globally significant biodiversity. Its agroecological systems, ranging from terrace farming in Uttarakhand and Himachal, shifting cultivation in the Northeast, to orchard-based systems in Sikkim and Arunachal—are not only sources of food and nutrition but also foundations of cultural identity, landscape stability, and climate resilience.

Yet these mountain systems face intensifying vulnerabilities: climate-driven rainfall variability, cloudbursts, glacial retreat, and landslides; drying of springs vital for drinking water and irrigation; soil erosion, forest degradation, and invasive species undermining productivity. Socio-economic challenges compound these pressures, with out-migration of youth, fragmented landholdings, and weak value chains leading to uncertain farm incomes, even as farmers safeguard vital ecosystem services for the nation.

Agroecological approaches such as mixed farming, agroforestry, and organic clusters inherently build resilience, but they remain underfinanced and undervalued. Unlocking finance is therefore critical, not only for strengthening these systems locally, but also to sustain ecosystem services downstream. At the same time there appears to be significant capital flowing into investments that are aimed at sectors focused on climate change adaptation. We have planned two sessions to explore the state of play in climate finance and to surface opportunities and challenges to scaling up flow of such finance to IHR communities.

Objectives:

The session will focus on financing solutions for Himalayan agroecology, focusing on the evolving financing with four interlinked aims:

Demystify climate and green finance by clarifying their relevance to Himalayan agroecology, outlining key global instruments and cash flows, tracing how these are evolving in India, and positioning where agroecology stands within this shifting financial landscape.

Highlight proven instruments: Present financing mechanisms already delivering measurable cash flows and showcase resilience outcomes for mountain communities.

Explore emerging opportunities: Discuss opportunities such as carbon markets, biodiversity credits, Payment for Ecosystem Services (PES), blended finance facilities for FPOs, and Green Credit mechanisms, while clarifying:

What enabling policy changes could unlock greater financial flows?

How can credible monitoring and impact measurement systems for biodiversity and ecosystem services be embedded into financial instruments to ensure transparency, trust, and equitable benefits?

By unpacking these questions, the session will link the unique vulnerabilities and strengths of the Himalayan region to the broader agenda of financing resilience, drawing lessons for how policy, institutions, and markets can together scale agroecological transitions.

Panelists

Integrated Mountain Initiative thematic lead: Bharti Gupta Ramola

1. Franklin Khobung, Joint Secretary, Department of Agriculture and Farmers Welfare (TBC)
2. Santosh Singh, Managing Director, Intellectap
3. Mrinal Ranjan, General Manager, Department of Climate Action & Sustainability NABARD
4. Krishnan Pallassana, Senior Specialist, Strategy and Partnerships, FAO India
Moderator: Reuben Gergan, Project Manager, TEEB, United Nations Environment Programme (UNEP) and Mrs. Bharti Gupta Ramola - IMI thematic lead

Mrs. Bharti Gupta Ramola



Mrs. Bharti Gupta Ramola is a member of IMI . She was a partner in the Advisory Line of Service at PwC during 1992-2017. She has worked extensively on carbon projects developed under the UNFCCC protocol including on the trading on CERs issued . Currently she serves on some listed company and higher education Boards .

Mr. Mrinal Ranjan



Mr. Mrinal Ranjan is working as General Manager in the Department of Climate Action and Sustainability in NABARD Mumbai. He has 25 years of experience in working in NABARD in various departments including Corporate Policy, Project Finance, Farm and Non-Farm Sector Development and Institutional Development.

At present he is working in the department handling climate finance, both in grant and debt mode. As a GM he oversees various works related to the International Funds like GCF and Adaptation Fund, and NAFCC for which NABARD is NIE/DAE and also NABARD's Climate Change Fund. NABARD has also recently started direct finance in both mitigation and adaptation measures through its NABARD Green Lending Facility.

He is a graduate from Delhi University and holds a postgraduate and MPhil degree from JNU, New Delhi.

Mr. Santosh Singh



Mr. Santosh is a Partner and Managing Director at Intellectap with over 20 years of experience in scaling up market-based solutions for climate change mitigation and adaptation. He has worked with the World Bank and GIZ, leading initiatives in energy access financing, carbon markets, and sustainable finance interventions across Asia and Africa. He has been spearheading initiatives in designing carbon market roadmaps for countries, structuring digital MRV systems, and defining market infrastructure requirements.

He is also an advisor to corporates, philanthropies, and financial institutions on strategy and impact. Santosh has authored publications on climate change, energy access, and climate finance and holds a Mathematics degree and postgraduate degree from Indian Institute of Forest Management.

Session 2: Parallel Session

(Conference Hall, Dr. Nityanand Auditorium Building)

Changing Agroecology: Voices from the Community

Moderated by Dr. Vinod Bhatt, Chairperson IRD Foundation



Dr. Vinod Kumar Bhatt has over 30 years of experience in livelihoods, organic farming, biodiversity conservation, and agroecology. Holding a D.Phil. in Mushroom Systematics from HNB Garhwal University, he has authored more than 30 research papers and co-authored 8 books on agroecology, organic farming, climate change, and medicinal plants. Since 1997, he has led pioneering initiatives on organic farming, seed and food sovereignty, climate resilience, and sustainable agriculture across 22 states of India, including the UTs of Jammu & Kashmir and Ladakh, as well as in Nepal and Bhutan. His work has also taken him to more than 12 countries, including the USA, Canada, Europe, Africa, and Latin America, broadening the global perspective of his efforts.

Currently, Dr. Bhatt heads the Ingenious Research and Development Foundation (IRD Foundation) and the Mount Valley Development Association (MVDA), both based in Uttarakhand. He has previously served as Executive Director of Navdanya, a leading non-profit working across India. His expertise has also supported organizations such as QCI, GIZ India, Bfdw Germany, and Bioversity International, among others. In addition, he has contributed to several national and state-level committees, including ICAR, UCoST, and the State Biodiversity Board, actively shaping policy and practice in sustainable agriculture, rural development, and biodiversity conservation.

Forgotten food crops and resilient Seeds: Agroecological pathway for Sustaining Mountain Agriculture

Dr Vinod Kumar Bhatt

Abstract

Agroecological farming in Uttarakhand offers a sustainable pathway for addressing the challenges of fragile mountain ecosystems, smallholder livelihoods, and climate change vulnerabilities. Rooted in ecological principles and traditional knowledge, agroecology emphasizes biodiversity conservation, soil and water management, integrated farming systems, and the use of local resources. In Uttarakhand, where steep slopes, fragmented landholdings, and erratic weather patterns limit the effectiveness of conventional agriculture, such traditional agroecological approaches are particularly relevant.

Himalayan communities have traditionally nurtured a rich diversity of forgotten food crops and resilient seeds to ensure food and nutritional security. Traditional farming systems such as Baranaja—the mixed-cropping of millets, pulses, and oilseeds—reflect ecological wisdom, resilience, and nutritional richness. Millets, once central to Uttarakhand's food culture, are climate-resilient, suitable for rainfed mountain agriculture, and highly nutritious, offering solutions to both food and nutritional security.

However, the spread of monocultures, input-intensive chemical farming, changing food habits, and increasing migration have led to the neglect of these crops, threatening agrobiodiversity and seed sovereignty. Revitalizing forgotten food crops such as finger millet, barnyard millet, amaranth, buckwheat, black soybean, and local pulses can play a critical role in addressing climate change, soil degradation, and malnutrition.

Agroecological approaches, combined with community-led seed conservation, participatory breeding, and women-led seed banks, provide a sustainable pathway to strengthen local livelihoods while conserving biodiversity. This paper highlights the potential of resilient seeds and traditional food systems in creating fairer, shorter, and cleaner supply chains, thereby supporting sustainable agriculture and nutrition security in the Himalaya.

Background Note

Changing Food Systems in the Indian Himalayan Region (IHR): Insights from The Himalayan Cleanup

The Indian Himalayan Region (IHR) has historically sustained diverse food cultures rooted in cultivated, foraged, and pastoral agroecology, with unique culinary traditions ensuring nutrition and livelihoods for mountain communities. However, this diversity is rapidly eroding due to dietary shifts toward packaged and processed foods. Between 2012 and 2018, the Indian market for such foods doubled, leading to major health and livelihood consequences in the IHR.

Findings from The Himalayan Cleanup (THC 2025) highlight the deep intersection between waste and food. Of the 233,945 items of waste collected across 148 sites, plastics accounted for 217,854 items, with 93% linked to food and beverage packaging—a trend consistent across recent years (81.8% in 2023, 82% in 2022, 83% in 2024). Non-recyclable plastics (52%) slightly exceeded recyclable ones (48%), raising concerns over both environmental impacts and the toxicity of ultraprocessed foods stored in plastic packaging. Smoking materials accounted for 4% of total waste. Energy drinks, increasingly sold in the mountains, pose further health risks, particularly for children and women, despite existing warning labels.

While the Extended Producer Responsibility (EPR) rules (2022) require plastic producers to manage their waste, implementation in the IHR remains negligible. This underlines the urgent need for mountain-specific frameworks, pilot programmes, capacity building of local bodies, and phasing out of multilayered plastics.

Pathways for action include systemic changes beyond conventional waste management:

- Promoting decentralized, localized waste solutions instead of burn or waste-to-energy options.

- Strengthening bans on single-use plastics.

- Investing in sustained education and awareness, particularly in tourism, religious, and forest landscapes.

- Designing waste out of production systems through stricter EPR.

Equally important is reclaiming mountain food cultures through campaigns, policies restricting junk food advertisements, energy drink regulations, and enforcement of FSSAI guidelines. Consumer awareness can be enhanced via simple front-of-label warnings.

Globally, a strong and legally binding plastics treaty is needed to address the crisis at scale. This initiative is supported by CPPGG (State Planning Department, Government of Uttarakhand), NMHS, Doon University, Government of Arunachal Pradesh, UCoST,

Himmotthan Society, SDFU, SARG India, UAFDC, and ICIMOD. Together, these partners emphasize the urgent need to safeguard mountain ecosystems, food systems, and community health from the twin threats of ultra-processed foods and plastic waste.

Dr. Smriti Panwar



Dr. Smriti Panwar currently serves as a Consultant at the National CAMPA, New Delhi. She holds a Ph.D. in Forest Genetics from the Forest Research Institute, Dehradun, and possesses extensive research experience in ecology, wild flora, and non-timber forest products (NTFPs) prevalent in the Indian Himalayan Region (IHR). She holds a postgraduate degree in Forestry and Environmental Sciences and is a qualified scholar under both UGC-NET and GATE.

Previously, Dr. Panwar worked as a Senior Research Fellow at the Integrated Mountain Initiative, Dehradun, under the mentorship of Ms. Binita Shah and Dr. Gopal S. Rawat, contributing to an agroecology project funded by the National Mission on Himalayan Studies (NMHS). Her academic and professional pursuits are driven by a commitment to advancing biodiversity conservation in the IHR through the integration of genetics, ecology, and forestry.

Agro-Ecology, Climate Resilient Farming and Livelihood Enhancement in Border Villages of Indian Himalayan Region

Gopal S. Rawat, Smriti Panwar*, Suren Limbu, Mast Ram, Auni Gurung, Rajan Kotru, Rajendra Gurung and Binita Shah

Introduction- The Himalayan region hosts diverse climates, farming systems, and communities that have preserved resilient crops like millets and pseudo-cereals for centuries. These traditional varieties support food security, livestock, fodder, and ecological balance, yet their climate-resilient traits remain under documented. As

traditional farming declines due to climate stress and economic shifts, agro-biodiversity and cultural knowledge are also at risk. To address this, the Vibrant Village Programme (VVP) supports livelihoods in remote border areas. Aligning with this, the Integrated Mountain Initiative (IMI) proposes a study across Himachal Pradesh, Uttarakhand, and Sikkim to document resilient agro-practices and scale sustainable models.

Objectives- This project will guide climate-resilient farming in Himalayan border districts, focusing on Vibrant Villages. It aims to revive traditional agroecology—centered on millets and pseudo-cereals like buckwheat—by creating market and Public Distribution System (PDS) linkages and promoting value addition. The initiative supports nutritional security, climate adaptation, and positions India as a global millet hub, contributing to UN SDGs 2 (Zero Hunger) and 3 (Good Health and Well-being).

Methodology- The project will build farmer capacity through baseline questionnaire survey, skill workshops and motivation programs, while mobilizing communities to co-create solutions. It will promote agro-ecological practices such as organic certification, biodynamic inputs, and regenerative techniques like vermicomposting. Seed sovereignty will be supported through community-managed seed banks. By aligning with government schemes and local institutions, adopting convergence strategies and improving market access for local produce, the initiative will strengthen sustainable agriculture and livelihoods in Indian Himalayan border villages.

Expected outcomes- The project aims to revive traditional farming and crop diversity, enhance climate resilience and food security in Himalayan border villages, and strengthen local livelihoods through sustainable practices. It will also document indigenous knowledge to support replication and broader policy adoption.

Session 3

Biodiversity & Agro ecology in Himalaya; Changing Patterns in Livelihood and Food and Nutrition Security

Moderated by:

Dr Rajan Kotru, Councilor, IMI



Dr. Rajan Kumar Kotru, Councilor, is a senior international expert in research and sustainable development with over 35 years of experience across South Asia, Europe, India, and the USA. Holding a PhD in Forestry Sciences from Ludwig Maximilians University, Germany, he has led impactful projects on forestry, climate-smart solutions, and mountain ecosystem restoration, working with national bodies like NITI Aayog and international platforms such as IUFRO, FAO, and the Global Landscapes Forum. Widely published with over 145 works, he has pioneered community-based innovations, youth mobilization, and policy advocacy, earning global recognition and awards. Currently, he serves as Chief Technical Advisor for Indo-German Development Cooperation in Northeast India, Lead Strategist at Trestle Management Advisors, and advisor to several academic and development institutions.

Prof (Dr) Nazir Ah. Ganai, VC, SKUAST, Jammu



Prof. Nazir A. Ganai is Vice Chancellor of SKUAST-Kashmir. After graduating in Veterinary Sciences, he earned his Ph.D. from the National Dairy Research Institute and pursued postdoctoral research at Wageningen University (Netherlands), Roslin Biocenter, University of Edinburgh (Scotland), and Durham University (England). He also completed leadership programs at Wisconsin and Michigan Universities, USA.

Under his leadership, SKUAST-Kashmir has become a leading innovation-driven farm university, achieving 85 patents and 72 startups in three and a half years, ranking among India's top five State Agricultural Universities. He introduced the SKUAST-K Developmental Model, integrating NEP-aligned Agri Education, Research & Innovation, ICT-backed Extension, and Social Development through the Rs. 5000 crore Holistic Agricultural Development Program. Key initiatives include Innovation & Entrepreneurship as a core mandate, SISP, SKIIE incubation center, AI & ML Center, School of One Health, and IBPR. At the 6th Convocation, 85 patentees and 72 startup founders were honored, showcasing the university's transformation from employability to entrepreneurship and knowledge-driven innovation.

Issues and Challenges of North Western Himalayan region: Resilience building and policy initiatives

Nazir A Ganai, Arshad Mughaal

Abstract

The Himalayan region, with its unique ecosystems and traditional farming systems, serves as a living model of agroecology. The North western Himalayan region consists of three border hill states of India, namely, Uttarakhand, Himanchal Pradesh and Jammu & Kashmir. This is also the region through which different civilizations entered into the North

India in the past until the British came, and gave cultural diversity that is a unique feature of the present India. The Indian Himalayas cover an area of 53.8 million ha, which is 16.4% of the total geographical area of the country. The region supports about 4% of the population and provides essential ecosystem services while sustaining food, fodder, and cultural traditions. It is having a rich indigenous knowledge system with variation in ecological, socio cultural and economic configurations providing a unique differential value to evaluate biodiversity and its senses. The region shelters more than 10,000 plant species, including 3,000 endemics, and supports diverse forest ecosystems critical for carbon sequestration, watershed regulation, and livelihood security.

However, this fragile landscape faces multiple challenges from climate change, deforestation, unsustainable land use, migration, and the gradual erosion of traditional knowledge. Agroecology can be a powerful lever for solving these major challenges and promoting sustainable solutions in an integrative manner.

In Uttarakhand, agriculture's share of state GDP fell from 29% in 2000 to 11% in 2022 and same is the case with Jammu and Kashmir. Around a third of the Himalayan population is food insecure, with half of the population, especially women and children suffering from malnutrition (Rasul et al., 2018). The narrowing of traditional, diverse cropping systems under commercial pressure has exacerbated food insecurity. Study has revealed that barley production decreased by 91.7%, paddy by 52.5%, and wheat by 31.9% in some central Himalayan villages. Demand for timber in J&K at present is 2.96 lakh m³ and 83% is being met from imports. By 2047 the demand is likely to increase to 3.36 lakh m³ due to increase in population. Studies from Uttarakhand indicated an average timber consumption of around 0.52 cubic meters/household/year, with per capita timber consumption estimated at 0.04 cubic meters/year. Fuel wood dependency in the region remains high. During 2023, in J&K 7–8 million people consumed 2.5 mm³ annually. By 2047, 5.3–6.4 million people may still rely on it thereby requiring fuel wood to the extent of 2 mm³. Livestock population in the J&K is 83.25 lakhs and annual requirement of green and dry fodder is 139 and 58.53 lakh Mt respectively. Demand for medicinal plants for trade and use in traditional medicine also remains high. Unsustainable harvesting has

pushed several high value species like *Saussurea costus* (Kuth) into endangered status, prompting stringent trade regulation. In Himachal Pradesh, around 643 species are recorded. Demand surged by nearly 50 % over availability. Evidences suggest that the state of Jammu & Kashmir supports about 3,054 species of plants representing approximately 1100 medicinal and aromatic plant species. According to the estimate In Jammu & Kashmir medicinal and aromatic plant cultivation is estimated to contribute about Rs 75 crores annually up to 2027, rising to over Rs 783 crore by 2037.

Climate change compounds these stresses. Rising mean temperatures, accelerated glacial retreat, shifting tree-lines, and forest fires are altering ecosystem stability. In Kashmir,

average temperatures have risen by over 1.4°C in two decades, with glaciers like Kolahoi losing nearly a quarter of their area. Such trends threaten forests, agriculture, and pastoral systems, amplifying vulnerability.

To address these challenges, a multidimensional approach is required. Policy directions, emphasize in-situ and ex-situ conservation of biodiversity, promotion of climate-smart agroforestry and integrated farming systems, and diversification of livelihoods through mountain products and agro-ecotourism. Revitalizing indigenous foods, improving irrigation via spring restoration and rainwater harvesting, and strengthening fodder and rangeland management are critical.

In conclusion, the Himalaya's biodiversity and agroecology remain foundational for sustaining livelihoods and ensuring food and nutritional security. Blending traditional wisdom with modern science, strengthening institutional support, and empowering mountain communities can transform the region into a model of sustainable and resilient mountain agroecology.

Key words: *Agroecology, Indigenous knowledge system (IKS), Biodiversity, Climate Smart Agroforestry, Nutritional security.*

Issues and Challenges of North Western Himalayan region: Resilience building and policy initiatives

Outline of Presentation

1. Challenges of Himalayan region
 - a. Gap in demand and supply of Forest produce
 - b. Vulnerability to climate Change
 - c. Increased glacial melt due to rise in Temperatures
 - d. Low profitability of agroforestry systems
 - e. Loss of biodiversity

- f. Decrease in productivity of range and pasture lands
2. Emerging insecurity in NW Himalayas
3. Strengths of Himalayan region
4. Policy recommendations
5. Way forward

Dr. Bandana Shakya, Landscapes lead, ICIMOD



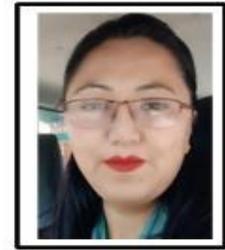
Dr. Bandana Shakya is from the International Centre for Integrated Mountain Development (ICIMOD). She leads the ICIMOD's Landscapes portfolio, overseeing the interventions on Springshed Management, Rangelands and Wetlands, Incentives for Biodiversity and Landscapes, and Human-Wildlife Co-existence. She leads ICIMOD's Nature-Based Solutions efforts, co-designing and scaling and monitoring the impact of solutions. She is focal person for the Global Biodiversity Information Facility, the open-access data repository – supporting the publication of biodiversity data for the Hindu Kush Himalaya region. She has previously managed the ecosystem services thematic portfolio, and the Landscape Initiative for Far-eastern Himalaya under the transboundary landscape management regional programme. Bandana holds a PhD in agroecosystem sustainability and is a senior landscape and ecosystems services management expert at ICIMOD.

Abstract

Agroecological Pathways for Climate Resilience: Harnessing Nature-based Solutions in the Himalaya

The Himalayan agro-ecological landscape is under serious stress from climate change, biodiversity loss, and water-related disasters, threatening the livelihoods and food security of millions. Conventional approaches—focused on chemical intensification and short-term productivity gains—have often deepened vulnerabilities, eroded soil and water systems, traditional knowledge, and undermined resilience. This presentation argues for a paradigm shift towards agroecological pathways anchored in Nature-based Solutions (NbS) as the foundation for climate-resilient development in the Indian Himalayan Region. Drawing on lived experiences and regional innovations, the presentation will illustrate how agroecological principles—diversity, soil health, water security, ecosystem services, and community co-creation—can transform fragility into resilience. We will also analyse the compelling economics agroecological foundation offers by generating premium market prices and providing invaluable ecosystem services that mitigate risks. By quantifying the co-benefits, we make a robust case for policy imperatives that incentivize agroecological principles, positioning them as fundamental to building a climate-resilient and economically viable **Viksit Bharat** from the ground up. The core message: *the future of Himalayan agricultural landscapes lies in being ecosystem-intensive rather than input-intensive.*

Dr. Jigmet Yangchen, Scientist, SKAUST, Ladakh



Prof. (Dr.) Jigmet Yangchan, born 17 March 1977, is Professor cum Chief Scientist at the School of Agriculture Science and Technology, University of Ladakh, and coordinator of the Mountain Research Institute, DST Purse, and CISIC Lab. She holds a Ph.D. in Soil Water Engineering from Punjab Agricultural University, an M.E. in Irrigation Water Management, and a B.E. in Agricultural Engineering.

With over 20 years of experience, she has held key positions at KVK Leh, HMAARI SKUAST-K Leh, and KVK Nyoma. Her expertise includes soil-water engineering, micro-irrigation, natural and organic farming, vermicomposting, mushroom cultivation, and permaculture. She has developed low-cost, farmer-friendly technologies such as solar irrigation systems, sub-zero mushroom units, and vermicompost harvesters.

Dr. Yangchan has trained over 4,500 farmers and youth through 300+ programs, published 137 research papers, contributed 8 book chapters, and led 24+ funded projects. She has received multiple awards including the Best Extension Scientist Award, Nari Shakti Samman, Eminent Scientist Award, and Best Women Scientist Award. Her work advances sustainable agriculture and livelihoods in Ladakh's high-altitude ecosystems.

ABSTRACT

AGRO ECOLOGY RESILIENCE FOR CLIMATE CHANGE ON AGRICULTURE OF CHANGTHANG IN COLD ARID DESERT LADAKH

Jigmet Yangchan

Professor Cum Chief Scientist School of Agriculture Science and Technology UoL

jigmetchan@gmail.com

Agriculture is one of the most sensitive sectors to impacts of climate change due to its high dependence on climate and weather. Impact of climate change over the last few years having both pros and cons in Ladakh region. On the basis of altitude Ladakh divided into three Agro-ecological zone. Upper agriculture zone (1800-15000ft) places like Changthang where agriculture is just a dream, people normally are nomads and not much having skill of agriculture, Central agriculture zone (1000-11800 ft) single cropped area and Lower agriculture zone < 10000 ft where double cropped area. In upper agriculture zone above +14000 ft climate change shows potential in agriculture sectors. People of Changthang starts doing agriculture, shifting from barley and turnip crop as ingenious crop today starting growing brinjal mushroom, all types of cash crop and start earning Rs10,000 per year to Rs 48000 per year. Mean time production of Pashmina also reduces due to rising temperatures, changing precipitation patterns, and melting glaciers. The degradation of the natural habitat of these goats is leading to a decline in their population, which in turn is affecting the production of pashmina wool 250gm to 227g per animal fiber diameter of 12–16 microns. The Emerging insects and pests are another big threat in other Agroecological situation zone due to climate change. Keeping in view a different Agroecology resilience measures were implemented against climate change to make on sustainable agriculture of Changthang in cold arid desert Ladakh

Key words: Climate Change, Pashmina, Agroecological, Melting Glacier, Changthang

Dr. Kitboklang Nongrum, Se. Consultant, NESFAS, Meghalaya



Dr. Kitbok Nongrum, a lecturer at the Department of Environment Sciences & Traditional Ecosystems at the Martin Luther Christian University (MLCU) and a firm believer of the boundless potential in the medicinal plants of Meghalaya carried out the much-needed research into this arena. He was initially involved in a project on screening tree bean genotypes from Northeastern India under the supervision of BP Bhatt, HOD Agroforestry Division, ICAR Umiam, came to know more about the species and was fascinated to witness its contribution to people of the region. This led to Nongrum pursuing deeper into the subject during the course of his PhD in Botany Department, NEHU under Uma Shankar

Abstract

Agroecology Resilience for Climate Change in the Himalaya: Lessons from Meghalaya, North East India

The agroecological landscape of the Himalayas is experiencing swift changes due to climate change, unchecked agricultural growth, and shifts in socio-economic conditions. Delicate ecosystems, irregular precipitation patterns, and soil degradation have aggravated the vulnerabilities faced by mountain dwellers. Nonetheless, agroecology, which emphasizes traditional ecological wisdom, conservation of biodiversity, and circular economies, presents a robust pathway for sustainable development in mountainous areas, aligning with the goal of Viksit Bharat by 2047.

Drawing insights from Northeast India, especially Meghalaya, community-driven innovations, supported by the North East Society for Agroecology Support (NESFAS), illustrate how agroecology enhances climate resilience. By updating 210 People's Biodiversity Registers (PBRs) leading to designing a tool called People's Perspective Landscape Management Plans (PPLMPs), communities are integrating natural resource management into local governance. To cite a few, in Khweng village, the acquisition of 5 acres of watershed forest supports paddy farming and aquatic ecosystems, connecting conservation efforts to livelihoods through the Mei Ramew Café. In Ladmawphlang, residents have recognized an open-access forest as a "Law Adong" community-conserved area and have established a section of Wah Umiong as a fish sanctuary, backed by cooperation among villages since June 2025.

These success stories provide answers to the summit's pivotal questions: how to merge traditional knowledge with innovations for resilience; how to create meaningful rural employment through seed banks, farmers' markets, and eco-tourism; and how to promote collaboration among various stakeholders to expand agroecological initiatives. By evaluating impacts via biodiversity registers and nutrition-sensitive food systems in Mid-Day Meal program PM Poshan, such initiatives demonstrate that agroecology can achieve food sovereignty, bolster adaptive capacity, and restore Himalayan ecosystems.

Therefore, it is essential to integrate agroecology into policymaking and climate finance frameworks as a fundamental element of resilience in the Indian Himalayas.

Dr. Ruchi Badola, Wildlife Institute of India, Dehradun



Dr. Ruchi Badola holds a Master's in Economics from Garhwal University and began her research career at the Wildlife Institute of India in 1988. She earned her Ph.D. on the "Economic Assessment of People–Forest Interactions in the Elephant Forest Corridor Linking Rajaji and Corbett National Parks" and joined the faculty in 1993.

Her research focuses on ethnobiology, socioeconomics of ecosystems, and ecosystem services, bridging ecological knowledge with socio-economic realities to support sustainable conservation. She has designed and implemented training programs for forest departments and stakeholders on community participation, sustainable livelihoods, conflict management, and ecosystem service valuation.

Dr. Badola specializes in biodiversity conservation, ecological economics, sustainable livelihoods, conflict resolution, and gender in conservation. She currently leads projects on the conservation of the sangai deer and its wetland habitat in Manipur, alongside initiatives reducing community vulnerability to environmental degradation and climate change in the western Himalaya.

Abstract

Agrobiodiversity underpins ecological resilience and sustainable food systems by integrating biodiversity conservation with agricultural practices. In the context of the Anthropocene "triple threat" of climate change, biodiversity loss, and food insecurity, agroecological approaches—such as polyculture, agroforestry, and natural farming—enhance soil fertility, ecosystem services, and community adaptation. Experiences from the Ganga basin, including millet revival, seed banks, and Jalaj initiatives linking conservation with women's empowerment and livelihood diversification, highlight scalable models. Mainstreaming agrobiodiversity through effective policies, technological innovation, and community engagement is essential for achieving the Sustainable Development Goals and securing future food systems.

Session 4

Fireside Chat: Experiences in generating carbon credits for community projects in the Himalayas: Opportunities and Pitfalls

Objectives:

The session will aim to explore if carbon finance can make a significant contribution in building agroecology resilience in IHR.

Practitioners who have developed or are developing projects with communities will share experiences across projects at different stages of development and a Carbon Finance expert with experience of over 20 relevant projects will supplement these experiences as also add perspective on opportunities and pitfalls.

IMI Session lead: Sushil Ramola

1. Ronald Castelino, CEO, Agrinet Food and Beverages: Bio Char project in Chamoli
2. Neichute Doulo, Founder and CEO, Entrepreneur Associates: Tree Plantation in Nagaland
3. Santosh Singh, MD, Intellicap: Carbon Finance Expert
4. Pankaj Tiwari, CEO Arohi Society: Afforestation project working with Van Panchayats in Kumaon

MR. SUSHIL RAMOLA, Former President of IMI (2017-2020).



Mr. Sushil Ramola, a founding member of the Integrated Mountain Initiative (IMI) and its President from 2017 to 2020, is a distinguished leader known for his contributions to social entrepreneurship, skill development, and sustainable livelihoods. He is the Co-founder and Chairman of B-ABLE and the B-ABLE Foundation, organizations that have provided skills training and employability opportunities to over 10 lakh youth across 28 states of India over the last 15 years. Prior to this, he held senior leadership positions in the corporate sector, both in India and abroad.

A chemical engineer and alumnus of IIM Ahmedabad, Mr. Ramola has played a pivotal role in shaping institutions that focus on education, livelihoods, rural tourism, and healthcare. Beyond founding and leading such initiatives, he has also served as a mentor and board member, guiding their growth and impact. Deeply connected to his roots, he hails from Uttarakhand and continues to dedicate his efforts to creating sustainable opportunities for communities across the country.

Dr. Pankaj Tewari, CEO, Aarohi Society, Uttarakhand



Dr. Pankaj Tewari is the Executive Director of Aarohi, a Nainital-based non-profit dedicated to sustainable mountain development and rural livelihoods. He holds a PhD in Forestry and Environmental Science from Kumaun University and brings over 20 years of experience in environmental research, natural resource management, and community development, including work with the marginalized Van Raji tribes.

He has led more than 21 projects for national ministries and international agencies such as the World Bank, GIZ, ICIMOD, Tata Trusts, UNDP, and MoEF&CC, and has served in leadership roles with organizations like CHEA and the Uttarakhand Academy of Administration. His work emphasizes holistic, climate-resilient development through watershed management, sustainable livelihoods, health, and education in mountain regions.

Abstract

Aarohi Integrated Mountain Model

Forest • Fire • Livelihood • Education • Health

1. Forest Restoration & Biodiversity (Green Pillar)

200 Van Panchayats – 4,000 ha under restoration linked with Carbon Forestry.

Linking with government and development programs

90 decentralized nurseries (15+ native species: oak, chyura, chestnut, bahunia, mulberry, etc.)

Community-led plantation drives with SHGs and school students

Soil & water conservation linked with farm fields

Linked **to** **Education:**
“Learning by doing” – school eco-clubs adopt nurseries & plantation sites, combining environmental education with practical farming. Plantation activity on birthday of school students and teachers.

2. Fire Prevention & Resilience (Orange/Red Pillar)

Pine needle collection & safe disposal

Fire lines, traditional control methods, advance planning with villagers

Van Suraksha Samitis (90) with women leadership

Collaboration with Forest Dept. and administration

Research on changing fire patterns & community perception

Linked to Health & Education:

Awareness in schools and villages on smoke hazards, safe water, and role of biodiversity in reducing health risks.

3. Sustainable Livelihoods & Enterprises (Blue/Yellow Pillar)

Apricot value chain and herbs → oil, soap, scrubs, skincare, infusion and herbal teas

Cooperative DHARA agro products → natural coolers, hand pounded spices, *Pisi loon*, *Aipan* arts

Pine needle utilization → scope identified for paper, handicrafts, briquettes (need more research)

Medicinal & Aromatic Plants (MAPs) → lemongrass, oregano, chamomile, tulsi, thyme

Honey & NTFPs for income

Recognition & incentives for SHGs and Van Panchayats

Linked to Nutrition & Health:

Nutrition gardens, MAPs, and fruit-based products tied to Aarohi Health Program – improving diet diversity in schools & villages.

4. Education Integration (Yellow-Green Bridge)

School curriculum connected to local ecology & farming

Farm fields as “learning labs” for biodiversity and sustainable agriculture

Plantation drives as practical environmental education

Inter-college outreach on climate, fire prevention & livelihoods

5. Health & Nutrition Integration (Blue-Green Bridge)

Nutrition awareness sessions linked with MAPs and forest foods

Hospital/community health workers promoting diet diversity

Preventive health linked to safe water, reduced contamination (via waste water management)

Forest & farm-based nutrition (nettle, buransh, kafal, local pulses and millets)
integrated into community diets

“Aarohi: Where Forests, Farms, Education, and Health grow together for resilient Himalayan communities.”

Day 2, 27th September 2025

Session 5

Conference Hall, Dr. Nityanand Auditorium Building

Panel Discussion

Climate Change Adaptation and Resilience: Good Practices from the IHR

(Review, Revisit and Way Forward)

Moderator: Dr. G.S. Rawat



Name: Dr. Gopal Singh Rawat

Designation: Former Senior Professor & Dean, Wildlife Institute of India, Dehradun

Qualification: Ph.D. & D.Sc. in Botany, Kumaon University, Nainital

Experience: 42+ years in Himalayan flora, alpine rangelands, orchids, medicinal plants, and natural resource management

Key Roles: Chief Scientist, Ecosystem Services, ICIMOD (2011–2014); Member, Planning Board (Ladakh); Member, Wildlife Board (Uttarakhand)

Specialization: Himalayan ecosystems, eco-floristic studies, alpine ecology, medicinal plants, wildlife habitat management

Publications: 300+ research papers, books, reports & articles

Supervision: Guided 35+ Ph.D. and 15 Masters students

Awards & Honours: Fellow, National Academy of Sciences, India (2004); T.N. Khoshoo Memorial Award (2019)

Professional Memberships: IUCN SSC Specialist Groups, IPBES (Asia-Pacific), Expert Committees on Invasive Species & Rangeland Policy

Notable Contribution: Led 2004 Western Himalaya ecological expedition documenting alpine meadows, wildlife, and medicinal plants

Panelists: Mr. Jigmet Takpa, Dr. S.P. Subudhi, Ms. Nina Grewal, Dr. Suruchi Bhadwal, Mr. T. Chuba & Dr. Pradeep Mehta

Background Note

The Himalayan region, one of the hotspots of biodiversity and water towers of Asia provides numerous ecosystem services to the millions of people within and outside the region. With the unprecedented climate crisis coupled with increasing anthropogenic pressures the natural as well as agro-ecosystems in the region are currently facing tremendous stress affecting the flow of ecosystem services and human well-being. Most visible impacts of the climate change in the region include rapid recession of glaciers, depletion of water resources, increasing forest fires, rapid invasion of alien species thereby depletion of populations of native flora and fauna. In response to rapidly changing climate and as per the national and global commitments towards mitigation and adaptation the Indian Himalayan states have been working on state action plans for climate change. A number of initiatives have been taken to mitigate the climate impacts and enhance resilience of the local communities in the Himalayan region. It is high time that we review and revisit the mitigation strategies and carry forward good practices in the region. As part of Sustainable Mountain Development Summit 12, this session has been dedicated to deliberate on policies and practices pertaining to climate change adaptation and resilience in the Indian Himalayan Region (IHR) with a focus on agriculture and forests and environment sectors as these sectors affect the rural livelihoods the most.

The session intends to briefly discuss the impacts of climate change across various states of IHR, flag some of the enabling policies and good practices covering various eco-climatic regions such as cold deserts, Western and Eastern Himalaya and Northeastern Hill states. It is hoped that the discussion will lead to distillation of a few suggestions for policy and action on the ground for the line agencies especially in forestry and agriculture. The speakers are expected to share the examples of best practices in terms of rural technology for saving energy for the agro-pastoral communities (e.g., Ladakh and Himachal Pradesh), nature based solutions in states such as Jammu & Kashmir, recent initiatives pertaining to organic farming, conservation of wetlands and curbing forest fires by sustainably harvesting pine needs from forest floor, watershed management with the help of community based institutions (Uttarakhand), and strategic plans for climate adaptations in Eastern Himalaya and North-eastern hill states such as Meghalaya and Nagaland.

Mr. Jigmet Takpa



Shri Jigmet Takpa, a distinguished Indian Forest Service officer with over three decades of service, has made outstanding contributions to environmental governance, biodiversity conservation, and sustainable development in Ladakh and the Himalayan region. As the first Principal Chief Conservator of Forests of Ladakh, he pioneered Project Snow Leopard, positioning Ladakh as the snow leopard capital of the world.

As Project Director of the Ladakh Renewable Energy Development Agency, he led the world's largest off-grid renewable energy initiative, significantly reducing fossil fuel dependency. He also spearheaded the Ladakh Ecotourism and the formulation of Ladakh Vision Document, harmonizing ecological preservation with sustainable livelihoods.

At the Ministry of Environment, Forest and Climate Change, Shri Takpa served as Joint Secretary heading the Mountain Division, Desertification Cell, River Conservation, Control of Pollution, and Environmental Impact Assessment divisions. He was India's National Focal Point for UNCCD, IUCN, and GEF, and successfully hosted UNCCD COP14, engaging 9,000 delegates from 198 nations in India. He also represented India at UNFCCC, UNCCD, GEF, G20, and G7 forums, enhancing global environmental leadership.

Abstract

The Ladakh Flash Flood of August 2010, triggered by an unprecedented cloudburst that released 14 inches of rain in just two hours, was one of the most devastating natural disasters in the region's history. The deluge caused widespread flooding, mudslides, and debris flows across Leh and surrounding villages, claiming 234 lives, inflicting hundreds of injuries, and destroying homes, infrastructure, agriculture, and forests. The Civil Hospital itself was severely damaged, complicating emergency response efforts.

Shri Jigmet Takpa, IFS, was appointed Relief Coordinator, leading the civil administration in partnership with the Indian Army, paramilitary forces, civil society organizations, and with critical support from the Central Government. Their collective efforts managed mass casualties, ensured timely relief, and restored essential infrastructure including roads, hospitals, and communication systems. Rehabilitation measures focused on rebuilding homes, reviving livelihoods, and encouraging inclusive community participation.

In parallel, Shri Takpa spearheaded the Ladakh Renewable Energy Development Agency's (LREDA) landmark off-grid renewable program—the largest of its kind worldwide—encompassing solar PV, micro-hydro, solar thermal (Solar Water Heaters, Cookers), and greenhouses. Together with ecotourism, biodiversity initiatives like Project Snow Leopard, and micro-level community planning, these integrated efforts positioned Ladakh as a global model of sustainable mountain development, climate resilience, and community empowerment.

The experience highlighted the need for robust early warning systems, community participation, and climate-resilient infrastructure. Integrating disaster relief with renewable energy and conservation proved essential for sustainable recovery and expanding green initiatives will enhance Ladakh's resilience and global leadership in sustainable mountain development.

Ms. Neena Grewal (IFS), PCCF, MD, Forest Corporation



Ms. Neena Grewal is an Indian Forest Service officer currently serving as Managing Director of the Uttarakhand Forest Development Corporation, Dehradun. She has extensive expertise in conceptualizing, designing, planning, implementing, monitoring, and evaluating externally aided projects, with a particular focus on water source and spring rejuvenation.

As a senior government officer, she has contributed to policy formulation and reforms in natural resource management. In recent years, her work has centered on watershed and rural management in the Himalayan landscape, bringing valuable insights and experience relevant to the proposed Hindu Kush Himalaya (HKH) Springs Outlook.

Abstract

ENHANCING ECOSYSTEM SERVICES BY BUILDING CLIMATE RESILIENT WATERSHEDS

Best Practices from Uttarakhand Decentralised Watershed Development Project-II, Uttarakhand

By Neena Grewal, IFS, Managing Director, Uttarakhand Forest Development Corporation, Dehradun

Uttarakhand being a hill state, is more vulnerable to severe soil erosion, flash floods, GLOFs and landslides due to its location, topography and underlying geology. Agriculture is the mainstay of most of the rural hill population though its share in the Gross State Domestic Product has declined from 11.5% in 2011-12 to 7.9% in 2020-21. Agriculture, the mainstay in the hills is mostly rain-fed and has remained traditional in its outlook as over 2/3 rd of the farm holdings are small and marginal (from 0.43 to 1.39ha) and only 1/3 rd of the total arable land is irrigated.

World Bank funded the Uttarakhand Decentralized Watershed Development Project II (UDWDP II) also referred to as Gramya II was implemented in 82 micro watersheds by the Watershed Department, with a focus on rainfed agriculture development through the use of Watershed development tools, particularly rain-water conservation and harvesting and land resource management. The project was implemented in villages of 82 micro watersheds covering 200,902 Ha on non-arable land in the hills of Middle Himalayas, lying between 700 m and 2700 m above sea level spread across 527 Gram Panchayats.

The project focused on building climate resilience by rejuvenating the natural resource base through significantly reducing soil erosion and runoff loss of rainwater, improving groundwater recharge. and reducing sediment load in the tributaries of the major rivers flowing through the state. The project also constructed water harvesting structures and small irrigation systems on 40,000 ha or arable land, and disseminated new technologies for increasing the productivity of cereals, pulses, and oilseed crops in rainfed areas, and of high-value vegetables in the irrigated areas. It also focused on developing value chains for selected agriculture and horticulture commodities.

In addition, it built the capacity of targeted Gram Panchayats (GPs) for developing and implementing sound watershed management plans. Keeping the sustainability of the project in view and its inclusive approach the project supported landless and vulnerable households by supporting them in income generating activities.

One of the primary strengths of the project was its decentralized planning process for developing Gram Panchayats Watershed Development Plan (GPWDP) undertaken with all the primary stakeholders. and especially women village members through Women Aam Sabhas (WAS) at the GP level to facilitate catchment area treatment activities. Innovations like the introduction of PME (Participatory Monitoring and Evaluation), and

Women Aam Sabha, have proved to be successful in bringing holistic measures in the planning and development processes.

The project introduced various initiatives on use of alternate energy, expansion of animal husbandry activities and agribusiness growth centers. Improved utilization of natural resources has been demonstrated through the increased area brought under cultivation (reducing the fallow area) as well as expanding the irrigated area through rejuvenation and development of water resources.

The project has demonstrated exemplary results in doubling farm income through strategic synergy between soil moisture improvement, demonstration of integrated crop management practices and cluster development approach.

Session 6

Meet of Legislators

“Ever Increasing Disasters in the Indian Himalayan Region - Legislators to deliberate on what the State must do differently.”

Key Note: Dr. Ravi Chopra



A recipient of IIT-Bombay's 2012 Distinguished Alumnus Award, Dr. Ravi Chopra is a former Director of People's Science Institute, a non-profit public interest research and development organization. It is known for its pioneering work on natural resources management, environmental quality monitoring and disaster mitigation.

Dr. Chopra's research has focused on the interactions between technology and society and environment and development. In 1982 he co-edited the First Citizens' Report on *The State of India's Environment*, critically acclaimed as "a unique effort anywhere in the world". He is a co-editor of the recently published Citizens' Report on River Ganga.

His present interests center around climate change, regeneration of Himalayan springs, river conservation and sustainable livelihoods.

Dr. Chopra has chaired two Supreme Court appointed committees to investigate the impacts of major infrastructure projects in Uttarakhand. He was a member of the National Ganga River Basin Authority chaired by then Indian Prime Minister, Dr. Manmohan Singh, besides numerous other official committees.

Since 1967, Ravi Chopra has helped establish several pioneering organizations to involve youth in nation-building, use science and technology for empowering the poor, and rehabilitate survivors of disasters. He has authored or co-authored many reports, books, papers and articles. Occasionally he teaches courses at reputed institutions. Dr. Chopra is a popular speaker in India and abroad.

Born in 1947, Dr. Chopra did his doctoral research at Stevens Institute of Technology, New Jersey. His wife, Jo Chopra, is a passionate advocate for the rights of the disabled. They live in Dehradun in a home with a roof rainwater harvesting tank and a garbage composting unit.

Ever-Increasing Disasters in the Indian Himalayan Region: What the State Must Do Differently

Ravi Chopra

The Hindu Kush Himalayan (HKH) region being the largest storehouse of ice and snow outside the polar regions is often called Earth's third pole. The current climate change is physically manifesting itself in the form of warming temperatures and changing precipitation patterns. The (HKH) region is witnessing greater impacts of climate change compared to many other parts of the world. In recent decades the Indian Himalayan region (IHR) has witnessed devastating disasters like glacial lake outburst floods, avalanches, flash floods, destabilization of mountain slopes, drying springs and streams, forest fires and drying soils, leading to a loss of lives, livelihoods, biodiversity, declining productivity of ecosystems and reduced stability and security of human settlements -- urban and rural -- in the IHR and the plains downstream. Analysis of these calamitous occurrence's points to a need for a region-specific model of development in the IHR. The presentation will specify physical, technical, legislative and administrative measures that can help minimize the disasters and thereby enhance social, economic and ecological security in the region.

Session 7

Beleaguered Waters of Himalayas: Blessings and a curse



Name: Dr. Vipin Kumar

Official Address: Room No. 202, Department of Geology, II Floor, Nityanand Centre, Doon University, Dehradun, 248001, Uttarakhand, India

EmailID: vipin@doonuniversity.ac.in

Mobile No.: 7500471164

Major Achievements/Experience:

Successfully secured funding as PI (UK/India, 2024) and Co-PI (India, 2023). Awarded grants including International Geographical Congress Bursary (2024) and Young Geomorphologists Grant (2022). Received SERB International Travel Grant (2022) and FNRS Postdoctoral Fellowship (Belgium, 2020). Recognized with Best Paper Award (IIT Mandi, 2019). Holds NET-JRF (CSIR, 2014) All India Rank-19, and Institute Research Fellowship (WIHG, 2014). Currently Assistant Professor & Head I/C at Department of Geology, Doon University, with prior roles at HNB Garhwal University, University of Liege, Belgium and Wadia Institute of Himalayan Geology, India, and Cengrs Geotechnica Pvt Ltd, India. Actively contributes to science promotion as Co-Coordinator (UCOST, Uttarakhand).

Other Information:

Holds UAV-Motorcraft License (2025) from DGCA, Govt of India. Training also includes landslide monitoring/modeling (China, 2018) and landslide hazard analysis (India). Expertise spans UAV Mapping, data processing, and geophysical mapping. 24 SCI publications with 593 citations. Research interests: Engineering Geology, Georisk, and Disaster Risk Reduction.

Background

The Himalaya, often called the "Third Pole," is a source of Asia's great rivers, yet their water systems are under unprecedented stress. This session, "Beleaguered Waters of Himalayas," convenes experts to address the escalating water crisis, where water is simultaneously a life-sustaining resource and a source of catastrophic hazards.

The discussion will be grounded in a scientific understanding of the challenges. Prof. Pradeep Srivastava will elucidate the geological context of extreme hydrological events, providing a foundational perspective on the region's inherent vulnerabilities. Building on this, Mr. Vinod Kothari will analyze the compounding pressures of climate change on these finite water resources. In response to the growing threat of disasters, Mr. Anand Sharma will highlight the indispensable role of precise weather forecasting in developing effective early warning systems. Culminating the discussion, Dr. Soban Singh Rawat will propose actionable adaptation strategies for the sustainable management of mountain water resources across the Indian Himalayan Region.

Moderated by Dr. Vipin Kumar, this multi-disciplinary session seeks to integrate geological science, climate impact analysis, and predictive techniques to formulate robust, long-term strategies for ensuring water security and resilience.

Mr. Vinod Kothari, ED, Himmotthan Society



Name: Dr. Vinod Kothari

Designation: Executive Director

Organization: Himmotthan Society

Additional Role: Member Secretary (Ex-officio, Tata Trusts Nominee)

Abstract

Climate Change and Water Resources

Climate change is a serious threat to India's water resources, affecting their availability, quality and distribution. Rising temperatures, irregular monsoons, melting glaciers, and frequent extreme weather events are disturbing the natural water cycle. This makes major river basins like the Ganga, Brahmaputra, and Indus highly vulnerable. Above issues lead to water shortages in dry seasons and increased risk of floods during heavy rains. Groundwater, which provides most of India's irrigation and drinking water, is under heavy pressure due to overextraction and less recharge from rainfall.

In Uttarakhand and other Himalayan states, the effects are more severe. Climate change is directly affecting fragile Himalayan water resources; glaciers are shrinking, reducing the flow of rivers.

Majority of the water supply schemes in the Uttarakhand state have their origin in local springs and springs, which are the main drinking water sources in rural Uttarakhand are drying. This issue includes decreasing availability, deteriorating water quality and poor governance which leads to conflicts related to water availability and supply. Decline in winter rainfall reduces groundwater recharge, while rising temperatures increase evaporation losses. Changes in forest cover and species composition affect infiltration and sub-surface water storage.

Together, these factors have accelerated the drying of springs that once supported rural water security. Irregular rainfall has caused both flash floods and drought like situations, harming farming and livelihoods in Uttarakhand.

Despite the importance, scientific studies on Himalayan springs remain fragmented across states and eco-regions, with very few efforts adopting a comprehensive, census-like approach. Taking this fact into account, a spring census was initiated by Himmotthan

Society in hilly districts of Uttarakhand in April, 2025. In the first phase, **Almora** and **Tehri Garhwal** districts were selected, that to review the lean season discharges along with other key variable, the study was conducted during April to June, 2025. The census adopted a district-saturation approach, mapping every spring on civil land and nearby - active, seasonal, or dried. Over 100 trained para-hydrogeologists, equipped with standardized tools and mobile devices, collected data on 55 hydrological, spatial, ecological, and socio-economic parameters, supported by in-situ physical water quality parameter tests, discharge measurements, photographic documentation and community interviews with key informants. This integrated approach, combining real-time digital surveys with local knowledge, ensured scientific rigor, minimized errors, and generated one of the most comprehensive district-scale datasets on Himalayan springs.

Over 10,000 springs which were known to community members and are in use were surveyed in 2,413 villages of 17 blocks of these 2 districts. Mostly three types of springs – free flow, naula/bawdi and seepage were observed based on spring outlet structure. Out of the 10,063 springs surveyed, 8325 (83%) were perennial in nature, 385 (4%) were seasonal, whereas, 1353 (13%) springs were dried. Of the 10063 springs, 5618 (56%) were free flow, 3250 (32%) were naula/bawdi and 1195 (12%) were seepage. Naulas showed a high percentage (56%) in Almora while a few (8%) in Tehri Garhwal. 81% of spring showed a discharge of less than 10 lpm, while 1% springs had a discharge of 40-50 lpm. This survey was done within a short time span of 2.5 months considering the criticality to conduct discharge measurements during the lean-flow season to establish robust baseline datasets, which are essential for accurately tracking temporal variations in spring discharge during future monitoring efforts.

The results show a clear trend of springs drying across all types of land use, suggesting that the problem is widespread and not limited to a single land use type. However, despite programs such as the Jal Jeevan Mission (JJM) dependence on natural springs continues to remain high. The survey of 2,413 villages found that nearly 86.4% of the population still relies on springs for drinking and domestic use at some point of time in a year. Meanwhile 76% springs are showing decreasing discharge trend since last decade based on the 10,063 springs surveyed. This highlights that springs are not only cultural and ecological lifelines but also remain critical in bridging gaps where piped supply is seasonal, limited, or difficult to maintain in remote mountain areas. Spring census is foremost need of the hour before developing any policy on it across the Himalayan region.

Prof. Pradeep Srivastava , Dept of Earth Sciences, IIT Roorkee



Dr. Pradeep Srivastava, Professor at the Department of Earth Sciences, IIT Roorkee, is a river geologist specializing in climate–tectonic interactions, landscape evolution, and extreme floods. Formerly a Scientist at WIHG, with postdoctoral experience in India and the USA, he has published over 100 papers and supervised 10 PhDs. His research integrates geomorphology, sedimentology, and geochronology. He serves as editor of leading journals, including *Palaeo-3* and *Natural Hazards*. Widely recognized with national and international honors, he received the National Geoscience Award and is an elected Fellow of INSA. He currently is Vice President of the International Union for Quaternary Research.

Abstract

Geology of Extreme Hydrological events in Himalaya

Pradeep Srivastava

Department of Earth Sciences, Indian Institute of Technology, Roorkee

Email: pradeep@es.iitr.ac.in

The Himalayan orogen, characterized by rapid tectonics and increasing population pressure, is highly vulnerable to catastrophic floods that often escalate into large-scale hydrological disasters. Geological and geomorphic archives including stratigraphy, floodplain morphologies, and sedimentary records reveal how the structural framework of the Himalaya controls flood magnitudes, spatial clustering of damage, and long-term landscape evolution. The orogen is composed of south-verging thrust sheets separated by major fault zones such as the Main Central Thrust (MCT), Main Boundary Thrust, and Himalayan Frontal Thrust. The geometry of the basal décollement fosters duplex formation beneath the MCT, generating steep relief that serves as an orographic barrier to the Indian Summer Monsoon (ISM). Post-event investigations of the 2013 Kedarnath disaster highlighted how destruction clusters along structural ramps, demonstrating strong coupling between mid-crustal architecture and flood intensity.

Along the ISM-dominated southern Himalayan front, floods preferentially incise and exhume the Higher Himalayan Crystalline core. Similarly, large geomorphic boundaries at the southern Tibetan margin modulate flood magnitudes in the Indus and Brahmaputra basins, with the latter exhibiting greater extremes. This talk will provide a perspective on flood frequency and magnitude by integrating geochronology and provenance analyses of Slack Water Deposits, revealing erosion loci, ISM variability, sediment routing, and possible feedbacks to human migration across the orogen.

Dr. Soban Singh Rawat, National Institute of Hydrology, Roorkee



Name: Dr. Soban Singh Rawat

Qualification: Ph.D.

Designation: Scientist 'F'

Institution: National Institute of Hydrology, Roorkee

Area of Work: Sustainable management of mountain water resources and adaptation strategies for the Indian Himalayan Region.

ABSTRACT

Towards Sustainable Management of Mountain Water Resources: Adaptation Strategies for the Indian Himalayan Region

Soban Singh Rawat (PhD)

Scientist 'F', National Institute of Hydrology, Roorkee

The Indian Himalayan Region (IHR), covering 537,435 km² (16.2% of India's geographical area), represents a fragile but strategically important ecosystem. As the "Water Tower of Asia," it sustains major river systems critical for agriculture, industry, and urban settlements in the northern plains. In addition, its springs, lakes, and wetlands are vital for local communities, biodiversity, and ecological balance.

In recent decades, accelerated glacial retreat, driven by global warming, has altered hydrological regimes and reduced snow cover. These changes, coupled with deforestation, unregulated development, and rising seasonal tourism demand, have placed unprecedented stress on the region's water security. The drying of mountain springs—primary sources of water in many towns—has further increased vulnerabilities in livelihoods, health, and agriculture.

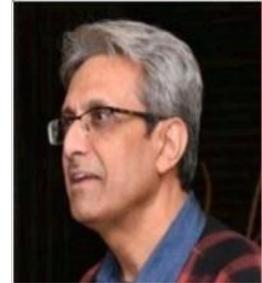
Given the region's steep altitudinal and land-use variations, a dense hydrometric and monitoring network is essential for reliable water resource assessment. However, operational and logistical challenges continue to limit systematic data collection. As highlighted in IPCC (2023), mountain ecosystems remain highly sensitive to climate change, necessitating urgent policy interventions.

To address these challenges, NITI Aayog has recommended the establishment of a "Himalayan Authority" as an overarching institution to coordinate integrated development. The proposed framework emphasizes five priority areas: revival of springs, promotion of

sustainable tourism, skill development for mountain communities, transition from shifting cultivation to resilient practices, and development of robust datasets and information systems. Strengthening water security in the IHR is pivotal to advancing national priorities and achieving Sustainable Development Goals (SDGs 1, 2, 5, 6, and 15), with direct implications for water, food, energy, and livelihood security across India.

Keywords: Indian Himalayan Region (IHR), Mountain water resources, Sustainable Development Goals (SDGs).

Mr. Anand Sharma, Scientist - G/Head, RMC, IMD, New Delhi



Shri Anand Sharma has over three decades of experience in meteorology and environmental sciences, having served as Scientist-G / Head, RMC IMD New Delhi, Additional Director General, and Deputy Director General at the Regional Meteorological Centre, New Delhi. He was the founding Director of the Meteorological Centre, Dehradun (2002–2015). He holds an M.Phil. in Environmental Sciences from JNU, an M.Sc. in Agricultural Meteorology from PAU, Ludhiana, and a B.Sc. (H) from Delhi University, and has received National Scholarship, GATE fellowship, and UNDP/WMO fellowship.

Shri Sharma's expertise includes weather prediction, crop-weather simulation, agro-advisories, mountain meteorology, early warning of extreme events, disaster management, and environmental awareness. He has led key projects such as UPROBE, Fog-field Experiments, and early warning systems in Uttarakhand, and predicted the 2013 Kedarnath heavy rainfall. He has published over 30 papers, a book on Dehradun climatology, and has been recognized with multiple awards including MOES Award for Excellence in Atmospheric Science, HUDCO Award, Doon Rattan, and Uttarakhand Rattan.

A noted educator and popularizer of meteorology, he has served as visiting faculty at numerous universities and administrative institutes, delivered lectures in prestigious schools, and appeared extensively in media including National Geographic, Discovery, Al Jazeera, NHK, BBC, and Voice of America. He has held leadership roles in the Indian Meteorological Society and is a life member of multiple professional societies.

Abstract

The talk will focus on understanding the weather systems that are responsible for extreme rainfall events, with particular attention to the interactions that amplify their impacts. These systems, ranging from monsoonal dynamics to localized convective activity, are undergoing significant shifts under the influence of global warming. The presentation will explore how a warming atmosphere alters their frequency, intensity, and duration, thereby increasing the risks of floods, landslides, and other disasters in fragile regions such as the Himalayas.

By drawing connections between climate change and the observed behavior of these weather systems, the talk will shed light on the emerging patterns of disaster vulnerability. It will emphasize the importance of integrating scientific understanding into disaster risk reduction strategies. A key focus will be on the role of early warning systems — how timely forecasts, effective communication, and community preparedness can prevent hazards from escalating into full-scale disasters.

In addition, the discussion will highlight broader lessons for policy, planning, and resilience building, underscoring the need for collaborative approaches that bring together science, governance, and local communities. The talk aims to provide both scientific insights and practical perspectives that are vital for adapting to an era of increasing climate variability and extremes.

Mr. Bhupendra Bhaisora, Swiss Agency for Development and Cooperation (SCA–Himalayas)



A Disaster Risk Reduction and Climate Resilience professional with over 20 years of experience in disaster management, water resource planning, and geospatial technologies. Currently serving as Technical Expert with the Swiss Agency for Development and Cooperation (SCA–Himalayas), he has led projects on landslide early warning systems, avalanche modeling, spring shed management, and integrated water resource planning in Uttarakhand. Previously, he spent nearly 15 years with the Disaster Mitigation and Management Centre, Government of Uttarakhand, where he established the State Emergency Operation Centre, implemented disaster reporting systems, coordinated preparedness and response across departments, and trained over 7,000 community volunteers. He began his career managing health information systems before moving into disaster management. Bhupendra holds advanced qualifications in disaster management, economics, and information systems, and has published research on seismic vulnerability, landslides, and climate risks. His expertise lies in DRR, Climate Change Adaptation, GIS/RS, Early Warning Systems, and Capacity Building, with a strong focus on applying science-based solutions for resilience in the Himalayan region.

Abstract

From Himalayan Springs to Downstream Taps: An Integrated Water Resources Management (IWRM) Framework for Sustainable Water Resource Management in Bhagirathi Basin

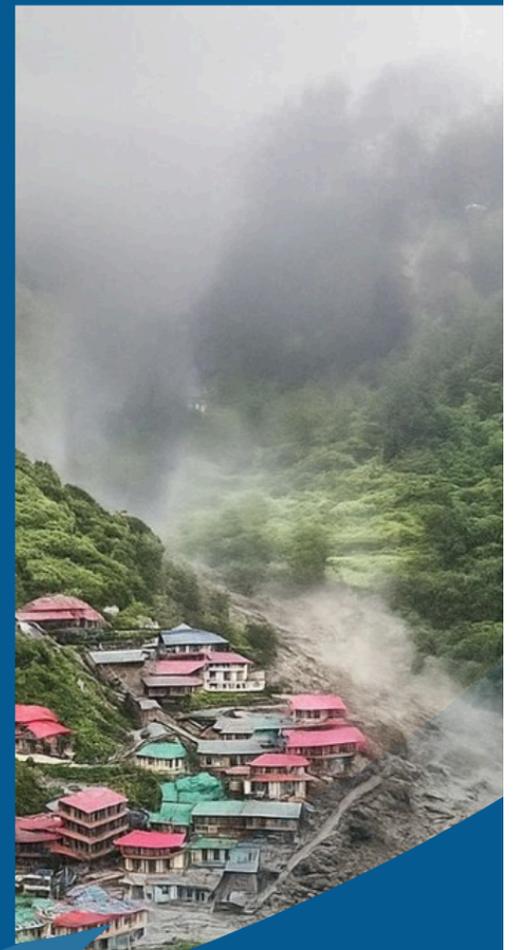
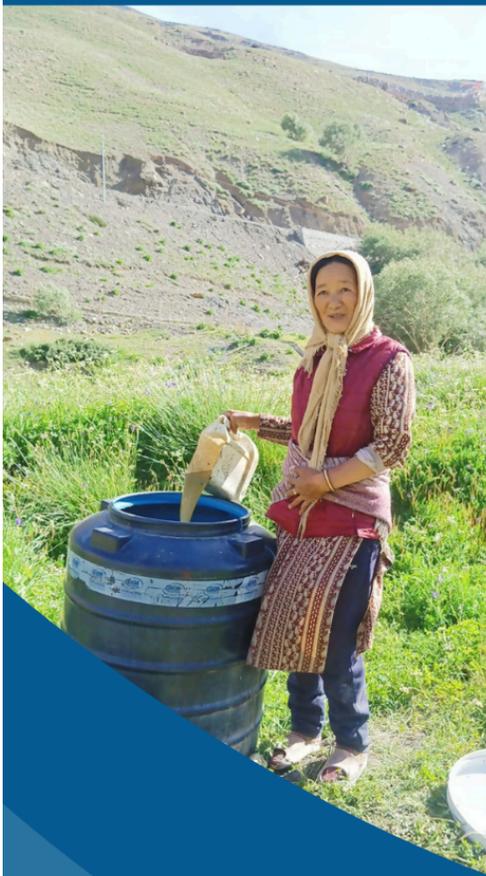
Uttarakhand's Himalayan water resources, fundamental to regional and downstream water security, are under increasing threat from climate change. Manifestations include accelerated glacial melt, spring drying, and heightened flood/flash flood frequency. Addressing these multifaceted water security challenges necessitates a comprehensive and holistic management strategy. Integrated Water Resources Management (IWRM) presents a viable framework for the sustainable governance of the state's water resources.

IWRM is a strategic process that promotes the coordinated development and management of water, land, and related resources to maximize resultant economic and social welfare equitably, without compromising the sustainability of vital ecosystems. As stipulated by the Central Water Commission, Government of India, IWRM encompasses the management of water as a resource and the institutional framework for water service provision, addressing both water quantity and quality.

From this perspective, an IWRM plan has been formulated for the Bhagirathi River basin, a major headwater tributary of the Ganga River originating from the Gangotri glacier and sustained by meltwater from multiple valley glaciers. The development of this plan employed an integrated methodology, combining glacio-hydrological modeling, water allocation modeling, and a comprehensive analysis of the basin's socio-economic, regulatory, and institutional frameworks. This document summarizes the key findings and recommendations derived from this integrated assessment for the Bhagirathi basin, and a scalable framework for balancing ecological sustainability with human water needs in vulnerable Himalayan watersheds.

ABOUT ORGANISERS / KNOWLEDGE PARTNERS

- National Mission on Himalayan Studies (NMHS)
- Doon University (Geography & Geology Dept.)
- Uttarakhand Forest Development Corporation (UAFDC)
- CPPGG, State Planning department, Government of Uttarakhand
- Government of Arunachal Pradesh
- International Centre for Integrated Mountain Development (ICIMOD)
- Uttarakhand State Council for Science and Technology (UCoST), Government of Uttarakhand
- HIMMOTTHAN Society
- Sustainable Development Forum Uttaranchal (SDFU)
- SARG India



INTEGRATEDMOUNTAIN INITIATIVE

Admin Office: 25, Lane no. 3, Teg Bahadur Road, Dalanwala, Uttarakhand- 248001

Regional Office: 'Tayakhim' J 155, Tadong,Gangtok, Sikkim – 737102