REPORT

Emergent Initiatives: Indian Himalayan Region

INDIAN NATIONAL ASSOCIATION FOR THE CLUB OF ROME

THE CLUB OF ROME Indian National Association

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Emergent Initiatives: Indian Himalayan Region

Report

2024-2025

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GOLF COURSE

Foreword by Shri S. Ramadorai

The Indian Himalayan Region (IHR) occupies a distinctive and irreplaceable role in the global ecological and socio-economic landscape. As one of the planet's 36 biodiversity hotspots, it not only sustains a remarkable range of flora and fauna but also underpins the livelihoods of millions and acts as a natural reservoir for countless river systems across the Indian subcontinent. Yet, today, the Himalayas face unprecedented pressure from climate change, urbanisation, unsustainable development, inadequate infrastructure planning and environmental degradation. As stewards of this fragile ecosystem, we must urgently reassess our approach, elevating sustainable and resilient development as our guiding principles.

This report emerges from a recent roundtable convened by the Club of Rome and Development Alternatives, where diverse stakeholders—from policymakers and scientists to community representatives and environmentalists—came together to deliberate on the urgent challenges and opportunities facing the IHR. The deliberations underscored the need for an integrated approach that recognises the unique geographical, ecological, social-economic and anthropogenic characteristics of the Himalayan states. Discussions ranged from the direct impact of climate-induced disasters on agriculture, water security, and biodiversity, to the equally pressing issues of air and water pollution, forest degradation, and the fragile balance between tourism and conservation.

A key takeaway from the roundtable was the importance of viewing the region through multiple lenses of environmental, economic, socio-cultural, and climate resilience. Building environmental resilience calls for adaptive strategies that align with the natural carrying capacity of the region, while prioritising community-led conservation practices. Economic resilience will depend on fostering sustainable tourism, agriculture and livelihood models, carefully balancing the needs of the people and the environment. Socio-cultural resilience emphasises the preservation of traditional knowledge systems, which have for centuries harmonised human activity with the natural environment. And, at the heart of climate resilience, there lies a profound need for policies and technological advancements that anticipate, rather than merely react to, the cascading impacts of global warming, erratic weather patterns, and glacial dynamics on local ecosystems.

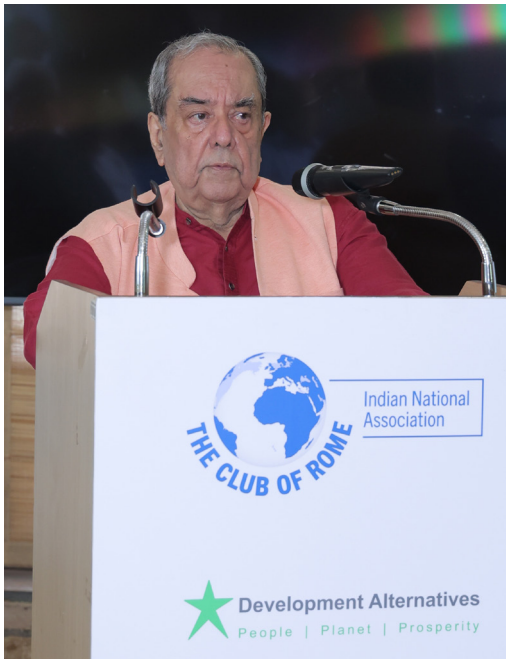
This report highlights the urgency of such shifts, offering actionable recommendations that call upon decision-makers to integrate scientific research, local knowledge, and community participation in policy-making processes. The Himalayan strategy must evolve from a conventional development model towards a stewardship model that embraces collaboration across sectors, champions innovative technologies, and harnesses the collective wisdom of the local communities. The Himalayan ecosystem is a legacy that we must preserve for future generations through Nature-

based Solutions (NbS) aligned with the Sustainable Development Goals (SDGs). Our idea of "Viksit Bharat" must envision a future where economic prosperity is achieved without compromising ecological integrity.

The Himalayas, as a living and life-giving landscape, demand a vision grounded in both reverence and commitment. Let this report serve as a clarion call for decisive action, ensuring that the Indian Himalayan Region continues to thrive, not only as a biodiversity hotspot but also as a cornerstone of ecological and human resilience. I commend the organisers for their foresight in uniting such a diverse assembly of experts and decision-makers, and I am hopeful that this forum's actionable insights and recommendations will lead to real-world impact in safeguarding the IHR's future.

S. Ramadorai
Chairman, CoR-India

Message from Dr Ashok Khosla



In this report, we present the results of the roundtable consultation that took place on October 5, 2024, at the Development Alternatives Headquarters in New Delhi. This meeting not only brought together large group of significant players involved in a variety of environmental, climate change, and sustainable development issues, but also served as a hands-on workshop designed to identify well-defined action points and specify strategies for implementing them.

For different topics, including mountains, forests, water systems, livelihoods and sustainable practices in industry, agriculture and tourism, the participants committed to undertake collective endeavours to create a better and more sustainable future for the entire Himalayan regions. Certain participants and their organisations have their roots in the mountain regions and have a deep understanding of the fragility of the area's ecosystems, economy and social structures. The perspectives they hold are informed by their scientific knowledge, religious experiences and cultural heritage – and vary widely. The meeting provided an excellent opportunity to bring about a viable synthesis of understanding and commitment to apply collective thought and action for solving the diverse problems of the region.

The Himalayas are not only an element of Indian geography, but they are also the source of Indian life. Hundreds of millions of people in the highlands and plains rely on the water systems fed by sources in this region, and on the food that is grown with it. They are also the source of many valuable resources, such as herbal medicines, timber and hydropower. Their cultural resources attract numerous tourists and religious shrines bring pilgrims from all over the country and abroad. It was the consensus of the meeting that everything possible must be done to regenerate the health of Himalayan communities, ecosystems and economy.

The consultation primarily concentrated on the most fundamental social and economic issues, specifically the question of how to maintain this extraordinary resource. It is anticipated that numerous meetings will be scheduled in response to the New Delhi meeting; however, we will need to address thematic and geographical issues in mountainous regions in the future. The fundamental theme of this day-long encounter was how we would be able to assemble the committed resources capable of persuading political, social, civil society and business leaders who are in a position to drive change in their respective areas of influence.

Dr Ashok Khosla
Trustee, CoR India
Chairman, Development Alternatives Group

Acknowledgment

I would like to express my sincere gratitude to all the participants of the conference, who shared their valuable insights on this very important subject. Grateful to 'Team Vishal' for painstakingly preparing a comprehensive report, that captures the key essence of the discussions on critical environmental, social and economic challenges in the Indian Himalayan Region (IHR). The insights and expertise shared by distinguished speakers and stakeholders have provided a clearer understanding of the unique vulnerabilities and opportunities within the region. This has paved the way for focused and synergistic application of the expertise, of various organisations working in this region.

Special thanks to DLF Foundation and Hindustan Unilever Limited (HUL), for their generous financial support, without which this consultation, the report and follow up action would not have been possible. Their commitment to sustainable development and environmental stewardship is commendable and critical for advancing long-term solutions in the IHR.

The Indian Himalayas, being integral to the 'Third Pole' are one of the most important biodiversity hotspots in the world. They, face an escalating range of climate-induced disasters, environmental degradation, and socio-economic pressures. As this report highlights, it is imperative to strike a balance between development and environmental sustainability, with a focus on preserving the region's rich agrobiodiversity, cultural heritage, and natural ecosystems.

The roundtable consultation on October 5, 2024, was a significant step forward in gathering diverse perspectives and generating actionable solutions. Moving ahead, we must remain focused on driving collaborative efforts to ensure the long-term ecological, social, and economic well-being of the Indian Himalayan Region.

I extend my sincere gratitude to all who contributed—both directly and indirectly—shared their experiences, offered their perspectives for progress, and supported this vital undertaking.

Lt Gen Arun Sahni
Director General and Trustee, CoR India
Former General Officer Commanding in Chief, Indian Army

Key Highlights

- The Indian Himalayas (IHR), a globally significant mountain range, is home to a diverse range of species and is one of 36 biodiversity hotspots. It supports 50% of India's forests, flowering plants, and terrestrial faunal biodiversity. However, the region is highly vulnerable to climate-induced disasters, with increasing frequency and weather change. Adaptation is crucial, but financial focus on infrastructure development often bypasses environmental norms. The IHR is under increasing pressure from urbanisation, tourism, unsustainable resources, and climate change, leading to water scarcity, deforestation, land degradation, biodiversity loss, and increased pollution.

- The Indian Himalayan (IHR) agriculture system relies on locally accessible natural resources and complex farm, forest, and animal systems. However, its contribution to India's agricultural output has been small, and the preservation of agrobiodiversity is threatened. The region's delicate state is a concern, with concerns about the terrain's carrying capacity and slope-cutting activities. The Himalayan development strategy should incorporate understanding of the region's vulnerability and the need to protect ecology. Urbanisation in western Himalayan states has grown exponentially, putting pressure on the environment. The absence of building typologies framework and lack of proper management contribute to disaster risk. The IHR is experiencing air pollution, untreated sewage, and solid waste due to inadequate management. The average annual growth rate from 2013 to 2023 is 7.9%. Ecotourism is crucial for long-term survival in the IHR, limiting disturbance to the local environment while benefiting local people.

- The roundtable consultation held on October 5, 2024, at the Development Alternatives Headquarters in New Delhi involved key players in environment, climate change, and sustainable development issues. Participants from various regions, including mountainous areas, gathered to address collective issues and generate action points. The Himalayas, a vital resource for Indian life, were the main focus. The consultation aimed to maintain this resource and gather diplomatic resources to persuade political, social, and business leaders, including civil society leaders and NGOs, to drive change. Future meetings will focus on thematic and geographical issues in mountainous regions.

- Dr Ashok Khosla proposed a change theory, focusing on identifying key issues, agents, and instigators to stop further disruption in the Himalayan regions. The alliance group aims to explore alternative strategies, provide recommendations to decision-making authorities, and explore alternative approaches to achieve internationally committed objectives. The current approach may not be sufficient alone.

- Shri P D Rai acknowledged other people efforts to protect Himalayan regions from development and disasters. He was of the opinion that mountainous terrain solutions are complicated and a roundtable discussion may help. Addressing the recent changes due to global warming, he mentioned that climate change-induced heatwaves of 30–32 degrees Celsius had led to schools being closed in parts of Arunachal Pradesh. Sikkim, a power-rich state, has seen tragedies like GLOF due to the climate impact in the Indian Himalayas. HE suggested the importance of studying snowmelt's influence on the river's hydrological system and ice formation, including the impact of melting of permafrost, on changes in water levels. He believes similar events are taking place at elsewhere in the Indian Himalayas and calls for priority actions.

- Mr Pande (Ex IAS), a 30-year resident of the Himalayan region, discussed challenges of climate change, deforestation, over-tourism, etc. He advocated high-end tourism where the eco system is fragile and differentiate between pilgrimages and tourism. He recommended nature-based solutions and alternative approach for infrastructure development, in the Himalayan region. He also discussed aspects of water scarcity, biodiversity and human-wildlife conflict. He advocated the use of AI and Drones for monitoring early indicators of climate change effects for the security of IHR.

- Dr Vishaish Uppal, from WWF-India, highlighted the need for India to focus on specific targets in the Himalayas, which is a global biodiversity hotspot. Despite having numerous plans and strategies, the focus on addressing the challenges of the mountainous terrain in the Himalayas, seem woefully inadequate. The Kunming-Montreal Global Biodiversity Framework, a globally recognised plan, lacks specificity for the Indian Himalayan Region. India is formulating national biodiversity targets, but the focus on specific targets for the Himalayas requires greater deliberation and attention. To effectively garner global support and weave this into international agreements, there is a need for scientific research to arrive at compelling justifications about the IHR's biodiversity and cultural diversity and the contribution towards biodiversity.

- Mr Tikinder, Ex-Deputy Mayor of Shimla, helped redefine the Indian Himalayas (IHR) perspective. He stressed the importance of distinguishing profitability from livelihoods and considering the region's development trends and distinctive peculiarities. In his opinion the Himalayas, based on their characteristics , need be divided into two sub sectors - "North Western" and "North Eastern." Referring to the IPCC report that has included Coastal India and the Himalayas as biodiversity hotspots and sensitive areas, he opined that to address climate change adversities, the priority should be mitigation, not adaptation. It requires sensitivity in protecting the local eco system for there are unintended consequences that may manifest over time. A case in point is the introduction of Pine trees in the Himalayas for commercial purposes, degrading oak woodlands. He highlighted that the 1990s financial architecture required States to generate financial resources, which have not been dynamic in addressing changing realities, leading to the current debt and salary issues. Hydropower potential in the Himalayas has been underutilised and needs greater deliberation for optimal utilisation. Himalayan states must promote sustainable tourism and work in harmony with central government for suitable infrastructure. This will protect the IHRs fragile ecology and ensure creation of climate-resilient infrastructure, geologically informed constructions, and technologically assisted waste management. There is a need to define urbanisation differently in the IHR, addressing the unique social and terrain sensitivities. Planning Institutions must quickly develop alternate understandings and methodologies, including establishment of a 'settlement commission', while addressing data convergence challenges. A people-centric approach with scientific study, should be adopted for infrastructure development activities. Local practices will be effective for meeting SDGs benchmarks, eg. double-pit toilets eliminates the need for sewage treatment plants, a challenge in hilly terrains. Universities need to establish 'centres of excellence' or 'policy labs' for data democratisation for Intra Institution and cross domain data sharing, for meaningful interventions in the region.

- Ms Arjundas discussed ATREE's experience in the Himalayas over the past decade and the strategic focus of their initiatives for the future. She emphasised the importance of examining development models from four perspectives: Environmental Resilience, Climate Resilience, Economic Resilience, and Socio-Cultural Resilience. As an example she mentioned that the current building code in Nepal was inadequate to the ground realities and it was ICI Mod that modified it, to suit the unique context of the region. She also emphasised that the government of Meghalaya facing challenges related to central government schemes, reached out for support

from producer enterprises and other agricultural based initiatives. Dr Eklabya Sharma, affiliated with ATREE, has formulated a comprehensive 10-year roadmap for the Himalayan Region, emphasising collaboration between state governments and local bodies. Environmental resilience needs to focus on degradation and fragmentation, with climate-smart strategies for agriculture and sustainable resources. Economic resilience requires cultivating nature-based enterprises alongside local communities, with initiatives in Darjeeling and Uttaranchal exemplifying this approach.

- Mr Rohit Ramola, the founding member of Integrated Mountain Initiatives (IMI) had been working for more than a decade to engage thought leaders from mountainous regions, on issues such as climate change, disaster management, livelihoods, and sustainable infrastructure. The challenge lies in facilitating collaboration and enabling actionable steps to influence policy. IMI has shared its recommendations with the Ministry with respect to plastic waste reduction, for mountainous areas. A waste audit has been initiated with volunteers, involving thousands of volunteers. He emphasises the importance of avoiding certain actions, such as engaging in community tourism and exploring agricultural practices. He calls for a collective scale up of small initiatives and a focus on larger entrepreneurial ventures to improve livelihood prospects and provide alternatives. He suggests providing assistance and a platform to facilitate connections between individuals and their communities.

- Mr Anand Sharma, Ex Dir, IMT, UK: Heavy rain, thunderstorms, and lightning are common occurrences in India, often mistakenly attributed to climate change. However, atmospheric alterations have intensified rainfall variability, leading to increased frequency and intensity. The Indian Himalayan region faces challenges such as overpopulation, exceeding carrying capacity, and increased building in geologically sensitive areas. High-end tourism also a concern, but issues related to aerosols must be considered. The Pradhan Mantri Sadak Yojana in hilly regions requires research for IHR for their need and necessity. The government must respond to warnings from meteorological departments with seriousness, as seen in the Kedarnath disaster. The Indian Meteorological Department (IMT) has a highly effective weather forecasting warning system, but the government must respond with seriousness. The Agro advisory system of IMT serves 40 million farmers, providing guidance on sowing, harvesting, irrigation timing, pesticide application, and disease prediction. Collaboration with all actors, departments, and stakeholders is essential to preserve lives and the ecosystem in the IHR.

- Mr Sabyasachi Dutta, a Shillong-based think tank director, presented three key ideas on the Himalayan worldview. He highlighted the importance of security, economy, and connectivity in connecting nations and balancing the fragile ecosystem. He suggested convening small discussions with thought leaders and local ambassadors, including agencies like Brahmaputra board and North Eastern Council. Dutta also highlighted the need to balance community rights, employment, and livelihoods with environmental concerns. He also highlighted the need for education about development in areas with limited land ownership and the importance of synergy between Delhi and local levels.

- Dr Rishi, from WWF, has dedicated over two decades to wildlife conservation in the Himalayan region, which hosts a diverse collection of wild mountain ungulate species and provides habitat for endangered carnivores like the snow leopard. The Trans-Himalayan rangelands are considered a wildlife haven, with many species of plants, large mammals, and edible white plants. The region also exhibits significant cultural diversity, with Buddhism deeply rooted in its heritage. The Trans-Himalayas ranks as one of the least productive ecosystems globally, dominated by graminoids. Effective snow leopard conservation requires robust monitoring and understanding of their response to biotic and abiotic heterogeneity and human presence and

resource use. A landscape-level planning approach, including clear and scientific land use planning, is crucial for the unique values and conditions of wildlife occurrence and human use in the vast Himalayan rangelands.

- Dr Siksha Swaroopa Kar from the Central Road Research Institute (CSIR) highlighted the importance of sustainable roads during development. The institute is dedicated to researching road design and construction across diverse terrains, prioritising sustainability and climate resilience. They have developed the Mobile Cold Mixer cum Paver (MCMP), which enables onsite amalgamation and application of bituminous material onto a prepped surface. Recycling pavement is another innovative approach for infrastructure rehabilitation, reducing transport costs and fuel consumption. Tunnel muck treatment has proven beneficial for road construction, reducing the need for high-quality aggregates and increasing project costs. A pothole repair machine has been developed to reduce the environmental impact of road construction.

- Ms Tanya Ahmad (NIUA) has highlighted the global impact of rapid urbanisation and climate change, highlighting the disproportionate impact on impoverished populations. NIUA collaborated with the Uttarakhand government and partner organisation BORDA in the Leh region to establish a platform for dialogue on addressing challenges in the Indian Himalayan Region. The platform aims to promote inclusivity, sustainability, and climate resilience in urban water and sanitation for states and Union Territories. The initiative has engaged with think tanks, NGOs, state government secretaries, donor agencies, central ministries, elected representatives, and the Planning Commission of India. The forum's objectives include advocacy, research, capacity building, and testing and piloting innovative solutions.

- Dr Sandeep Tambe (IFS), PCCF – Sikkim Govt., former AP, IIFM-Bhopal, highlighted the main challenges facing the IHR, including the decline of springs, the threat of Glacial Lake Overflows (GLOFs), exploding feral dog populations in wildlife regions, tyranny of tree plantations, and a sharp decline in horticulture-related livelihoods. He highlighted the need for a watershed approach that emphasises community participation for spring rejuvenation, which requires government regulation due to geological factors affecting private lands. The Sikkim government has released a training video on aquifer-based spring-shed management, and Para hydrogeologists have been trained to promote this work. Dr Tambe also highlighted the need for scientific studies to understand the inner workings of mountain aquifers, policy to address spring ownership, responsibility, benefit sharing, and grievance redressal, and practice to plan and implement these measures. He also highlighted the need for mitigation efforts, such as syphoning, pumping, enhancing existing channels, artificial open channels, open-cut moraine with artificial dams, and tunnelling, to prevent glacial lake outburst floods and impede road connectivity. He also highlighted the need for better food waste management in defense establishments, facilitating the growth and movement of feral dogs, and the decline in horticulture livelihoods.

- Ms Mallika Bhanot, a Ganga Ahvaan founder member and Bhagirathi Eco Sensitive Zone Monitoring Committee member, has highlighted thee major concerns regarding Uttarakhand projects. First, Bhagirathi Eco-Sensitive Zone, which contains Ganga River, has 80 kilometres of free flow, need to look at differently and biodiversity to be maintained. Secondly in Uttarakhand the government wanted to create a 12-meter-wide road between four Uttarakhand Dhams as land acquisition is highly difficult, though it was against the norms of Road Transport Ministry. In August 2019, the Supreme Court created the High Powered Committee (HPC) to study the Char Dham project's effects on the Himalayas. The committee decided that widening in the Himalayas is impossible, thus the government was ordered to create 5.5-meter wide roads. After the Indian government argued for security, the Supreme Court accepted it, further it will

create many disasters here. Thirdly, she has also raised sustainability issues about hydropower projects, including as low-capacity dams in Uttarakhand due to winter water flow and debris-carrying rivers. She feels tourism should be taken seriously and proposes actions to government.

- Mr Manasvi Srivastava, an Ex IAS official, and Dr Pravin Bhagavat, a pioneer of WiFi technology, have been working to restore ecologically ravaged terrain near Pune. They planted 14 trees on 200 acres of desolate land, recycling runoff water and enhancing recharge through ponds and native trees. They also engage in initiatives like barren land restoration, carbon dioxide sequestration, green water management, biodiversity restoration, job creation, micro and green ventures, and corporate social responsibility engagement. They are also developing methodologies for mapping and quantifying carbon sequestration from a business perspective.

- Dr Sushil Saigal, The Nature Conservancy, India, discusses the organisation's efforts in sustainable development in India. TNC began operations in 2017, focuses on forests and biodiversity, promoting local vegetation in hilly terrains. They also aim to enhance forest personnel, communities, and NGOs' competencies through innovative forestry approaches. They have provided assistance -Uttarakhand in eco-tourism, collaborating with local groups on landscape planning and large dam integrity. Dr Saigal emphasises the need for discourse on forest cover and its indicators, as well as the classification of waste land, which holds significant ecological importance. He also calls for a revaluation of waste land classification due to its intrinsic natural value.

- Dr Rajiv Bhartari, Ex PCCF, Uttarakhand gave his views - Eco-tourism, despite its potential, has limitations, as demonstrated in the Corbet Tiger Reserve (CTR). The reserve, home to India's largest tiger population, has faced challenges such as rights and usage issues, land tenure modifications, and resource utilisation patterns. The CTR has undergone zoning changes, policies, and practices, undergoing reterritorialisation and transitioning resource usage. However, environmental justice is crucial in the context of ecotourism, as local communities remain excluded from the sacred core area, and resources cannot be used in the buffer area. Limitations on progress within 46 Chaks, discontinuation of public transport services along forest routes, and prohibition of angling in the Ramganga River also exist. Additionally, the development of tourism zones in both core and buffer areas faces limitations on entry and the displacement of villages.

Based on the input of participants, the organising team identified over 35 significant concerns in the area, which will inform future efforts through an alliance of organisations to address IHR.

Emergent Initiatives: Indian Himalayan Region

Background

The Indian Himalayas (IHR), the world's youngest, most tectonically dynamic, and most marginalised mountain range, is one of 36 global biodiversity hotspots with numerous unique floral and faunal species spread across 13 Indian states/union territories. About 4.8% of the world's mountain population lives there. The region supplies 13% of the world's population and 61% of India with freshwater from snow and glaciers. Forest cover is 40%, barren/unculturable/wasteland 19.3%, snow and glacier 18.9%, and built-up and plantation regions the least, showing the ecosystems relative intactness. It supports 50% of India's forests, over 50% of its flowering plants, and 38% of its terrestrial faunal biodiversity at the intersection of the Palearctic, Afro-Tropical, and Indo-Malaya worlds.

The entire Himalayan range is extremely vulnerable to climate induced disasters as pointed out by IPCC(Intergovernmental Panel on Climate Change) VI report. It has estimated that the frequency of disasters in the Himalayan range is increasing rapidly. More precipitation in a short period of time is the general pattern across the region, also with long spell of drought. Adaptation is the key in the Himalayan region and for that disaster risk reduction must be the guiding principle in carrying out developmental trajectory. However, given the financial architecture the focus is on developing infrastructure even bypassing the basic environmental norms.

The IHR is under increasing pressure from urbanisation and development, which is compounded by an influx of high intensity tourism, unsustainable infrastructure and resources (land and water) and further aggravated due to climatic variations like precipitation (intensity and duration of snowfall) and rise in temperature. This has led to scarcity of water, deforestation and land degradation, biodiversity loss and increased pollution from wastes including plastics. These pressures, in many areas, have the potential to disrupt lives and livelihoods drastically, impacting the socio-economic-ecological fabric of the Himalayas.

IHR agriculture system relies on locally accessible natural resources and complex farm, forest, and animal systems. It exemplifies stability, variety, and long-term sustainability. Agriculture practices may vary across the Himalayas, but its fundamentals are the same. The contribution of IHR to India's agricultural output has been tiny, even if the areas where crops were sown and irrigated have increased. Both fruit yield and the area under cultivation have decreased. While urbanisation and population growth are on the rise, agricultural output remains an issue in the region. Additionally, the preservation of agrobiodiversity is also being significantly threatened.

Geologists and environmentalists routinely express concern about the delicate state of the Himalayas and highlight the importance of utmost caution while building dams, roads, power stations, or tunnels. Despite these warnings, uncontrolled infrastructure expansion and the unrelenting rise of revenue from tourism and pilgrimages continue. Experts have regularly highlighted worries about the terrain's carrying capacity and slope-cutting activities that defy geological principles. The Himalayan development strategy ought to incorporate an understanding of the region's vulnerability as well as the need of protecting the ecology. In the last decade, tourism in western Himalayan states like Jammu & Kashmir, Ladakh, Himachal Pradesh, and Uttarakhand has grown significantly.

All-weather mountain roads, helicopter services, tunnelled railway lines, and multi-story luxury hotels boost tourism in Himalayan states. These massive infrastructures further negatively impacted the Himalaya ecosystem.

Urbanisation is another IHR development symbol. New urban settlements and urban population have grown exponentially in the last two decades. Urban Local Bodies increased from 245 in 2001 to 320 in 2022. The 2011 IHR urban population was 40% higher than in 2001. The influx of visitors to the mountains and the continued expansion of urban settlements are putting pressure on the environment of these regions, as per the International Centre for Integrated Mountain Development (ICIMOD) and the World Bank. One of the main features linked with urbanisation in the Himalayas is complete absence of building typologies framework. This should be based on the basis of geological foundational principles, in order to minimise disaster risk. The natural environment of the Himalayan region is being disrupted by the accumulation of solid waste, which is being deposited in the region as a result of the increased frequency of mountain visits. The IHR is experiencing a continuous rise in air pollution, untreated sewage, and solid waste due to the absence of appropriate management.

Over the past few decades, tourism at the IHR has continued to expand and diversify. The average annual growth rate from 2013 to 2023 is anticipated to be 7.9%. (ref: Niti Ayog: Sustainable Tourism in the Indian Himalayan Region). Additionally, current tourism in the IHR replaces eco-friendly and aesthetic infrastructure with inappropriate, unsightly, and dangerous construction, poorly designed roads and infrastructure, inadequate solid waste management, air pollution, degradation of watersheds and water sources, and the loss of natural resources, damaging biodiversity and ecosystem services. Ecotourism is guaranteed long-term survival via environmentally friendly tourism. The Himalayas entail limiting disturbance to the local natural environment and nevertheless benefiting the local people. Tourists visiting the isolated Himalayan regions could either purposefully or inadvertently use the local resources.

Why SDGs framework?

The way to move ahead should be guided by strong principles of international frameworks which are duly adopted by our federal and provincial governments as well. Though these frameworks may be lacking in many aspects, still adherence to such frameworks is a linear way of moving ahead. In this background it is pertinent that the Sustainable Development Goals(SDGs) as adopted universally across the globe should be our way forward. Of the 17 SDGs more than nine goals (poverty- 1, hunger -2, health and well-being-3, quality education- 4, gender equality-5, clean water and sanitation – 6, clean energy -7, sustainable cities and communities – 11, climate action -13), are directly linked to the Himalayan region.

The Roundtable : Theory of Change

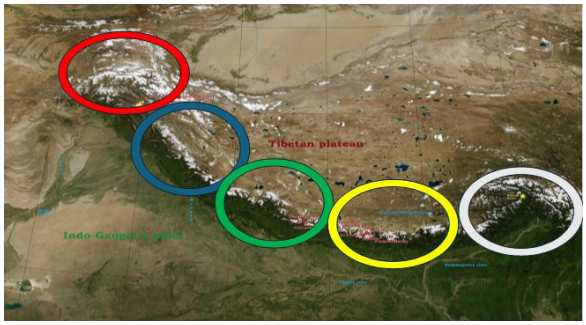
Recognising these challenges and opportunities for sustainable development in the IHR, the Club of Rome and Development Alternatives aimed to convene governments, communities, organisations, academia, experts, and the private sector to deliberate on potential future actions. A day-long consultation was scheduled at the International Headquarters of Development Alternatives, on 5th Oct 2024, where all important actors from the Indian Himalayan Regions convened to develop strategies for significant Himalayan concerns using an alliance strategy.



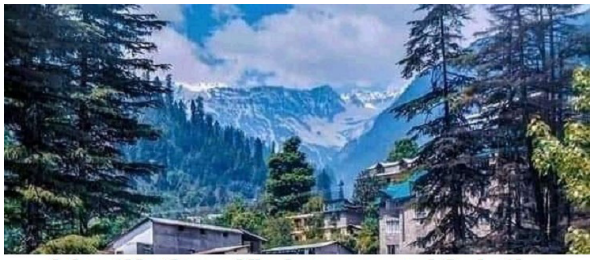



Dr Ashok Khosla intended that the traditional development-oriented approach would not be effective in IHR since revolutionary work is required. He then implemented a change theory: "Identify key issues," which could be 5-6 or more, that are critical for disrupting Himalayan regions; "Identify key agents," who have the potential to introduce change on the ground; and "Key instigators," who must determine strategies, tactics, and identify priorities of areas, and then set goals, targets, and milestones, as well as a self-monitoring system. Conservation alone may be insufficient in this urgent crisis, as the organisational representatives present in the hall have previously undertaken substantial efforts in conservation, including initiatives related to forests, wildlife, roads, infrastructure, bridges, and tunnels. Social action is not necessarily required alongside political movements and Yatras, as evidenced by certain change agents from Ladakh who are currently marching from Ladakh to New Delhi. However, the alliance group can explore alternative strategies to attain objectives to which the government is also internationally committed, and can provide recommendations to decision-making authorities in governance, policy, business, and civil society.

The regions can be categorised based on analogous challenges, geographical concerns, or interconnected strategies included in IHR.



The identification of existential issues in mountain regions may be influenced by a variety of factors, including geological, geographical, anthropogenic, social, and economic factors, as well as resource depletion and utilisation.



Identify Specific Issues and Solutions for EACH Subregion

Identify "Ambassadors" to Address Each Change Agent in Each SubRegion

Set Up Teams and TimeTable

Opening Address

Mr Prem Das Rai

Former, Member of Parliament (Lok Sabha), Sikkim

He was ecstatic to observe a multitude of familiar faces, fellow travellers who were working to safeguard the Himalayan Regions. They had been witnessing the development patterns and disasters that had occurred in this region.

The intensity of climate change is being felt, as he noted. He was with a friend from Arunachal Pradesh the day before this incident, and they discussed the unbearable heat they were experiencing in Meghalaya and other locations. Consequently, the schools in Arunachal were closed. The region in which he resided, which is in close proximity to Gangtok, has experienced a temperature increase of 30 to 32 degrees Celsius, a phenomenon that was not as prevalent in the past.

The challenges that individuals encounter in mountainous environments are truly multifaceted, and it is crucial to determine the solutions that are available. He was confident that the roundtable gathering would result in a consensus on some of the most well-tested and experienced solutions, as a significant amount of scientific and other research has been conducted and knowledge has been accumulated.

He is currently engaged in Sikkim and has never come across the obstacles he is presently encountering. Prior to the COVID-19 epidemic, Sikkim was seeing economic expansion; however, the pandemic halted progress, severely impacting the state's economy and obliterating tourism. The state's survival was contingent upon cooperation from both state and national governments.

On October 4, 2023, a glacial lake outburst flood occurred in Sikkim, India, causing 46 deaths, 77 missing, and 88,400 affected. The flood destroyed bridges, highways, and utilities, raising water levels in the Teesta River basin.

This has affected the commuting routes, necessitating passage through Darjeeling or Lava, hence impacting various livelihoods and the economic advancement of a significant number of individuals. Today, we have seen significant losses, despite Sikkim being a power surplus state due to its hydroelectric resources; however, nearly all hydropower projects are currently halted. The weather pattern has altered, presenting a daunting predicament that makes it exceedingly difficult to navigate the situation. Sikkim has also faced numerous significant disasters, similar to those occurring in the Indian Himalayan Region within the Asian context. It is imperative to propose specific answers for sustainability, whether in economic form or addressing the rural challenges we face as we progress.

He suggested an idea to a scientist to assess the impact of snowmelt on the river's water system and the fluctuations in water levels resulting from the reduction of ice and permafrost.

He emphasises that the events occurring in Sikkim are likely transpiring in every other part of the Indian Himalayan Region (IHR). Therefore, it is crucial to determine our actions over the upcoming year or two to ensure they have a significant influence. Inaction may yield more detrimental consequences; so, if Sikkim aims to revert to its 2019 status, substantial efforts are required. The job we are undertaking must not be politically divisive; it should be politically driven and executed in a coordinated manner, for which we anticipate collaboration. Let us advance with the concepts, prioritising our activities.

Session 1 :

Himalayan Issues- Challenges and Opportunities

This session was intended to address a variety of sectoral themes, with a primary emphasis on sustainable infrastructure, biodiversity, food security, and livelihoods, including tourism.

Mr Hem Pande

Former Secretary, Government of India

Mr Pande commenced his thoughts by analysing the writings and topics presented in Mr Gunter Paul's book titled "Blue Economy[1]," which was a contribution to the Club of Rome. He lived in the Himalayan region for around 30 years, including 5 years in the Darjeeling area. Thus, not only as an administrator has he observed the Himalayan areas, but also as a man who could be regarded as a son of the Himalayas, aspiring to improve the region.

He stated that the Himalayas had been providing all of the needs of the Indian people for thousands of years before the term "Ecosystem Services" was coined. However, the region is currently confronting a variety of challenges. Although it is not a novel concept, IHR has always been at the cross road of the initial stages of human civilisation. However, these changes are exacerbated by the climate change induced by homo-sapiens, for which we are all responsible.

He also mentioned that he was in a telephone conversation with his mother last night. She resides in Almora, Uttarakhand, and she informed him that she is using fans in the evening due to the high temperature and humidity. This kind of thing was not a common occurrence in the past.

He also expressed the concerns of Government Institutions of Himalayan Research, which have been forced to focus more on administrative tasks, for which they were not originally intended. He also outlined various missions related to the Himalayas and climate change undertaken by ministries and departments. The National Mission for Sustaining the Himalayan Ecosystem (NMSHE), established by the Ministry of Science and Technology, aims to support the sustainability of the Himalayan ecosystem. This mission is unique as it focusses solely on a specific geographic area. Sufficient financial resources have been allocated for this mission. The team is conducting their studies and providing recommendations, but it is essential to engage the community to ensure that the research recommendations are translated into actionable steps. Despite the government's efforts, the situation concerning climate change, deforestation, and over-tourism remains troubling. It is essential to differentiate between pilgrimages and tourism. The western region of Uttarakhand is facing distinct challenges, leading to considerable hardships for the local population.

He believed that the Himalayan region is suited exclusively for high-end tourism, rather than the detrimental impact of fossil fuel-based SUVs or the construction of four-lane or eight-lane roads.

[1] https://www.clubofrome.org/publication/the-blue-economy-2010/

It should resemble Almora and Ranikhet, which were cantonment areas with well-organised systems in the 1970s. However, this road (Almora and Ranikhet) has also been widened.

He highlighted the recommendation to the government that further excavation in the Himalayas should cease. It is essential to focus on maintaining what has already been constructed using nature-based solutions and to address the damage caused by infrastructure development through alternative approaches. It is regrettable that the Government has not reviewed the recommendations that are already available. He believes that the distinguished participants have successfully persuaded the Government on numerous occasions, but there is no disadvantage in engaging them with new change agents and scientific methodologies.

While the Himalayas supply water to many individuals in India, this region is currently facing a scarcity of potable water. The Bhimtal area is experiencing a shortage of drinking water during the months of March and April. Localised is encountering these challenges.

Landslides are occurring with increasing frequency, biodiversity challenges are significant, and human-wildlife conflict is escalating daily. The present requirement of communities is access to clean drinking water and fresh air for breathing. The cut and dump approach is increasing in IHR; however, cut and fill methods are necessary for the area, as dumping is adversely affecting the natural drainage systems. GB Pant as an institution provided numerous recommendations on the construction of green roads.

He further emphasised the importance of ceasing any further excavation and promoting high-end tourism. If tourists are to visit, it is essential to uphold proper conduct—avoiding overconsumption of resources, refraining from littering, and implementing cross-subsidisation for pilgrimage activities, as he believed that tourists participating in pilgrimage often harm the ecology.

Despite extensive research, the IHR continues to face a shortage of sufficient data. However, numerous government institutions possess valuable knowledge that can be reprocessed in the current era of artificial intelligence. This forum has the potential to play a crucial role in disseminating that information.

He also shares the issues of The Bhagirathi Eco-Sensitive Zone (ESZ) encompasses an area of 4,179.59 square kilometres in Uttarakhand, dedicated to safeguarding the Bhagirathi River watershed from development and pollution. Harsil Valley does not require road widening; rather, it necessitates the cutting of Deodars that have already been approved for road construction. The recommendations from the Supreme Court have not been observed, primarily due to security concerns. However, it is essential to recognise that contemporary conflicts are no longer fought on the ground but rather through advanced technology such as drones and missiles. He also emphasises the importance of Himalayan guards, similar to how we in India have coast guards, rather than focussing on road security if security is a concern. These Himalayan guards must be equipped with all necessary aeronautical technological components.

Dr Vishaish Uppal

WWF- India

Despite the limited data available, this region is among the most vulnerable and ecologically rich areas, recognised as a global biodiversity hotspot; however, it has not received adequate attention.

She highlighted that there are three types of planetary crises: 1) halting and reversing biodiversity loss, 2) adapting to climate change, and 3) minimising pollution. All three hold precedence in this region; however, there seems to be a gap in our approach as we continue with standard operations. There are numerous plans and strategies established, yet the focus on specific targets in the Himalayas appears to be inadequate.

The Kunming-Montreal Global Biodiversity Framework is a globally acknowledged biodiversity plan. This framework delineates techniques for the conservation and management of terrestrial biodiversity, freshwater systems, and marine ecosystems. Nonetheless, it lacks specificity for mountainous terrain. As India aligns with this, we are formulating our national biodiversity targets. We have defined 24 target objectives for the Kunming-Montreal Global Biodiversity Framework. In delineating each objective, we have explicitly specified certain features and actions relevant to the Himalayas. Nevertheless, the question persists: are we truly participating in that practice?

We possess numerous documents, including the national biodiversity target, Nationally Determined Contributions (NDCs)[2], the national adaptation plan, the national action plan for climate change[3], the national biodiversity strategy action plan, the state biodiversity strategy action plan, and the state action plan for climate change. Where are we discussing these matters?

These are valuable books and reports; extract sufficient insights from them, and subsequently engage in discussions with individuals who genuinely care about the Himalayas. This region is characterised by both biodiversity and cultural diversity. The cultural landscape, significant endemism, and ample wildlife necessitate an examination of the extent to which food security relies on wild animals, and this region excels in this regard. It has been established that 700 species of animals inhabit the state of Arunachal Pradesh; exploring all states will reveal the contributions of this region to biodiversity.

Therefore, effective policy consistency, collaboration with scientific research, and compelling justifications for the region are essential. Without such, we cannot effectively incorporate the actions into the numerous existing documents. We may not require new declarations and documents; rather, if we include these aspects into our efforts, we will likely make progress. This could be one method of engagement.

[2] https://climatepromise.undp.org/what-we-do/where-we-work/india

[3] https://shorturl.at/TTBmJ

Mr Tikender Panwar

Ex Dy Mayor – Shimla

Mr Tikinder was quite happy that, after prolonged and sustained efforts, this inaugural roundtable was being initiated in New Delhi. He played a significant role in conceptualising the idea to reframe IHR in a novel manner, as envisioned by some of the leading members of the Club of Rome. He served the City of Shimla as Ex. Deputy Mayor, offering his insights on how to perceive the Himalayas from a similar vantage point. Even he stood before the entire development model, thus sharing the same struggles as those present in this hall for IHR. However, he asserted that we must reconsider our perspective on the Himalayas, whether it is viewed through the lens of profitability or as a means of sustaining livelihoods. It is essential to establish that distinction prior to embarking on any actions in that context.

Two significant elements must be considered when synergising policies for the Himalayas. The first is the general pattern of development that the region has experienced. The second involves the peculiar features present in the states and zones of the Indian Himalayan Region.

The overarching themes are derived from IPCC reports, highlighting not only the presence of biodiversity hotspots but also identifying two particularly vulnerable regions within the Indian subcontinent: coastal India and the Himalayas. The notion of exclusively focussing on tree planting is a concept that has become outdated. The IPCC consistently emphasises that we are currently experiencing a period of significant disruption. We ought to resolve to refrain from exacerbating the situation by establishing superfluous infrastructure merely in the name of development. Climate change, coupled with increased precipitation over shorter periods, necessitates a heightened level of caution to prevent exacerbating the situation, which could lead to further disasters. Rather than adhering to a simplistic dichotomy of adoption and mitigation, our focus here is inherently on the process of mitigation itself.

In a broad sense, what is our current understanding of the Himalayas when we examine the historical context of the past two centuries? The colonial legacy and the economic exploitation of the region reveal a narrative where Pine trees were systematically introduced, leading to the degradation of the once-thriving Oak forests. This transformation was largely driven by the demand for furniture in England, sourced from the northwestern Himalayas, and it is reasonable to assert that similar circumstances prevailed in the northeastern regions as well.

This colonial mindset ought to have ceased following independence; however, regrettably, this transformation did not occur at that time. The expansion of railways likely facilitates this process without the necessity of exploring alternatives. Approximately 20% of the forests in Himachal consist of pine forests. During the 1960s and 70s, extensive pine plantations were established, leading to a significant loss of biodiversity in the region. One area that warrants our attention and focus is

the financial architecture that emerged in the 1990s. The impetus from the central government mandated that states generate their own financial resources, which has led to significant debt accumulation, as exemplified by Himachal Pradesh. Consequently, even the disbursement of salaries to government employees has become a formidable challenge. Thus, the Himalayan region was not perceived through the lens of the populace, but rather as a prospect for hydropower by various stakeholders, resulting in significant disruption in the area. Himachal possesses an impressive electricity potential of 30,000 million watts. We must now consider who will serve as these ambassadors; within the current political landscape, it appears exceedingly challenging, regardless of which party holds power. Consequently, the Himalayan States must embrace extensive tourism for sustainability. This necessity has led to the promotion of four-lane highways in collaboration with the central government. The swift technological progress in infrastructure development, aimed at rapid construction, instead necessitates sufficient time for meticulous processes and numerous precautions. This approach has proven unsustainable for the region's fragile ecosystem, leading to various emerging challenges.

These challenges encompass generalities that must not be overlooked; obtaining solutions is challenging, yet engaging with individuals is essential. If we continue to lose these infrastructures, what is the purpose of constructing them? Last year, Himachal incurred a loss of INR 12,000 crore due to damage to its infrastructure. The World Bank anticipated a $40 billion loss in India due to climate change, with the Indian Himalayan Region identified as a hotspot. The question now is whether we can conceptualise climate-resilient infrastructure, structures informed by geological factors, and scientifically grounded waste management. These are the concerns we must address. The prevailing notion that IHR serves solely as a locus for economic development is a misinterpretation of the region's true nature. Consequently, both state and non-state actors bear responsibility for this. The state of Himachal has transitioned from traditional agricultural practices to a market-oriented approach, driven by the limited shelf life of horticultural and agricultural products. Consequently, farmers are compelled to transport their goods to market, leading locals to favour the development of their own roads through state and local self-governments, despite the weak engineering standards in place. Now the subject of discussion shifts from the existence of roads to the manner in which these roads ought to be constructed—what alternative forms might these roads take?

In the context of urbanisation, we adopt the definition provided by the Government of India, which is framed through census and statutory terms. The statutory term refers to politically defined towns; however, the unique characteristics of the Himalayas necessitate a distinct definition for urban areas. As we pursue road and infrastructure development, akin to other regions of the nation, it becomes evident that the settlement patterns in this area diverge significantly from those elsewhere. Consequently, density-driven models cannot adequately inform our approach. This discrepancy implies that planning institutions must cultivate alternative understandings and strategies promptly, as current planning efforts extend beyond their conventional scope. Thus, it is imperative to comprehend the dynamics of urbanisation as they unfold in this context. The question at hand pertains to the potential ambassadors. In his perspective, there is a necessity for the convergence of this concept, involving entities such as NIUA, IMI, CoR, DA, Action Aid Association, among others.

It is essential to categorise the Himalayan region into two distinct areas: "North Western" and "North Eastern." The North Western region may include Uttarakhand, Himachal, Ladakh, and Jammu & Kashmir, while the North Eastern region encompasses all the northeastern states, along with a portion of West Bengal. The North Eastern states of India are collectively known as the "Seven Sister States," along with the additional state of Sikkim. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura. All these states in the region exhibit commonalities, although there may also be particular characteristics. Although some perspectives suggest that we should refrain from establishing new institutions, he proposed the idea of initiating Policy Lab Centres in collaboration

with Universities, potentially one in the northeast and another in the northwest. Additionally, there is a pressing need to democratise data, consolidating all ongoing studies onto a single platform and forum for easier access. As we contemplate the institutionalisation of structures and their convergence, this will serve as a pivotal area for fostering connections between ambassadors. Regrettably, the agents of revolution and destruction are currently absent in India, particularly from the political elite.

Finally, he emphasised the necessity of localising the entire array of sustainable development goals, noting that repeated pressure from the central government may prove ineffective, and that concerns over infrastructure development must be addressed through robust, evidence-based initiatives grounded in scientific principles. He presented a perspective on Bhramani, Himachal Pradesh, where the Minister advocates for the establishment of a Sewage Treatment Plant (STP). Although the small village of Ripa in Kinnaur does not necessitate a STP, one will be constructed due to pressure from the central government. However, it is imperative to localise sanitation and WASH initiatives, as they require distinct strategies to prevent contamination of the entire ecological region.

Himachal has around 16000 villages with habitations, of which around 13000 are equipped with single pit toilets, indicating that the solution is to transition from single pit to double pit toilets, eliminating the necessity for sewage treatment plants (STPs) universally. The argument he wishes to make is that the paranoia emanating from the core is, in fact, exacerbating the problem. He elaborated on the requisite infrastructure and its development to ensure a people-centric approach, outlining the necessary processes, including the establishment of a settlement commission, urban management strategies, and the resolution of data convergence issues.

Ms Anita Arjundas

Executive Director, ATREE

Ms Arjundas presented the ATREE experience acquired over the past decade in the Eastern Himalayas, as well as their strategic focus for the forthcoming decade in the Indian Himalayan Region (IHR). She discussed the approaches required to consolidate knowledge for constructing persuasive arguments, particularly with respect to alternative development models that should be examined in the context of the Himalayas.

She discussed the vulnerability of the mountains and its people, emphasising that enabling resilience was key to this fragile and critical landscape. Resilience that encompassed - 1. Ecological Resilience, 2. Economic Resilience, 3. Socio-Cultural Resilience, and 4. Climate Resilience. She discussed the need for research, action, capacity building, and policy making to take an integrated view of mountain-specific issues and challenges to build more sustainable solutions and greater resilience. She remarked that models, policies and schemes produced in the plains or the Centre, should not be uniformly and indiscriminately applied to the IHR as they are often ill-suited to address the needs of the IHR. She shared some specific examples with respect to residential building codes and agricultural schemes and subsidies that need to be tailored to the unique context of the Eastern Himalayas.

Ms Arjundas shared that ATREE's 10-year plan in the IHR - The Himalaya Initiative has outlined five key objectives, based on its experience in the region, its own areas of expertise, and inputs from local partner organisations in the region. The emphasis is on collaboration with state governments and local self-governments.

In the pursuit of ecological resilience, attention is directed towards issues of degradation of ecosystems and the resultant impacts on biodiversity and ecosystem services. Recognising the multi-functional nature of landscapes today, the endeavour is to co-design solutions with communities and local institutions to restore landscapes ranging from private forests and protected areas to agricultural lands and tea estates in the Khangchendzonga landscape. Meanwhile, in Arunachal Pradesh, where the majority of forests are individual or community owned lands, the focus is on establishing community conserved areas (CCAs).

She remarked that ecological resilience strategies need to be co-designed with communities and the long term sustainability of such approaches requires the integration of economic and socio-cultural resilience of the communities dependent on these landscapes. She shared examples of past efforts around nature-based livelihoods in the hills of Darjeeling and the endeavour to integrate context-specific local enterprises in the region. The primary emphasis in this approach is on the access to and sustainable use of bioresources, and the knowledge and skills needed to enable nature-based livelihoods, including access to markets.

Climate resilience in the mountains of IHR are a major concern given the unique geological characteristics of the region and its vulnerability to climate shifts and extreme weather events, be it from the perspective of water and food security or disaster risk management. ATREE's focus is building adaptive capacities with respect to food systems and associated livelihoods including climate-smart agricultural strategies and the impact of various climate scenarios on bioresources.

Mr Sushil Ramola

IMI & B-ABLE

He has served as a founding member and elected president of Integrated Mountain Initiative, a voluntary platform of individuals and institutions from across the Indian Himalayan Region, which has dedicated the past 13 years to engaging thought leaders from mountainous regions on issues ranging from climate change to disaster management, livelihoods to sustainable infrastructure, while also developing models to address these challenges. His main thrust was to reduce focus from what shouldn't be done to what can be done and building collaborative action around what can be done.

He highlighted that champions already exist; organisations and individuals. They champion various themes and operate at different levels such as policy, research and practice. The current challenge lies in facilitating the collaboration of these individuals and organisations around

specific high priority themes, enabling them to take actionable steps on the ground in a synergistic way. Through these actions, they can influence policy, grounded in research and practice, all while ensuring a systematic approach is maintained. The issue at hand is that these initiatives currently are predominantly localised, disjointed, and lacking cohesion – it is imperative that we discover a method of building a force multiplier, and this forum has the potential to emerge as a beacon of excellence.

A case was referred regarding a policy on plastic waste reduction, which does not adequately differentiate between the plains and mountain areas. IMI conducted comprehensive consultations among the stakeholders across IHR and presented recommendations to the ministry for a mountain specific policy to address these concerns. While progress has been made, it remains insufficient. Simultaneously IMI has conducted plastics waste audits yearly for the last six years. It is a voluntary effort engaging 10,000 to 15,000 volunteers across IHR in conducting waste audits and submitting reports on the level of waste pollution in mountain areas and its impact on the ecosystem.

The second point he emphasised is action through youth and entrepreneurship. Having been born in Uttarakhand, he moved out after the school for further studies and work, yet he has maintained a connection to his roots. He observed that young individuals seek external opportunities for alleviating distress caused by deteriorating environmental, cultural, social and economic factors or for pursuing education, and securing improved employment prospects. Approximately a decade ago, he embarked on a community tourism initiative in his ancestral village, utilising his ancestral home and adjacent residences. He engaged local youth in this endeavour. Currently, he is also exploring agricultural practices centred around natural farming and aiming to build models which can inspire the young farmers to adopt these techniques and thereby secure incomes comparable to what they can get in the cities. If the youth from the mountainous regions continue to migrate, achieving any action on the ground will remain a pipe dream.

At a part of this this, is also important for us to collectively examine the myriad of isolated small initiatives that numerous individuals are undertaking in the mountain regions, mostly led by youth. They are in diverse areas such as tourism, which of course needs a major course correction, or value added grains, fruits, vegetables, and herbs, spurred on by the healthy eating movement. This forum must amplify these efforts by providing assistance and a platform through quality standardisation, common branding, facilitating forward and backward linkages and networking to build larger entrepreneurial ventures, as well as strengthen policy, finance and market interfaces. New micro-entrepreneurship areas such as climate entrepreneurship, improving water availability, sustainable mountain infrastructure development, etc. can be propagated through the role models already working on these. This engagement will foster improved livelihood prospects, enabling individuals to earn a respectable income and at the same time achieving the broader goals of sustainable development.

Mr Anand Sharma

Ex Director, IMD, UK

He highlighted "heavy rain," "very heavy rain," and "extreme heavy rain[4]," asserting that these phenomena are common occurrences. Often, they are mistakenly attributed to climate change; nevertheless, they can also be components of the monsoon. Still, atmospheric alterations resulting from climate change have intensified the variability of rainfall patterns. He also noted that in 1880, India experienced a significant incident at Nainital, resulting in the loss of 151 lives, similar to several big disturbances that occurred in the pre-colonial era as well. This was attributable to natural climate fluctuation; but, the frequency and intensity have escalated due to significant alterations in land use patterns resulting from unplanned development over time. An increasing number of individuals are residing in precarious regions. Flooding is crucial in the Himalayan region to ensure prolonged water availability for agrarian societies in the plains. Similarly, thunderstorms and lightning are beneficial as they facilitate nitrogen fixation. Nature serves a purpose through hazardous phenomena; for instance, dust storms in Rajasthan provide essential nutrients to Haryana and Punjab. The current concern is the necessity to prevent these hazards from escalating into disasters, which involve overpopulation, exceeding carrying capacity, and increased building in geologically sensitive places.

He additionally mentioned that high-end tourism has been discussed in this forum; nevertheless, issues related to aerosols must be considered, as helicopters are depositing black carbon in the IHR, which, when deposited on glaciers, may absorb heat and accelerate the melting of snow. It is essential to re-evaluate the methodology, technology, and processes involved in implementing the Pradhan Mantri Sadak Yojana in hilly regions, as the Indian Himalayan Region requires all-weather roads rather than four-lane roads.

He expressed concerns regarding the political nexus and local businesses associated with tourism, which occasionally exert pressure on the government to disregard warnings from meteorological departments, fearing that such actions may adversely affect tourism-related enterprises. A similar situation occurred during the Kedarnath disaster, where warnings from the India Meteorological Department about impending heavy rains were not adequately publicised in advance, leading to thousands being caught unprepared and resulting in significant loss of life and property.

He additionally stated that IMD had a highly effective weather forecasting warning system; nevertheless, the government must respond to it with due seriousness. The early warning system comprises four components. 1) Risk Analysis - this assessment is to be conducted by the state government in areas where the risk is elevated due to adverse weather conditions; 2) Monitoring and Prediction of Weather - while this may achieve high accuracy, it is not infallible, as it relies on forecasts and the monsoon system's inherent complexity. Ongoing research encompasses the

[4] Heavy Rain: -Rainfall between 64.5 mm and 115.5 mm, Very Heavy Rain: Rainfall between 115.6 mm and 204.4 mm, Extremely Heavy Rain: Rainfall 204.5 mm or more @ 24 hours

lithosphere, atmosphere, hydrosphere, biosphere, etc., often utilising various software to create models for prediction. 3) Early Communication – essential for disseminating information across extensive areas through various channels such as radio, television, news websites, and social media. "Early warning without early communication is ineffective." 4) Action and Response: It is imperative to address them, since the government must regard them with gravity.

He highlighted the Agro advisory system of IMD, which serves 40 million farmers by providing guidance on sowing, harvesting, irrigation timing and quantity, pesticide application, and disease prediction. A single accurate forecast can prevent significant agricultural losses and enhance irrigation revenue.

Furthermore, he emphasised that collaboration with all actors, departments, and stakeholders is essential to preserve lives and the ecosystem in IHR.

Mr Sabyasachi Dutta

Founder-Director of the 'Asian Confluence', India East Asia, Center

He is directing a think tank located in Shillong and presented three ideas on the Himalayan worldview. When observing the Himalayas, security is often the primary concern due to the presence of neighbouring countries. Security, economy, and connectivity play crucial roles in facilitating the value chain and connecting nations, necessitating diverse infrastructure and strategies. Simultaneously, the fragile ecosystem of the Himalayan region requires meticulous equilibrium.

Ecology vs security, connectively, economy, growth are the most important issues now a days, we need to convene small discusses, engaging with thought leaders, local ambassadors. He emphasised the importance of various agency such as Brahmaputra board, North Eastern Council they should also be a part of these discussions here and the plans they made need more deep deliberation in which sometime they failed to do a larger consultation, but they can use our small forum to cartelise them.

Secondly, he emphasises the importance of ground activities. The communities are not addressing ecological concerns, despite the pressing issues of topsoil degradation, increased runoff, severe water degradation, contamination, the depletion of rivers, and the critical danger facing spring sheds. Concurrently, the matters of community rights, employment, and livelihoods must be balanced against these environmental challenges. Additionally, certain constitutional frameworks, such as the 6th Schedule, represent a unique aspect of our legal system. In areas where land ownership and control are limited, it becomes crucial to educate individuals about the true nature of development. At times, there is a misconception that westernisation and infrastructure advancement are the sole means to achieve a dignified existence. He emphasised that the synergy between Delhi and local levels on policy issues is of great significance.

Session 2 :
Special Presentations

This session featured targeted presentations from GB Pant Institute, WWF-India, CSIR-CRRI, and NIUA, focussing on a thorough examination of challenges and solutions via a scientific lens.

Dr Sandipan Mukherjee

GB Pant NIHE

Dr Mukharjee, a researcher from the Ladakh Centre of the GB Pant Institute, established in 2019, focusses on water, regional issues, climate-smart agriculture, and housing. There are nearly 30 staff members present to attend to various initiatives. They are diligently engaging with glaciers, permafrost, groundwater, and tourism in collaboration with the district tourism department, prominent social activists, and the municipal committee of Leh. The new area of inquiry they are set to explore is disaster management. Their efforts involve the systematic mapping of regions in Ladakh that are susceptible to disasters. He delivered a presentation on "Exploring the use of treated wastewater for vegetable cultivation through hydroponics in Ladakh UT," a distinctive initiative by MoEFCC.

The initiative commenced by the institute follows the establishment of the FSTP by Leh Municipality in the region. The output from the FSTP was rendered ineffective after treatment, given the severe water scarcity in Leh and Ladakh. The bore well water contains a high concentration of calcium, which necessitates the implementation of this hydroponic method. Hydroponics is a cultivation method devoid of soil, wherein plants thrive in a medium enriched with essential nutrients.

Ladakh imports a significant volume of vegetables and fruits from various regions of the country. During the winter months, access to leafy and fresh vegetables is often limited, potentially resulting in nutritional challenges. Plant productivity is primarily restricted to a single season because of severe climatic conditions during extended winters, characterised by sub-zero temperatures lasting for 4 to 5 months each year. The total irrigation requirement is fulfilled by the seasonal flow of glacial melt water, which does not align with the cropping patterns, thereby contributing to a reduced growing season in the crop field.

In this hydroponics method, the yield quality, flavour, and nutritional value surpass those of soil-raised plants. This method is devoid of disease and environmentally sustainable, utilising 10% less water compared to traditional field-grown plants. Facilitate continuous cultivation throughout the year, thereby enhancing agricultural profitability.

The solar radiation is harnessed to heat solar-optimised buildings constructed from polycarbonate. Within these structures, three innovative technologies are employed to cultivate vegetables: first, the utilisation of solar energy; second, the treatment of water from FSTP through the removal of contaminants and hard elements; and third, the maintenance of nutritional quality. This technology has served as a demonstration model, incorporating green building codes. The Department of Science and Technology has expressed appreciation for this project, and they are pursuing a patent for it, with plans to scale up in collaboration with key departments.

Exploring the use of treated wastewater for vegetable cultivation through hydroponic in Ladakh UT

(Funded by NMHS, MoEFCC)

Dr Lalit Giri
Dr Sandipan Mukherjee

G. B. Pant National Institute of Himalayan Environment
Ladakh Regional Centre, Leh, Ladakh (UT)

Ladakh: Issues



- Ladakh imports high volume of vegetables/ fruits from other parts of the country.
- In winter, people do not have much access to leafy and fresh vegetables, which may lead to nutritional issues.
- Largely Plant Productivity is limited to one season due to extreme climatic conditions during prolonged winters (prevailing sub-zero temperature for 4-5 months in a year).
- Total irrigation requirement met from the seasonal flow of glacial melt water which is not synchronized with the cropping patterns, thus add to short growing length in the crop field.

Hydroponic (Soilless) Cultivation

Plant growing in nutrient + water medium

Plant growing in nutrient + Coco peat medium

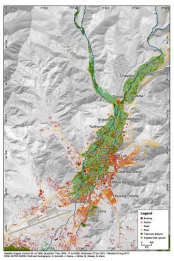
Hydroponic is a soil-free (other than soil) cultivation method in which plants grow in a nutrient containing medium.

Advantage

- The quality of yield, taste and nutritive value is higher than soil raised plants
- This practice is disease free and eco-friendly
- 10 % less water than plants grown in the field.
- Ensure all-year-round cultivation and enabling higher farm incomes.

Project Site

Leh Town , Ladakh (UT)



Total Population (inhabitant) = 30,870 (2011)
(Leh District= 1, 33,487)

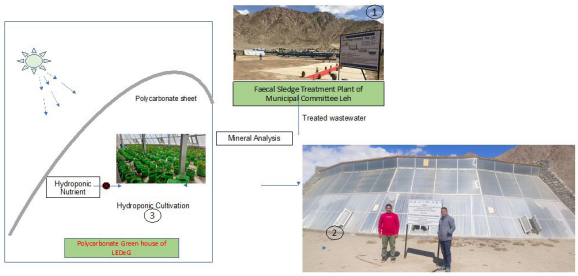
A significant increase in tourist flow from 2012 (1,79,491) to 2022 (5,29,260)

Municipal Committee Leh Comprising 13 wards

Faecal Sludge Treatment Plant (FSTP) at Bomb Garh near Leh town

The current capacity of the FSTP is to treat 12,000 litres of fecal sludge per day

Project Concept



Literature: Wastewater used in Hydroponic

Type of wastewater	Type of crop	Type of hydroponics system	References
Urban	Tomato, lettuce, Chinese cabbage, romaine lettuce	Deep flow technique	Chow et al., 2001; Cui et al., 2003; Lopez-Galvez et al., 2016; Magwaza et al., 2020
Domestic	Sunflower	Semi –hydroponic	Santos - Júnior et al.,2014
Domestic	Lettuce, gerbera	Nutrient film technique	Damasceno et al., 2010; da Silva Cuba et al.,2015; da Silva Cuba etal., 2018
Aqua culture effluent	Barley	Nutrient film technique	Snow et al., 2008
Brewery effluent	Vetiver grass	Floating raft	Worku et al., 2018
Anaerobic digestion	Silver beet	Media bed based	Krishnasamy et al., 2012
Domestic	Winter squash, green beans, sweet corn, eggplants, cherry tomatoes, etc.	Media bed based	Haddad and Mizyed,2011

No study is reported from India

Physiochemical Parameters

Treated Wastewater Vs Hogland Hydroponic Nutrient

SN	Test Parameter	Treated Wastewater	Hogland Nutrient
1	pH	7.75	6.2
2	EC 25° C (mS cm^{-1})	3.33	1.15
3	Total Suspended Solids (mg/l)	140	0
4	Calcium as Ca (mg/l)	110.51	60
5	Magnesium as Mg (mg/l)	32.49	28
6	Sodium as Na (mg/l)	273	0
7	Potassium as K (mg/l)	127	197
8	Total Phosphorus as P (mg/l)	0.84	31.0
9	Nitrate as NO3 (mg/l)	14.8	113

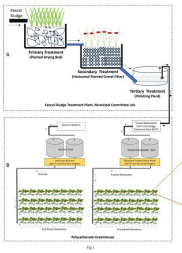
Physiochemical Parameters

Treated Wastewater Vs Hogland Hydroponic Nutrient

Heavy Metals

SN	Test Parameter	Treated Wastewater	Hogland Nutrient	Recommended maximum level for irrigation (World Health Organization [WHO], 2006)
1	Manganese as Mn (mg/l)	0.124	0.25	0.1 to 1.5
2	Copper as Cu (mg/l)	0	0.01	0.2
3	Zinc as Zn (mg/l)	0	0.03	2.0
4	Iron as Fe (mg/l)	1.4	0.5	0.1 to 1.5
5	Lead as Pb (mg/l)	0.03	0	5.0
6	Mercury as Hg (mg/l)	0	0	NA
7	Arsenic as As (mg/l)	0	0	0.1
8	Cadmium as Cd (mg/l)	0	0	0.01

Technology Executed



Hydroponic Type: ***Drip system***

Micro-irrigation kits

Plant

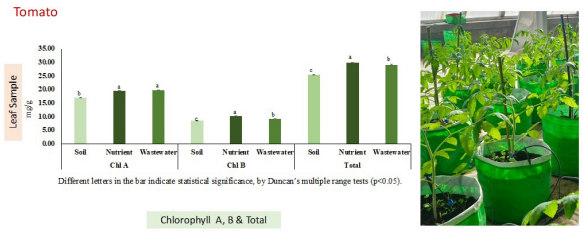
Cocopeat (Inert medium)

Grow bags

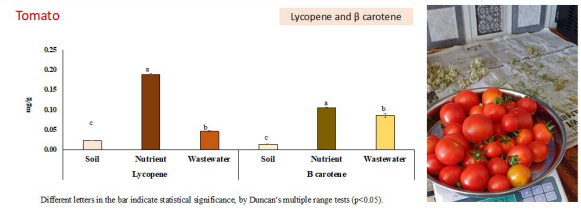
Technology Executed

Technology Executed

Assessment: Chlorophyll Content

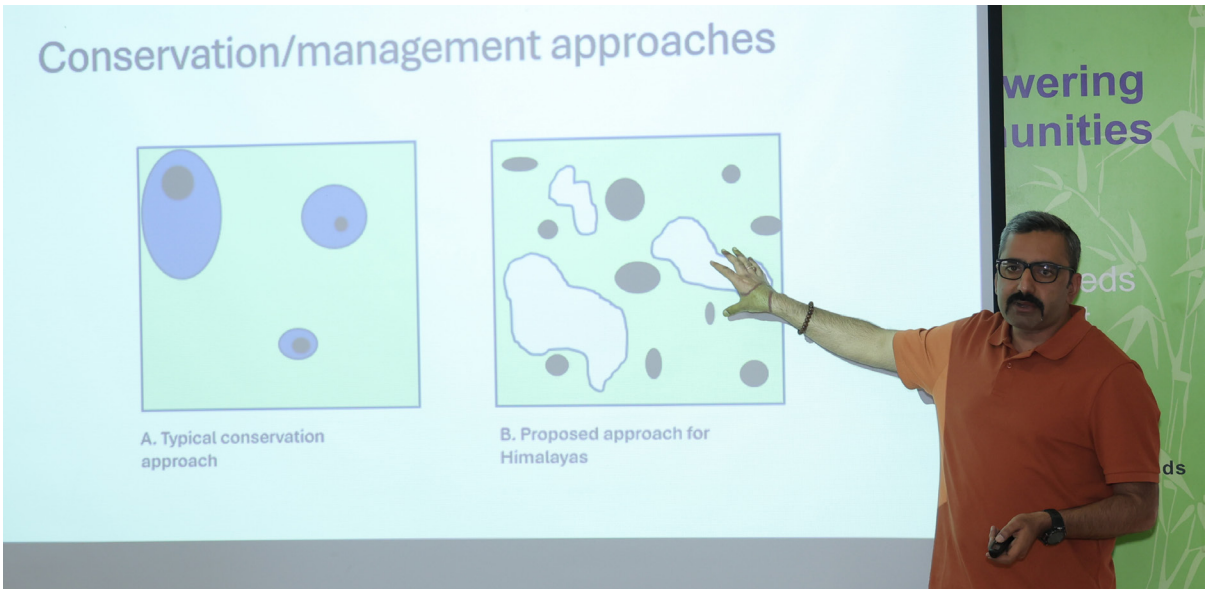


Assessment: Lycopene and β carotene



Dr Rishi Sharma

WWF- India



Dr Rishi has committed over the last 18 years to wildlife conservation in the Himalayan region, focussing specifically on the Snow Leopard, particularly in the Trans-Himalayan area. The Trans-Himalayan rangelands host a diverse collection of wild mountain ungulate species and provide habitat for endangered carnivores, including the snow leopard.

In contrast to the nation's other terrestrial ecosystems, where the majority of wildlife populations thrive within designated protected areas, the Trans-Himalayan landscapes stand out due to their wildlife populations existing beyond these confines, permeating the broader landscape.

However, this area is also regarded as a wildlife haven, featuring several species of plants, large mammals, a significant number of edible white plants, and much more to be discovered within the IHR Trans-Himalayan landscapes, as much of the region remains unexplored.

This region exhibits significant cultural diversity, with Buddhism deeply rooted in its heritage, complemented by a vibrant landscape. This area serves multiple purposes, and the local population has a significant reliance on it. Nomadic pastoralism in the region has a long history spanning several millennia, likely characterised by low-intensity grazing, similar to practices observed in the Central Asian steppes (Blench & Sommer 1999). The Trans-Himalayas ranks as one of the least productive ecosystems dominated by graminoids globally, particularly concerning above-ground graminoid biomass (Mishra 2001).

Effective conservation of snow leopards, a conservation flagship of Asia's high mountains, requires robust monitoring of their populations and a thorough understanding of how they respond to the biotic and abiotic heterogeneity in the landscape and to human presence and resource use.

In majority of India's terrestrial landscapes, wildlife persists largely in insular protected areas which are further divided into core (no anthroprogenic use) and buffer zones (regulated anthropogenic use), surrounded by rural and urban landscapes.

Given the unique values and conditions of wildlife occurrence and human use in the vast Himalayan rangelands, a landscape level planning approach that incorporates clear and scientific land use planning, including zonation is extremely important. The approach must be one that works on landscape level plans and localised management. Key elements of this include co-management of resources using scientific, participatory and adaptive management approaches.

An enhanced framework for the higher Himalayan and Trans-Himalayan region involves a landscape-level approach, categorising each landscape unit as either a core unit or a buffer unit, each with distinct multiple-use objectives.

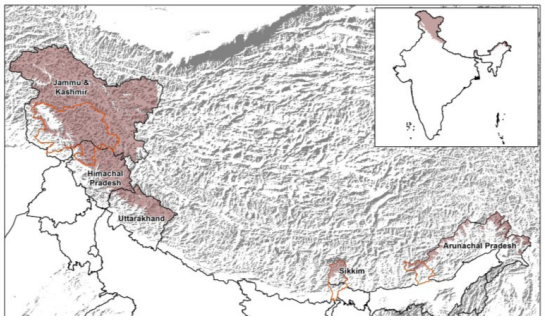
Broad management principles

(i) In core landscape units, management objectives should aim to maintain wildlife populations (Nc) at carrying capacity (K) over the long-term, enable conditions where birth rates (bc) exceed rates of mortality (mc) , and rates of emigration (ec) are considerably higher than immigration rates (ic) to enable spill-over effects, i.e., $Nc \approx K$, $bc > mc$, and $ec >> ic$

(ii) For each buffer landscape unit, the desirable wildlife population size (Nb)will be a function of the trade-off between conservation and human use objectives and the wildlife populations would be maintained such that: $Nb = K - f(A)$, and $bb + ib \geq mb + eb$ where f(A) is a function by which the wildlife population size is reduced below carrying capacity because of an acceptable level of human anthropogenic pressure for each landscape unit.

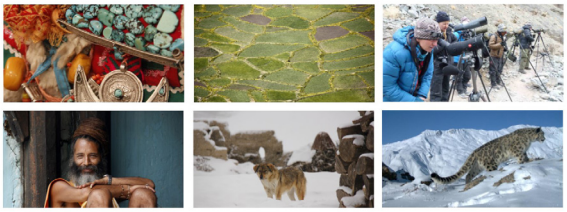
WWF is undertaking various initiatives, including community-led visioning for shared landscapes, restoring degraded forests, rejuvenating Himalayan springs, establishing community conserved areas, mitigating human-wildlife conflict, and implementing evidence-driven conservation strategies. This should be the strategy for alliance-based activities too.

Shared Habitats, Shared Futures: Insights from Snow Leopard Conservation



A wildlife haven

A multiple use region



A history of Nomadic pastoralism

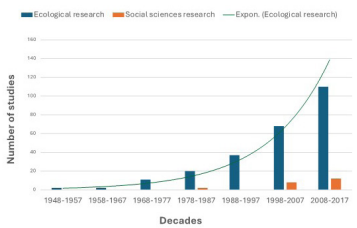
Insights from studies

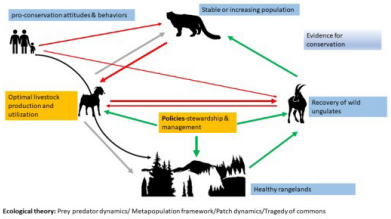
- < 6 percent of SL range under formal protected areas
- 170 protected areas in the global snow leopard range, 40% are smaller than the home range size of a single adult male (Johansson et al. 2016)
- Little robust estimates of population size

Insights from snow leopards

- 221-450 Snow Leopards were estimated to have been poached annually since 2008
- Of these, 55% are killed in retaliation for livestock depredation
- Large proportion of snow leopard diet is comprised of livestock (20-80 %)

State of knowledge





Dr Siksha Swaroopa Kar

CSIR- Central Road Research Institute

She emphasised that during development, the necessity of wide roads is sometimes questioned, particularly when disasters ensue as a consequence. She asserted that their institution is committed to investigating the design and construction of roads across diverse terrains and circumstances, prioritising sustainability and climate resilience. Her presentation also included an overview of this method.

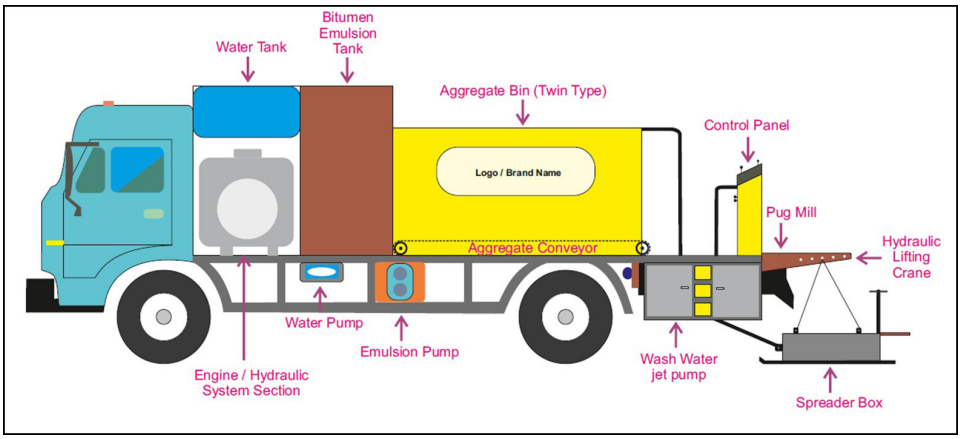
They are engaged in road construction and management systems, bridge engineering and structures, ecotechnological engineering, flexible pavements, pavement evaluation, rigid pavements, traffic engineering and safety, as well as transport planning and environmental considerations.

Cold Mix & Mobile Cold Mixer cum Paver:

CRRI has produced exceptional technology and has already provided it for widespread implementation. Currently, contractors have to heat stone chips and a mixture of coal tar, which is solid at room temperature, as heat is necessary to transform it into a liquid state and to ensure adherence to the stone chips. Coal tar is a viscous dark liquid that is a by-product of coke and coal gas production from coal. It is a kind of creosote. Coal tar was identified as a recognised human carcinogen in the inaugural Report on Carcinogens published by the U.S. Federal Government in 1980.

Coal tar Heating is, undoubtedly, a source of carbon emissions. Constructing roads using the same methodology necessitates the establishment of construction plants at short intervals. In the case of the Himalayas, acquiring land for setting up plants in the Indian Himalayan Region (IHR) is consistently challenging. Furthermore, if land is secured, the transportation costs for conveying raw materials to the work site are substantial. Which, of course, necessitates sufficient transportation, which ultimately generates carbon emissions owing to the combustion of fossil fuels.

Consequently, the development of the Mobile Cold Mixer cum Paver has been undertaken, for which funding was secured from the Ministry of Environment to advance the project for the National Himalayan Region. The Mobile Cold Mixer cum Paver (MCMP) has been meticulously engineered to enable the onsite amalgamation and application of bituminous material onto a prepped granular or existing surface.



Source : CSIR- Central Road Research Institute

The strength of the road is notably superior compared to previous constructions, making it suitable for use in road construction within hilly regions. A notable example is the road constructed in Jhimar, Uttarakhand, where the temperature was recorded at 7 degrees centigrade. In contrast, hot mixing technology necessitates temperatures exceeding 25-30 degrees centigrade, thereby limiting the paving window due to the potential for the material to cool preterm. Nonetheless, this technology enables contraction at a temperature of 2 degrees centigrade, which is a boon for the hilly region. In previous methodologies, utilising labour and construction materials allowed for the completion of 200 meters in a single day; however, advancements now enable the construction of 1.2 kilometres within the same timeframe. The fuel consumption has decreased significantly; previously, 8 litres of fuel were necessary for 200 meters, whereas now only 26 litres are needed for 1.2 kilometres. This indicates an impressive reduction, allowing for nearly six times the fuel savings. The same technology has been employed in the construction of a 6 km road at the Border Roads Organisation (BRO) R&D centre in Shillong, for which they have received an appreciation letter from the Border Roads Organisation (BRO). Under Project Deepak, this machine was also transferred to the BRO for utilisation on a broader scale in various regions where road construction is underway by them. The same will be employed in Manali for an extensive stretch of road construction exceeding 120 km, commencing this month (October 2024).

Rehabilitation of Pavement using Recycling Technology

The recycling of pavement represents an innovative approach employed for infrastructure rehabilitation. The materials obtained from excavation during road construction are repurposed on-site, thereby eliminating the necessity to transport waste to a different location. In a comparable manner, the transport cost and fuel consumption have also experienced a significant reduction throughout this process. In IHR, obtaining high-quality materials for road construction presents

significant challenges, often requiring sourcing from long distances.

In Tripura, a road length of approximately 120 km has been constructed along NH 44 utilising existing materials, specifically employing brick aggregate. The assessment of brick aggregates generated on-site from Jhama bricks complies with the standards outlined in IRC codes. The proposed composition of CTSB, consisting of 56.5% brick aggregate, 40% sand, and 3.5% cement, adheres to the minimum specified requirements outlined in IRC:37-2012. The construction time has been significantly reduced through this process.

Use of Tunnel Muck in Road Construction

The construction of roads in the IHR is unfeasible without tunnels. Currently, approximately 26 tunnel projects are underway in the Himalayan region by National Highways, and similarly, the BRO is also engaged in the development of several tunnels. Previously, the issue of tunnel muck presented significant challenges on-site due to the absence of an effective waste management system to support the process. Additionally, road construction companies were often reluctant to engage in this task, viewing it as both time-consuming and expensive.

The developed treatment process for tunnel muck proves beneficial for road construction. The requirement of approximately 20,000 tonnes of high-quality aggregates per kilometre of road, coupled with the unavailability of the material within an economical lead, results in delays and a significant increase in the overall project cost. Moreover, in the absence of these materials, the extraction of natural resources served as the sole source, resulting in the reduction of green belts, fertile soil, and the depletion of the water table, ultimately leading to environmental degradation.

This process has been successfully validated at the project site: Khellani tunnel, Jammu IHR, States Location: Jammu, Coordinates: 33.439145°N, 75.604426°E.Following a two-year period, field testing and impact evaluation will be conducted, as the current adoption of this technology is based on laboratory testing. Consequently, they will proceed to seek guideline for using this technology at massive level from the Ministry of Road Transport, drawing on the project's success.

Road Construction & Emission

A project has been conducted on approximately 24 national highways aimed at reducing emissions from road construction. Plants and vegetation were utilised adjacent to the roadside, with a road design that minimises traffic congestion, while disjunction will naturally aid in the reduction of carbon emissions. On the maintenance front, it is essential to minimise wear and tear.

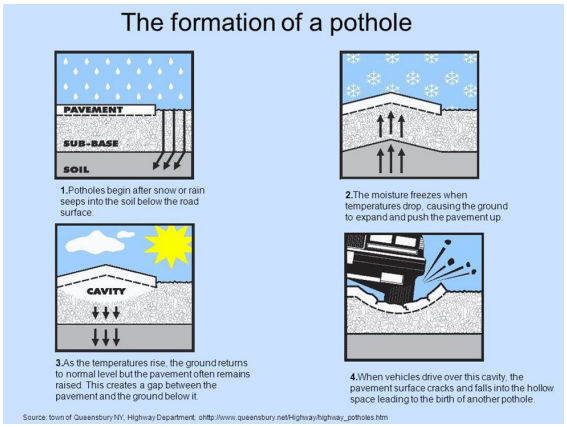
S.No	NH stretches	Stretch Length (Km)
1	4 laning of Pune- Solapur Section in the state of Maharashtra.	104.4
2	4/6 laning of Chennai- Madurai- Kanyakumari	573.23
3	4/6 laning of Ranchi-Hazaribagh-Barhi section	114.78
4	4/6 laning of Mansar- MP/MH Boarder-Seoni, Maharashtra -MP	93.54
5	Eastern Peripheral Expressway; UP and Haryana;	67.5
6	Delhi - Meerut Expressway in Delhi and UP	59.98
7	4/6 laning of Khanpara (Guwahati) - Nagaon	66.61
8	4/6 laning of Walayar (KL/TN boarder) –Vadakkanchery-Thrissur-Angamaly in Kerala;	124.68
9	6 laning of Ismailabad - Narnaul (Trans Haryana)	228.4
10	Porbandar to Dwarka of NH-8E in the state of Gujrat; Length:	117.75
11	Pasighat-Bomjur (NH-13), Arunachal Pradesh, NHDCL	22.15
12	Singer River to Sijon River, Arrunachal Pradesh, NHDCL	23.377
13	Delhi Dehradun Section (Akshardham to Kherka) in Delhi & UP	31.2
14	Quazigund-Banihal , Jammu NH-1A	16.27
15	Chenani Nashri Tunnelway, Jammu NH 44	19.8
16	6 laning of Panipat-Jalandhar; new NH-44; Haryana and Punjab;	291
17	6 laning of Delhi Agra Section NH2	179.5

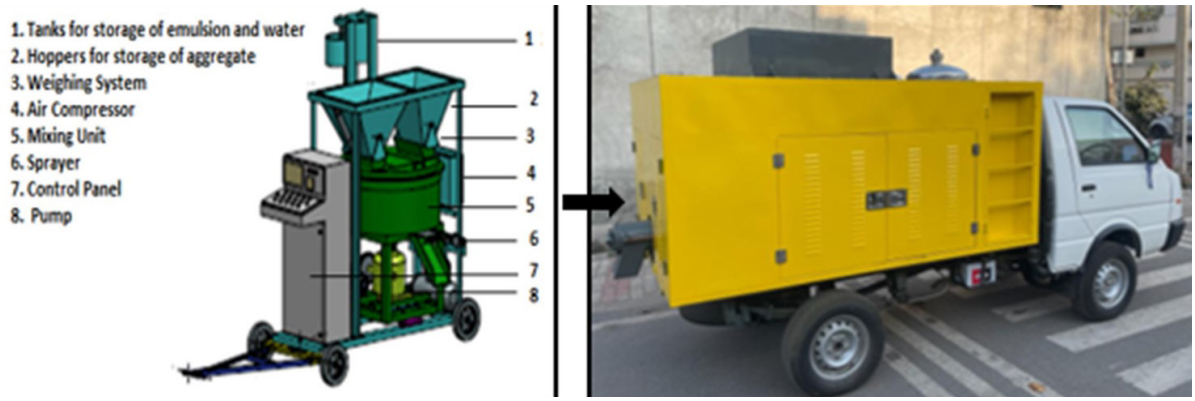
Total kilometres assessed: 2134.39 km, with carbon emissions avoided over this distance amounting to 25,485,433.36 CO_2-e. The emissions avoided per kilometre stand at 11,940.38 tonnes CO_2-e.

State governments and agencies involved in road construction should conduct comparable studies and data analysis, as this would be highly beneficial.

Pothole Repair Machine

Potholes are a prevalent issue in India, which possesses the second-largest road network, spanning approximately 6.3 million kilometres. The inadequate maintenance of these roads contributes to an estimated 3% loss in GDP. This is not even the case, considering the approximate 5000 deaths reported by TOI in 2018. The technology was expensive, and traditional methods were employed for pothole repair. A machine was developed for this purpose, which can be utilised extensively by the Public Works Department and municipalities.





Emergent Initiatives by CSIR-CRRI: Sustainable Infrastructure in the Indian Himalayan Region

Dr Siksha Swaroopa Kar
Principal Scientist
Flexible Pavement Division

CSIR-Central Road Research Institute

CSIR-CRRI at a glance

- Bridge Engineering and Structures
- Geotechnical Engineering
- Flexible Pavements
- Pavement Evaluation
- Rigid Pavements
- Traffic Engineering and Safety
- Transport Planning and Environment

Cold Mix & Mobile Cold Mixer cum Paver

10/13/24

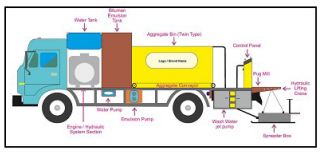
Current Practices of Construction in Hilly Region


Manual process of laying using hot mix technology


Non-availability / limited availability of space for set up of plant for road construction

Development of Mobile Cold Mixer cum Paver

- Received funding from Ministry of Environment for development of "**Mobile Cold Mixer cum Paver**" for National Himalayan Region
- The Mobile Cold Mixer cum Paver (MCMP) has been designed and developed to facilitate the onsite mixing and laying of bituminous material on a prepared granular/old surface.



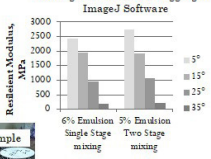
Schematic Diagram of Proposed "Economical Mobile Cold Bituminous Mixer-cum-paver

10/15/24

Developed Laboratory Mixing Technology

Two Stage Mixing

Coating of emulsion over aggregate: ImageJ Software

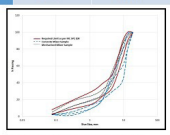


Field Laying

- Jhimar, Uttarakhand
- Temperature: 7°C
- 1.1 msa Traffic
- Pavement design as per IRC SP 72
- Subgrade CBR: 5

Benefit

Parameters	Conventional Process	Mechanized Process
Total No. of Labors Involved	15	7
Total stretch made in a day	200 m	1200m
Fuel consumption per day	8 Liters	6 Liters



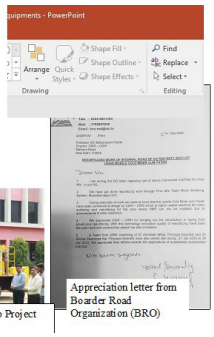
Better quality control

OUTPUT

- Technology has been transferred to Industry

aying in BRO R&D, Shillong

Fabricated model has been transferred to Project DEEPAK,BRO



Appreciation letter from Boarder Road Organization (BRO)

Appreciation letter from MoEFCC

Rehabilitation of Pavement using Recycling Technology

FEASIBILITY OF USING OVERBURNT CRUSHED BRICK AGGREGATES IN CEMENTED SUBBASE LAYER ON UDAIPUR - SABROOM SECTION OF NH - 44

Laboratory evaluation of brick aggregates produced at site from Jhama bricks meet the requirements as stipulated in IRC codes. The composition of CTSB as proposed i.e., 56.5 % brick aggregate; 40% sand and 3.5 % cement meets the minimum specified requirements as per IRC;37-2012.

Sand and Brick mixed sample for application in CTSB

General Condition of Cement Treated Sub-base (CTSB) using 56.5 %brick aggregate; 40% sand and 3.5 % cement)

Laying and Compaction of Foamed Stabilized Mix

Laying of BC

General Condition of Pavement after a year of construction of Pavement

The performance of UDAIPUR - SABROOM SECTION OF NH – 44 comprising CTSB, BSM and BC found satisfactory after 2 years of construction

Use of Tunnel Muck in Road Construction

Current Scenario for Tunnel Muck Dumping

- 26 tunnel projects are in Himalayan region by National Highways
- Contamination in ecosystem

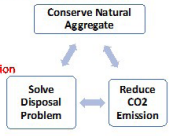
Dumping of tunnel muck at river side

No Proper waste management system is available.

12

Need of Study

- Require about 20,000 ton of good quality aggregates/km of road-Non availability within economical lead -Delays and tremendous increase in total cost of the project.
- Mining of natural resources-Reduction of green belt, fertile soil and depletion of water table- Environmental degradation.
- Problem Statement:
  - Scarcity of Natural Resources
  - Difficult to transport material to Hilly region
  - Pollution to the environment



13

Site Visit and Muck Material Collection

Project site:	Khellani tunnel, Jammu
IHR States Covered:	Jammu
Long. & Lat.:	33.439145°N and 75.604426°E

Muck Material collection

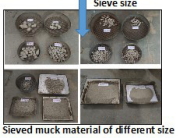
- Muck Material
- 40mm aggregate
- 20mm aggregate
- 10mm aggregate

14

Sampling at CSIR-CRRI

Sampling of muck material as per IS 2430

Sieve size



Sieved muck material of different size

Muck Aggregate Gradation

Sieve size	% passing
75	96.31865
53	94.25375
45	89.83844
37.5	86.92613
26.5	80.63018
22.4	79.12364
19	75.95531
13.2	67.53239
11.2	65.55718
9.5	63.66637
4.75	47.6817
2.36	39.40282
1.18	29.77161
0.6	24.35465
0.425	19.92052
0.3	18.11724
0.15	11.4808
0.075	5.813948

Coarse aggregate

Fine aggregate

CSIR CRRI 15

Pavement Design

conventional pavement

	BC 40mm
	DBM 70mm
	WMM 250mm
	Subbase 200mm
Total	560

Strain parameter for conventional pavement

	Permissible	actual
Bitumen	300	247
Subgrade	578	320

stabilized pavement

	BC 40mm
	DBM 70mm
	AIL 100mm
	CTB 135mm
	Subbase 200mm
Total	545

Strain parameter for stabilized pavement

	Permissible	actual
Bitumen	300	177
CTB	76.6	75.2
Subgrade	578	217.9

Site Selection

Road Construction & Emission

S.No	NH stretches	Stretch Length (Km)
1	4 laning of Pune- Solapur Section in the state of Maharashtra.	104.4
2	4/6 laning of Chennai- Madurai- Kanyakumari	573.23
3	4/6 laning of Ranchi-Hazaribagh-Barhi section	114.78
4	4/6 laning of Mansar- MP/MH Boarder-Seoni, Maharashtra -MP	93.54
5	Eastern Peripheral Expressway; UP and Haryana;	67.5
6	Delhi - Meerut Expressway in Delhi and UP	59.98
7	4/6 laning of Khanpara (Guwahati) - Nagaon	66.61
8	4/6 laning of Walayar (KL/TN boarder) –Vadakkanchery-Thrissur-Angamaly in Kerala;	124.68
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10	Porbandar to Dwarka of NH-8E in the state of Gujrat; Length:	117.75
11	Pasighat-Bomjur (NH-13), Arunachal Pradesh, NHDCL	22.15
12	Singer River to Sijon River, Arrunachal Pradesh, NHDCL	23.377
13	Delhi Dehradun Section (Akshardham to Kherka) in Delhi & UP	31.2
14	Quazigund-Banihal , Jammu NH-1A	16.27
15	Chenani Nashri Tunnelway, Jammu NH 44	19.8
16	6 laning of Panipat-Jalandhar; new NH-44; Haryana and Punjab;	291
17	6 laning of Delhi Agra Section NH2	179.5

Study Scope

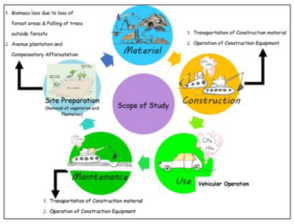


Figure 1: Scope of the study

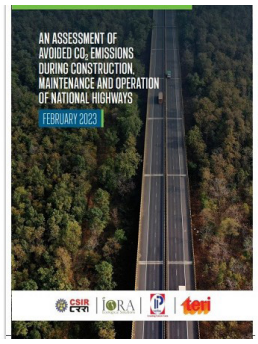
Net Carbon emissions avoided

Sr.no.	NH stretches	A	B	C	D	E= A+B-C+D
		Highway Stretch	C emitted from NH construction	Potential C saved over 20 year period from NH operation	C emitted due to Felling TDF + Forest clearance	Potential C sequestered in Avenue plantation + CA over 20 yr period	Net C emissions avoided
		Km	tons CO2-e	tons CO2-e	tons CO2-e	Tons CO2-e	tons CO2-e
1	Pune-Solapur	104.40	31616	1043058.31	12860.36	21396.19	2019978.14
2	Chennai- Madurai- Kanyakumari	573.23	9651268	9119075.75	75497.56	126913.2	-4480776.45
3	Ranchi-Hazaribagh-Barhi section	115.00	440545	8528152.09	54999.52	26775.29	5876592.86
4	Mansar- MP/MH Boarder-Seoni, Maharashtra –MP	93.54	264806	3150666.63	36737.8	3147.27	16670.10
5	Section of Eastern Peripheral Expressway; UP and Har	67.50	3119735	838804.36	0	197287.8	-2083642.86
6	EPE-Delhi - Meerut Expressway in Delhi and UP	59.98	83597	186973.12	4162.33	25607.83	87360.62
7	Nagaon-Khanpara; Assam	66.61	145039	3222179.26	6981.37	18474.66	188733.55
8	Walayar (KL/TN) –Vadakkancher y-Thrissur-Angamaly	124.68	52794	8563245.03	6113.85	11886.5	9261198.48
9	Ismailabad - Narnaul (Trans Haryana)	228.40	138214	5681219.51	1719.54	69490.46	5953576.23
10	Porbandar to Dwarka of NH-8E in the state of Gujrat	117.75	378494	4562389.68	70875.59	21123.93	28044.02
11	Pasighat-Bomjur (NH-13); Length	22.15	4247	7025.76	23569.79	0	-20991.03
12	Pasighat – Mariyang- Yingkiong road - Singer to Sijon	23.38	3221	9600.75	42.96.17	0	2083.56
13	Delhi Dehradun Section (Akshardham to Kherka)	31.20	18626	1151685.03	2439.04	0	1130619.99
14	Quazigund-Banihal , Jammu NH-1A	16.27	35797	4212857.61	20595.3	2655.46	4159298.57
15	Chenani Nashri Tunnelway, Jammu NH 44	19.80	96042	184411.51	19969.3	279.08	128679.29
16	Panipat-Jalandhar; new NH-44; Haryana and Punjab	291.00	657488	216052.05	52663.91	50424.3	-917648.36
17	Delhi Agra Expressway	179.50	296688	4801208.12	53590.44	39924.97	4490454.65

Total Km assessed: 2134.39 km

C emissions avoided over these kms: 25485433.36 CO_2-e

C emissions avoided/km: 11940.58 tons CO_2-e

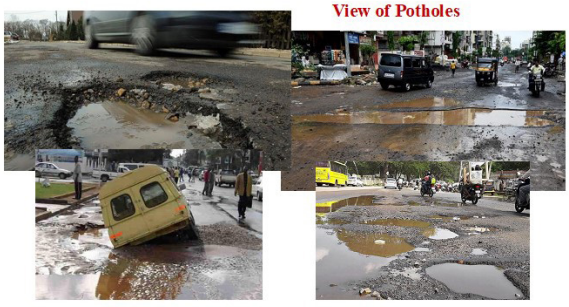


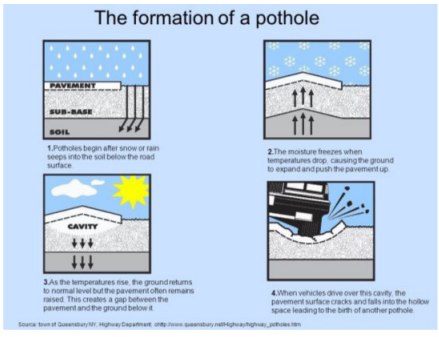
This report was released by Shri Bhupender Yadav Ji, Hon'ble Minister for Environment, Forest and Climate Change (MoEFCC), on 22nd February 2023

World Sustainable Development Summit (WSDS) 2023

Pothole Repair Machine

View of Potholes

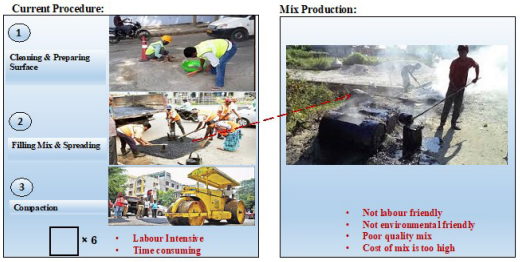




Potholes: The Pain Area of Indian Road Network

- India: 2nd Largest Road Network- about **6.3 millions km**
- Poorly maintained roads: **3% GDP Loss**
- **Approx 5000 deaths** as per TOI report 2018

Current Practice for Repair of Pothole



Mechanisation Process i.e Development of indigenous pothole repair machine

Development of Low cost environmental friendly Material

10/13/24

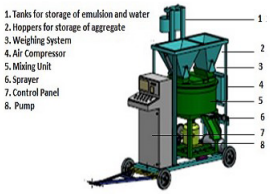
Imported Machines

- Capital Cost
- Maintenance Cost
- Operational Cost

10/13/24

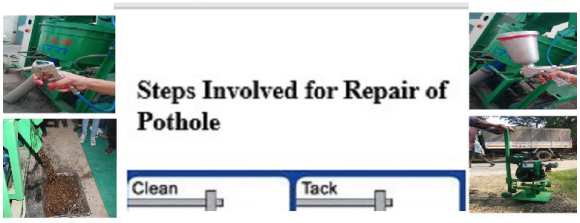
Design and Development of Pothole Repair Machine

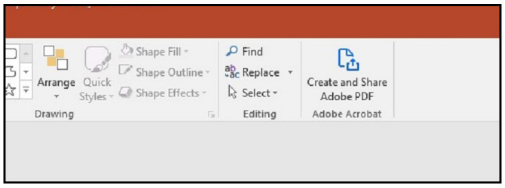
- Designed and developed the prototype machine to produce cold mix as per approved guidelines of Indian Roads Congress (IRC)
- **Patent Granted**: "Design and development of Pothole Repair Machine"



10/13/24

Method of Repair (Conventional)





One Stop Solution :

- Clean
- Tack Coat
- Mix Preparation
- Fill the Pothole
- Compact

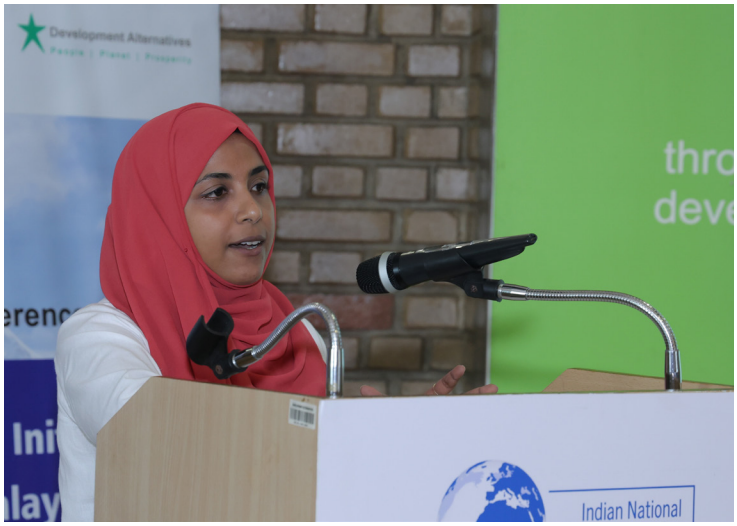
Outcome

Sl no	Societal Benefits	Existing Technology	Developed Technology	Savings
1	Cost Savings			
	Capital Cost	1-2 crore	Approx 35 lakh	Nearly 8times cheaper
	Material Cost (per tonne)	Rs 1000/-	Rs 600/-	40%
2	Labor Required	Min 6	Max 2	-
3	Time required to fill a single Pothole (medium size)	5min (max)	15 min (min)	-
4	Emissions (for repair of 10 potholes)	Approx 25 tonne eCO_2	Approx 7 tonne eCO_2	72%

10/13/24

Ms Tanya Ahmad

National Institute of Urban Affairs (NIUA)



Ms Tanya Ahmad has indicated that our nation is undergoing fast urbanisation and experiencing climate change on a global scale, with the effects intensifying daily, posing challenges for vulnerable populations in addressing these impacts.

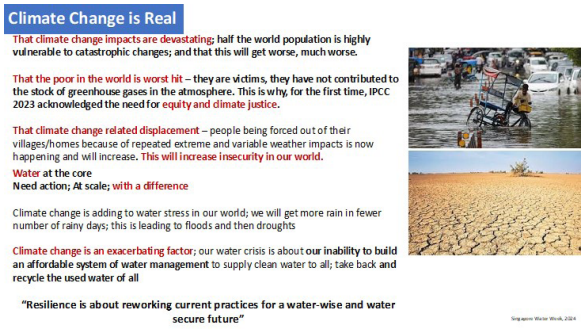
The effects of climate change are disastrous; half of the global population is significantly susceptible to severe alterations, and this situation will deteriorate considerably. The impoverished populations globally are disproportionately affected; they are victims and have not contributed to the accumulation of greenhouse gases in the atmosphere. For the first time, the IPCC 2023 recognised the necessity of equality and climate justice. Climate change-induced displacement, wherein individuals are compelled to vacate their residences due to recurrent intense and fluctuating weather events, is currently occurring and is projected to escalate. This will exacerbate insecurity globally.

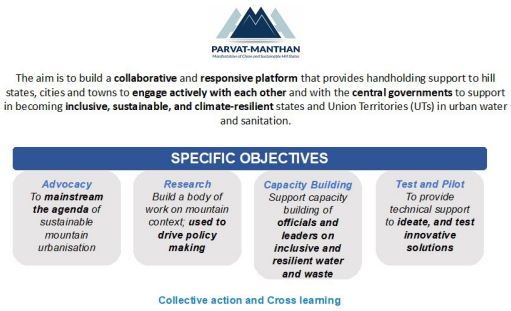
NIUA initiated collaboration with the Uttarakhand government by offering technical support to them and the partner organisation BORDA in the Leh region. Through this engagement, they recognised the necessity for a platform that facilitates dialogue on addressing the challenges and issues present in the Indian Himalayan Region (IHR) - establish a collaborative and responsive platform that offers support to hill states, cities, and towns, facilitating active engagement among them and with central governments. This initiative aims to promote inclusivity, sustainability, and climate resilience in urban water and sanitation for states and Union Territories (UTs). They engaged with think tanks and NGOs, state government secretaries, donor agencies and development banks, central ministries—Urban Development and North-East Development, elected representatives and ULBs, and the Planning Commission of India (known as NITI Aayog).

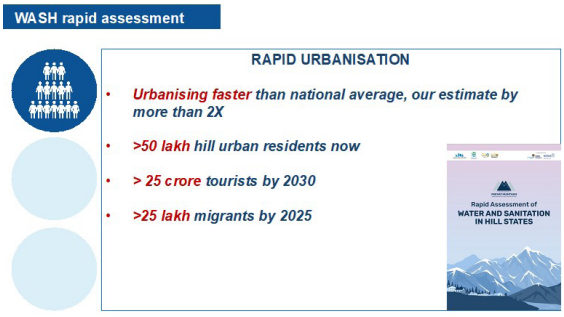
- THE FIRST CONSULTATION MEETING WAS CONDUCTED IN LEH: It was conducted by the Government of the Union Territory of Ladakh. Present and former administrators, senior government engineers, other experts, and international funders comprised the participants.
- SECOND CONSULTATION MEETING WITH STATE DEPARTMENTS IN SIKKIM: Subsequent to the meetings with the respective state secretaries, who are the decision-makers.
- FORMAL LAUNCH OF THE FORUM: The forum's official inauguration, which is spearheaded by the hill states and is anchored by the MoHUA

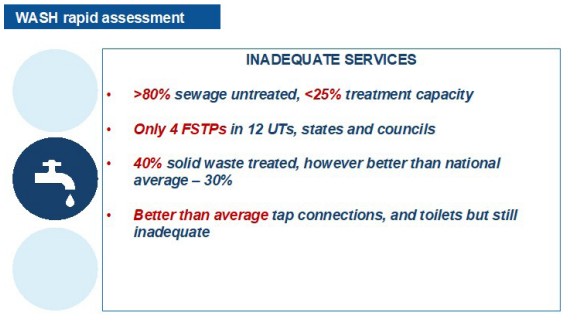
It was to establish a collaborative and responsive platform that offers handholding support to hill states, cities, and towns, enabling them to engage actively with each other and with the central governments. This support is intended to assist in the development of climate-resilient, sustainable, and inclusive states and Union Territories (UTs) in urban water and sanitation. In accordance with the specific objectives:

1. Advocacy: To integrate the sustainable mountain urbanisation agenda into the mainstream
2. Research: Develop a corpus of work on the mountain context that will be used to inform policy decisions.
3. Capacity Building: Provide assistance to officials and leaders in the development of inclusive and resilient water and waste management capabilities.
4. Test and Pilot: To offer technical assistance in the development and testing of innovative solutions









WASH rapid assessment

LOW MUNICIPAL CAPACITIES

- *Substantial HR gaps*
- *3X lower municipal revenue – ₹1700 hill cities vs ₹4700 national average*
- *Multiple states with no elected representatives*
- *Only capitals have master plans*

Potential work areas

Key Take Away and Way Forward

- Data is integral to create an informed decision
- Public Private Partnership is intrinsic
- Investment in context to climate change and inclusivity
- No work in silos: Multi-sectoral approach and fostering key partnerships
- Convergence of various national missions and philanthropic programmes
- Strengthen capacities of ULBs

Session 3:
Region Specific Key Issues

The session discussed regional issues related to wildlife, spring rejuvenation, conservation technology, climate resilience measures, tree planting, agroforestry, and sustainable infrastructure models.

Dr Sandeep Tambe

PCCF Wild Life, Forest Department, Sikkim / Former Assistant Professor- IIFM

He underlined the main challenges that IHR is confronting; these are, in his perceptions Sustaining Himalayan Springs and Streams, the looming threat of GLOFs, exploding feral dog populations in wildlife regions, the tyranny of tree plantations, and the sharp decline in horticulture-related livelihoods.

In IHR, springs are dying; although they fill with water during the rainy season, they dry up in the dry season. The water supply scheme under the Jal Jeevan Mission relies on a gravity-based water supply system. When the springs dry up, the household tap water supply is significantly impacted. While the Government of Sikkim has made significant progress over the past two decades, it is important to note that two-thirds of the springs are located on private lands. This situation limits the government's ability to regulate these resources effectively. Therefore, a watershed approach that emphasises community participation is essential for their rejuvenation. This is a matter that requires government regulation, as it pertains to geological factors affecting private lands. Landowners have often not taken action or heeded the insights of local communities. However, instances of local greed have also emerged, with individuals selling spring water to others.

The government has released a training video on aquifer-based spring-shed management that clearly explains the issue at hand.

https://www.youtube.com/watch?v=rVbkQBnDjAs&t=244s

For promoting this work, Sikkim government made Para hydrogeologists by developing their capacities, and using this technology on the ground.

Despite the fact that numerous issues persist, they must be addressed.

Science

- Scientific studies needed to understand inner workings of mountain aquifers
- Science is lagging behind practice.

Policy

- Springs are still invisible in policy discourses
- Issues related to spring ownership, responsibility, benefit sharing, and grievance redressal are yet to be addressed by most governments
- Spring shed development included in several national programmes

Practice

- Planning is complex, while implementation is relatively easy
- Expertise needs to be developed at the local level to prepare DPR
- Mixed methods are needed for impact assessment
- Benefits are distributed inequitably across the elevation gradient, with those needing it the most, benefitting the least.

Mitigating the Gracious Floods

- Retreating glaciers are leaving behind growing lakes
- Tremendous altitude differential (5km) between the lakes and the lowland
- Results in stored potential energy (in the form of glacial lakes) to turn into violent kinetic energy (in the form of debris-filled floods).
- There are a total 40 high-risk lakes in Sikkim of which 16 are in Category-A (Out of 189 high risk Glaciers lakes in Himalayas)
- Sikkim, with 320 glacial lakes, is a hotspot for future glacial floods
- GLOF disasters, in contrast to other disasters like earthquakes, cyclones, cloudbursts, and landslides, are preventable. While distinct from others, examples of mitigation efforts can be observed in Bhutan, Nepal, and Peru; however, no Indian state has undertaken significant initiatives in this regard.

Six ways are available: 1) Syphoning, 2) Pumping, 3) Enhancing Existing Channel. 4) Artificial Open Channel (Artificial Spillway) 5) Open-cut moraine with artificial dam. 6) Tunnelling

Nevertheless, certain local rituals are deemed necessary due to the belief that glacial lake outburst floods and impeded road connectivity result from the wrath of a local deity.

Food waste management in Défense Establishments, growth of Feral Dog and Predation of Wildlife

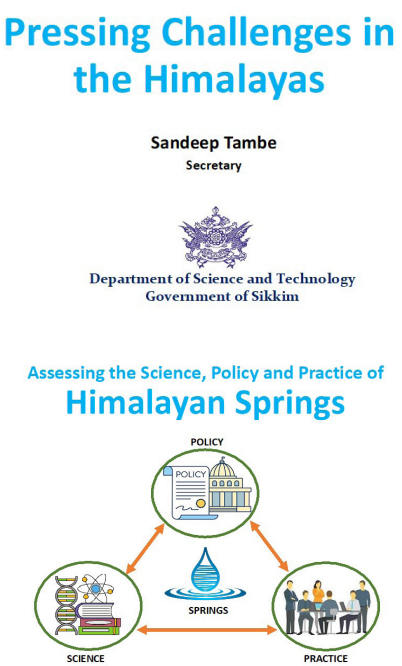
The presence of numerous defence activities and their sites in high altitudes is a result of the ongoing tension with China. This has resulted in inadequate food waste management, which in turn has facilitated the growth and movement of feral dogs, thereby resulting in the predation of wildlife. Sometimes, the defence establishment is larger than the local population. The management of feral dogs and associated issues requires greater research and policy inspection, as there is currently no effective policy or legislation to address the problem. Even these dogs are causing disturbances in areas rarely traversed by humans, ultimately disrupting the food chain of the snow leopard as well.

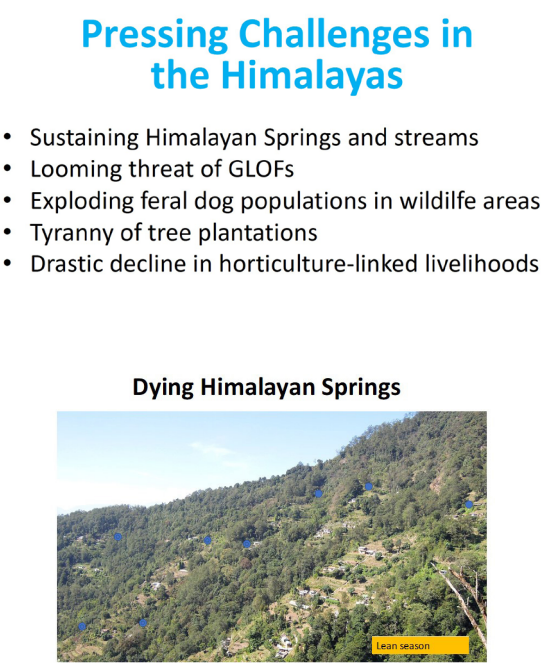
Decline in Horticulture livelihoods

Large Cardamom, a spice cultivated in the eastern Himalayas. India was the preeminent global producer. Sikkim accounted over 85% of the national production. The total cultivated area was 25,000 hectares, comprising around 20,000 smallholder cardamom farmers. Primary catalyst of affluence in elevated settlements, predominantly tribal.

Cardamom cultivation in Sikkim has experienced a decline of over 60%. The total area has decreased by over 60% to 12,500 hectares, and production has decreased from 5,152 metric tonnes to 2,500 metric tonnes. Nepal is currently the world's greatest producer, with a 53% share. An epidemic has been the consequence of viral and fungal diseases. Achieves a market price of Rs 1000-1200 per kilogramme.

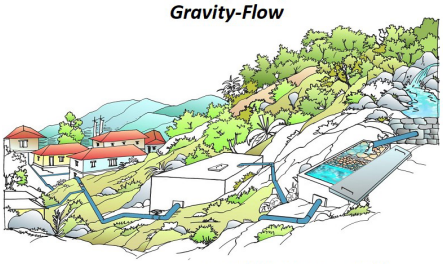
He recommended strategic thinking to address the issues, place-based interventions, co-production of solutions, and science-practice-policy.





Water Supply System

Gravity-Flow



Source: *VWSP Guidelines prepared by GIZ*

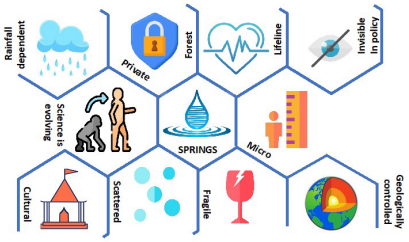
Implication of Dying Springs

Piped water supply

In the meetings women told us "just provide us water during dry season, we will take care of agriculture and livestock"

Lean season hardships

Unique Resource



Training video

Develop local capacity

Para-hydrogeologists

Lessons Learnt from the SPP of Springs

Science

- Scientific studies needed to understand inner workings of mountain aquifers
- Science is lagging behind practice.

Policy

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Ticking timebomb

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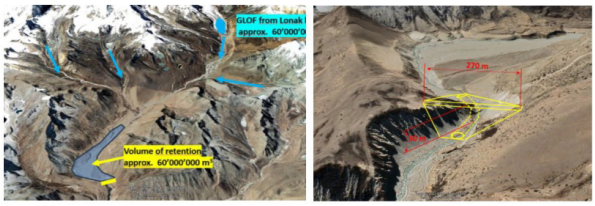
- Sikkim, with 320 glacial lakes, is a hotspot for future glacial floods
- Unlike other disasters, such as earthquakes, cyclones, cloudbursts, and landslides, GLOF disasters can be prevented.

Watershed Level Measures



Retention Dam

Ticking timebomb

- Unlike other disasters, such as earthquakes, cyclones, cloudbursts, and landslides, GLOF disasters can be prevented.
- Limited guidance available from Science, Policy and Practice
- Need pilots to create workable solutions

Food Waste Management in Defense Establishments, Growth in Feral Dogs and Predation of Wildlife

Improper food waste management

Rapid growth in feral dog population

Predation of wildlife

Rapid Growth in Feral Dog Population

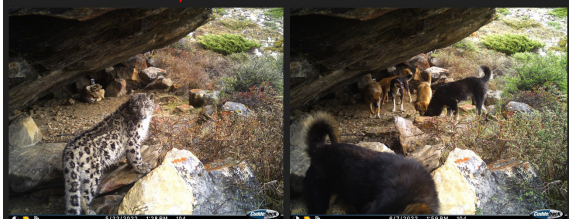
- Availability of easy to access, high calorie left-over food
- Poultry dressing waste
- Dogs breed twice a year with an average litter size of 5-6

Feral dogs adapted to the high altitudes

The Impacts...

Worrying shots: Feral dogs in forests displacing wildlife from prime wildlife habitat (Source: Snow Leopard Monitoring Exercise: F&ED & WWF-India)

Snow Leopard



The impacts...

Worrying shots: Feral dogs in forests displacing wildlife in prime wildlife habitat (Source: Snow Leopard Monitoring Exercise: F&ED & WWF-India)

Musk Deer

TYRANNY OF THE TREES PLANTATIONS

DECLINE IN HORTICULTURE LIVELIHOODS

PAST PROSPERITY

- Large Cardamom, spice crop of the eastern Himalayas
- India was the largest producer in the world
- Sikkim contributed 85% of national production
- Total area under cultivation was 25,000 ha
- More than 20,000 small-holder cardamom farmers
- Main driver of prosperity in upper villages, mostly tribal

PRESENT STATUS

- More than 60% decline in cardamom production in Sikkim
- Total area has declined by more than 60% to 12,500 ha
- Production has fallen from 5152 MT to 2500 MT.
- Nepal is now world's largest producer, with a share of 53%
- Viral and fungal diseases have resulted in an epidemic
- Fetches a high market price of Rs 1000-1200/kg

From Conversation to Action

- Strategic thinking
- Place-based interventions
- Co-producing solutions
- Science-Practice-Policy

Pressing Challenges in the Himalayas

- Sustaining Himalayan Springs and streams
- Looming threat of GLOFs
- Exploding feral dog populations in wildlife areas
- Tyranny of tree plantations
- Drastic decline in horticulture-linked livelihoods

हज़ारों ख़्वाहिशें ऐसी कि हर ख़्वाहिश पे दम निकले
राह-ए-इश्क में अगर दर्द न हो,
तो ये सफ़र किस काम का, ये आरज़ू क्या है।
जब आँख ही से न टपका तो फिर लहू क्या है

Ms Mallika Bhanot

Ganga Ahvaan

She is a founder member of Ganga Ahvaan and a member of the Bhagirathi Eco Sensitive Zone Monitoring Committee as well. Out of a total of 2,525 km, only 80 km of the Ganga flows freely. This region was designated as an ecologically sensitive zone in 2010, specifically known as the Bhagirathi Eco-Sensitive Zone. A notification regarding this was issued in 2012, yet its implementation remains unclear. A multitude of findings emerged, and the committee provided its recommendations; however, without practical implementation, they hold no real value.

Char Dham Project: In Uttarakhand, there are four Dhams: Badrinath, Kedarnath, Gangotri, and Yamunotri. The government has planned all-weather roads to connect them. For this project, a 12-meter-wide road has been suggested. To get the right of way (ROW) of about 24-meters, which is twice the width of the road, land must be acquired. People from the area went to court, and because the case was so important, the Supreme Court of India set up a High Powered Committee (HPC).

A 900 kilometre road project has been broken up into 51 smaller projects, which is likely a way to avoid doing an environmental impact assessment (EIA), which provides a chance to mitigate environmental harm. The HPC was set up in August 2019 to look into how the Char Dham project would affect the valleys in the Himalayas. The Wildlife Institute of India, the Physical Research Laboratory, and the Wadia Institute of Himalayan Geology are some of the organisations that have members on the HPC. The Supreme Court also set up an Oversight Committee to make sure that the

HPC's suggestions are carried out. Supreme Court Justice A.K. Sikri, who has since retired, is in charge of the group.

However, roads in the world's tallest and youngest mountain range can only be expanded by excavating trees, soil, and boulders from the hillsides, thereby compromising the stability of the entire slope. The more the excavation, the higher the instability. The problem deteriorates if the bare hillsides remain unaddressed—lacking replanting, soil-retaining meshes, and obstruction of natural water courses along the slope. The situation is exacerbated if the material is merely discarded into the valley, ultimately affecting the rivers below.

The committee concluded that widening in the Himalayas is not feasible, and a March 2018 Ministry of Road Transport notification further supported the idea that 5.5 m wide roads should be permitted to be built in hilly regions because wider roads may cause more landslides. For this, the government was ordered by the court to build 5.5-meter roadways only. However, the administration told the court once more that these highways are being used for defence. A bench led by Justice D Y Chandrachud (CJI) stated that striking a balance between the necessity of protecting the environment by protecting major highways that are vital for national security and the idea of sustainable development is imperative. The bench stated that no other hilly or mountainous road could be compared to the highways, which are vital routes for the military services[5]. The troops cannot be airlifted to high altitude border areas when massive infrastructure is being erected on the other side of the border, the court emphasised during the hearing.

Bhagirathi Eco-Sensitive Zone

The public has protested three hydro power projects on the upper section of the Bhagirathi-Ganga since 2006. In 2010, a GoM consisting of Sh.Pranab Mukherjee, Sh.Jairam Ramesh, and Sh.Sushil Kumar Shinde decided to cancel three projects (Loharinag Pala, Pala Maneri, and Bhairon Ghati) to conserve the area. Dr Agarwal, who fasted for this cause, received a letter from then-Honorable Finance Minister Sh. Pranab Mukherjee on August 23, 2010, announcing the cancellation of three hydropower projects and the declaration of a 135 km stretch from Gaumukh to Uttarkashi as an eco-sensitive zone under the Environmental Protection Act 1986.

The National Environment Policy (2006) defined the Eco-Sensitive Zones "as areas/zones with identified environmental resources having incomparable values which require special attention for their conservation" because of its landscape, wildlife, biodiversity, historical and natural values. In order to protect the environment and the biological integrity of the area outside the protected areas and other such areas where an eco-system has been adversely affected due to anthropogenic and climatic factors, the Ministry of Environment, Forest and Climate Change has been declaring such areas as Eco-sensitive zones/ areas. In other words, it is a type of designation of an area, which is rich in environmental resources and need special protection.

https://moef.gov.in/eco-sensitive-zone-esz#:~:text=Objective:,aspiration%20of%20the%20local%20people.

5 https://www.deccanherald.com/india/sc-allows-centre-s-plea-for-double-lane-roads-on-char-dham-highway-project-1060662.html

These are feeder roads, not border roads as some have claimed. The activists argued that since the borer roads are only 7 meters wide, there is no need for the feeder roads to be 12 meters wide. However, due to nationalist sentiment and apprehension about the Supreme Court, no one from any of the democratic pillars was willing to respond to the same point.

Hydropower projects

She has also highlighted the challenges and sustainability concerns associated with the hydropower project. Through a Right to Information request, it was revealed that all the dams in Uttarakhand are operating at low capacity. This situation can be attributed to two primary factors: 1) significantly reduced water flow during the winter season, and 2) the presence of numerous rivers in the Himalayan region that transport debris, which can lead to turbine blockages. Both represent a natural region; as the glaciers melt, the para-glacial sediments will also be included in this debris alongside plastics. While the dam plan (DPR) was developed, it may not adequately address this issue, potentially raising concerns regarding sustainability and the rate of return of the dam.

Tourism

She highlighted that the tourism sector of IHR has become a fundamental component of the states' economy, and the concept of tourism carrying capacity is often regarded as a trendy term; however, there is currently no governmental study on this matter. The tourism department assesses carrying capacity by analysing tourist footfall alongside the availability of accommodations in hotels and resorts. This forum should address this issue with the utmost seriousness and propose measures to the relevant authorities.

Mr Manasvi Srivastava

14 Trees Foundation

Mr Manasvi Srivastava was an IAS official who quit government and went to Microsoft and KPMG. He has similarities to Dr Pravin Bhagavat[6], who pioneered WiFi technology and lives in Pune. The main aim was to restore ecologically ravaged and barren terrain near Pune, where 14 trees were planted on 200 acres of desolate ground in Vetale, Pune. The gramme Sabha of neighbouring villages allocated an additional 2,000 acres to replicate the initiatives undertaken in Vetale, thereby creating a substantial impact in this region. For these initiatives, they utilise crowdfunding, personal funds, and operate without water, labour, and soil nutrients. They attempt to recycle runoff water, dug 84 ponds to enhance area recharge, and have planted native trees, shrubs, herbs, and climbers. Protection was provided for three years, with the community also ensuring its safeguarding, as the names of both the donor and guardian were inscribed near the tree. The total alteration of flora and fauna has been achieved through this technique. To ensure organisational sustainability, they engage in various initiatives: barren land restoration, carbon dioxide sequestration through indigenous trees,

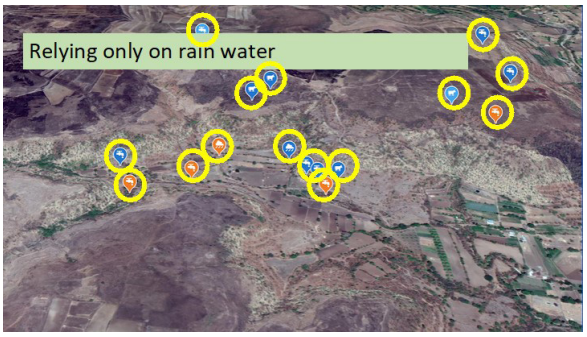
[6] https://iitk.ac.in/dora/profile/dr-Pravin-Bhagwat

green water management, biodiversity restoration, job creation for tribal communities, incubation of micro and green ventures, local inspiration initiatives, crowdfunding, volunteer involvement, and corporate social responsibility engagement, among others.

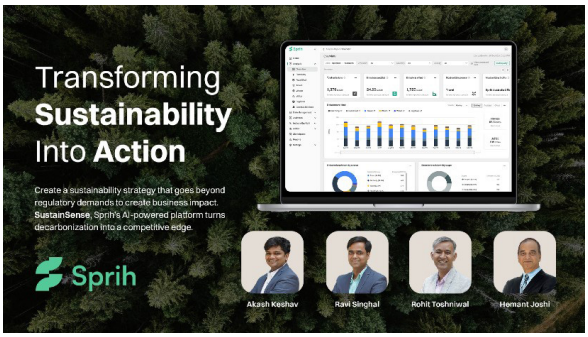
Moreover, they are not merely halting at this stage; they are devising methodologies for mapping and quantifying successful database management of carbon sequestration from a broader business perspective.

In Uttarakhand, the extreme summer heat in the hills, exacerbated by pine trees, contributes to the damage caused by forest fires; thus, there is a pressing need to enhance and diversify tree cover.

They emphasise the exploration of Climate Wealth Funds and seek to integrate commitment, community, resources, and technology.



Not just planting trees



Next Frontier: Uttarakhand

- Unbearable heat in summer months in the hills
- Devastation due to Forest fires
- Need for increasing and diversifying tree cover

- We wish to Learn from Your Experience and Expertise
- Exploring the Creation of Climate Wealth Funds
- Will attempt to bring together:
  - Commitment
  - Community
  - Resources
  - Technology

  To mitigate the effects of climate change in Uttarakhand

-Manasvi Srivastava
-Rahul Joshi

Dr Sushil Saigal

ED- The Nature Conservancy, India

The Nature Conservancy, India is a non-profit organisation that focuses on sustainable development in India. It has a strong scientific background, decision-making tools, and the ability to pilot on-the-ground projects. The organisation works closely with the Indian governments to achieve the vision of an India that "develops without destruction." They are results-oriented and impact-driven, focusing on smart scientific solutions with the highest conservation impact at the lowest cost.

TNC commenced its operations in India in 2017, engaging in various initiatives throughout the country. Dr Saigal highlighted the efforts of IHR, noting that some initiatives have been compiled while others remain ongoing. Their emphasis lies on the coverage of forests and the biodiversity present in this area, concentrating on the promotion of local vegetation that thrives in hilly terrains. This includes a strategic approach to landscape planning, the recognition of community forest rights, and the unification of communities around sustainable green enterprises. An exemplary initiative was undertaken in Shillong with the establishment of a local "Food Caffe."

Their endeavours encompass the augmentation of the competencies of forest personnel, communities, and NGOs via innovative approaches in forestry. In central India, selection and improvement schemes are being implemented, alongside the development of manuals aimed at promoting Oak in hilly forest regions.

They have provided assistance to numerous NGOs in Uttarakhand concerning the realm of eco-tourism. Individuals with specialised training are engaged as tourist guides, contributing their expertise in Spring shed operations, and collaborating with various local groups of specialists on landscape management, large dam integrity, and related matters. Additionally, he emphasised the necessity of incorporating desert ecosystems and glaciers into the financial commission's resource allocation framework appropriately.

He also highlighted the necessity for discourse regarding forest cover and its indicators as provided by the Forest Survey of India. In this context, it is important to note that plantations are included within the definition of forests; any area exhibiting 10% canopy is classified as forested. Furthermore, there exists a distinct definition for tree cover. If natural forests have been supplanted by plantations, our current monitoring system will be inadequate in recognising this discrepancy.

The classification of waste land has been hindered by governmental policies, deemed unproductive for revenue generation and agriculture. However, these areas possess intrinsic natural value and warrant a revaluation of the definition of waste land, as they hold significant ecological importance.

Dr Rajiv Bhartari

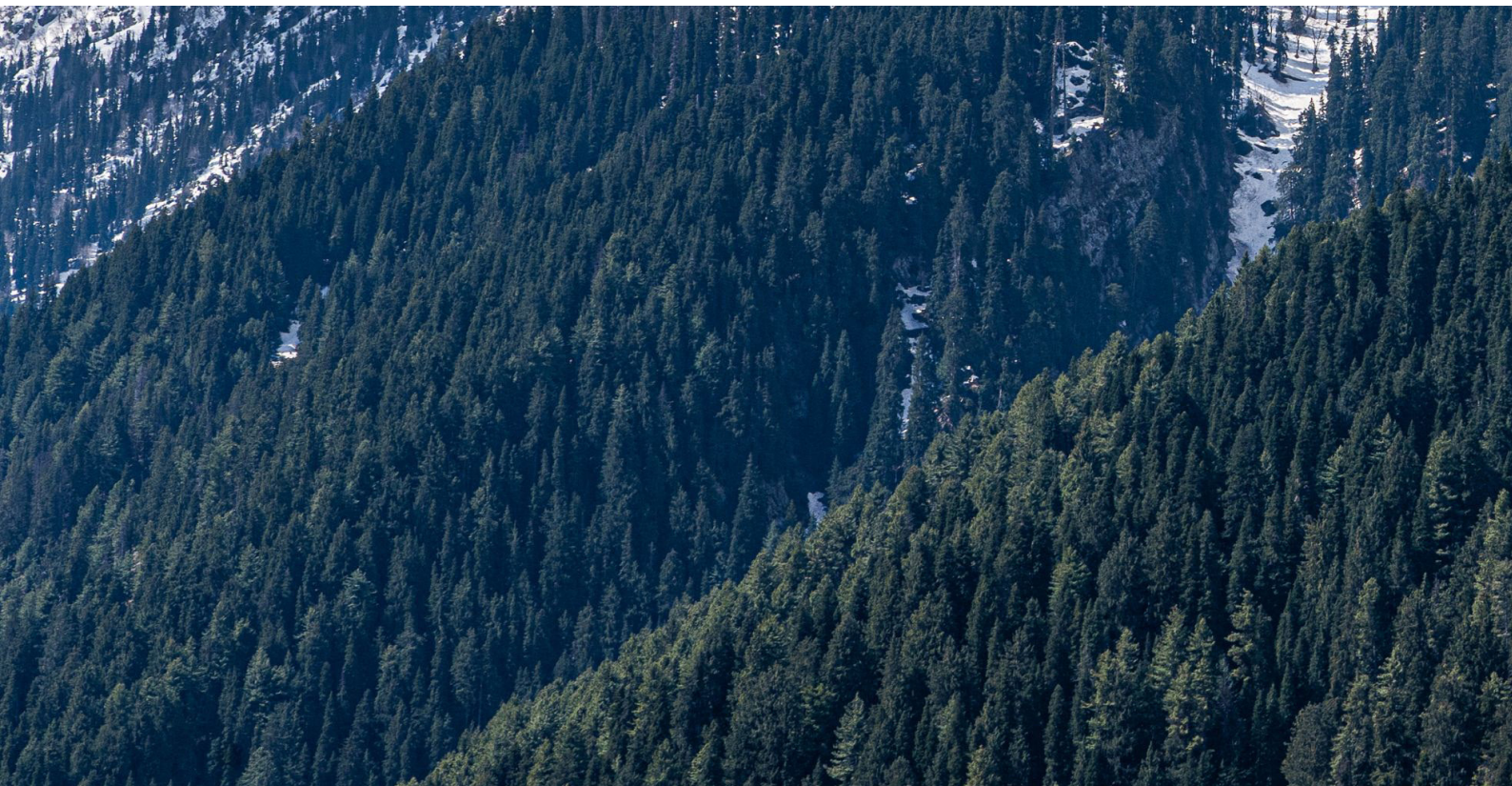
Ex PCCF-UK

Dr Rajiv Bhartari, former PCCF of Uttarakhand, expressed his perspective that eco-tourism, although its potential, also has limitations, as evidenced in the Corbet Tiger Reserve (CTR). The reserve, which houses India's largest tiger population, has encountered obstacles including rights and usage disputes, alterations in land tenure, and patterns of resource utilisation.

The CTR has experienced zoning modifications, policy alterations, and practice adjustments, resulting in reterritorialisation and a shift in resource utilisation. Environmental justice is essential in ecotourism, as local residents are marginalised from the core region, and resource utilisation is prohibited in the buffer zone.

Restrictions on advancement within 46 Checks, cessation of public transit along forest roads and a ban on fishing in the Ramganga River are also in place. The establishment of tourism zones in both core and buffer areas encounters restrictions on access and the relocation of villages.

Summary of Discussion



In the end of the RTD, the key issues are highlighted to provide the frame work to move ahead:

"Theory of Change for IHR"

1. Traditional development-oriented approach deemed ineffective due to revolutionary work required.
2. There is a need for implementation of change theory: Identifying key issues, and presenting these forcefully to key agents and key instigators to stop damaging Himalayan regions.

    a. *Set goals, targets, and milestones, and a self-monitoring system.*

    b. *Conservation alone may not suffice, as previous efforts in conservation including forests, wildlife, roads, infrastructure, bridges, and tunnels have failed.*

    c. *Social action is required but not necessaries alongside political movements and Yatras, as seen in Ladakh's change agents.*

    d. *'Alliance group' for various States can explore alternative strategies and provide recommendations to decision-making authorities.*

Concerns articulated and contemplated

1. The Himalayan region for future action plans should be divided into two areas, based on their similar characteristics - "North Western" and "North Eastern.". However, while formulating plans and implementation, the State boundaries must be taken into consideration, for effective policies and technological enhancement for IHR.

    - *Northern Himalayas*. J&K; Ladakh; Himachal Pradesh & Uttarakhand.
    - *Eastern Himalayas*. Sikkim; Arunachal Pradesh; Assam & Eastern Hills Sector (Manipur, Meghalaya, Mizoram, Tripura & Nagaland).

2. Climate Change. The IHR is also experiencing extreme heatwaves and erratic rainfall, but the environmental challenges faced in mountainous environments, require a consensus for effective solutions. Effective coordination among all agencies, government entities, and the public is essential to address these challenges and prevent the situation from deteriorating further. The India Meteorological Department (IMD) has a remarkably efficient weather forecasting and warning system, but more engagement with all participants, divisions, and stakeholders is crucial.
3. GLOF disasters as experienced in Sikkim , will increase in frequency with the impact of climate change. These can be prevented with right strategies and preparedness. However, additional studies are necessary to ensure that the gap between scientific understanding and practical application is bridged, allowing for effective implementation to avert disasters.
4. *The Kunming-Montreal Global Biodiversity Framework*, is not designed for mountainous regions. Therefore, India while establishing national biodiversity targets should integrate specific actions and plans for the IHR.
5. Distinguishing between pilgrimages and commercial tourism is essential, with high-end tourism in the Indian Himalayan Region being promoted.

6. The Himalayan region was once a promising site for hydropower, but its dams are functioning at low capacity due to decreased water flow and debris-laden rivers, need more scientific actions, for increased efficiency.

7. A transition from conventional agricultural methodologies to market-driven strategies, requires better road connectivity. In tune with the sensitivities of the fragile rock structure in the Himalayas, there is a need to adopt new technologies facilitated by CSIR-Central Road Research Institute for road construction.

8. The Himalayas, a global biodiversity hotspot, is under-recognised due to limited data, however, it is believed that government institutions hold valuable knowledge that can be processed for development of artificial intelligence tools. Towards this, the concept of "Himalayan guards" is essential for not only security, but to safeguard the eco system. They must have technical prowess and empowered with modern aeronautical engineering parameters, AI and modern equipment.

9. A people-centric approach to infrastructure development is recommended, including the establishment of a **settlement commission** – for land use and human settlements, urban management strategies, and resolution of data convergence issues.

Road Ahead

Integrated Action Plan Concerns expressed and considered at the roundtable have prompted the forum to begin a long-term program, leading to synergised efforts by all Institutions working in IHR, for the future. Thought leaders have identified the following major verticals, which should be handled by different bodies and their professional leadership, by synergising the combined strengths of different organisations and their unique characteristics.

I. Forest and Biodiversity Protection: Afforestation & Reforestation including diversifying species for health of forests; preservation of endemic bio-species; prevention of forest fires; deriving commercial value from forests.

II. Wildlife Conversation: Preservation of animal species & their habitats; Species protection; Anti-poaching.

III. Water Conservation; Flood control; streamflow management & rejuvenation of streams & springs; Ground water monitoring & management; water quality (pollution control, agricultural & industrial runoff).

IV. Glacier Monitoring: Preventing GLOFs; As the "third pole," the Himalayas are crucial for global water security, making glacial conservation vital.

V. Air & Water Quality Management: Pollution reduction; regular monitoring; to prevent ecological degradation and health hazards.

VI. Disaster Risk Mitigation: Implementing early warning systems & data sharing platforms for monitoring; resilience-building strategies for mitigation of landslides, earthquakes, and flash floods; disaster resilient infrastructure and technologies.

VII. Sustainable Urban Planning & Infrastructure Development: Pragmatic assessments and resilient policies for infrastructure development (roads, tunnels, bridges & buildings) factoring in inescapable requirements of security forces; audits to make existing cities/ urban spaces safe & sustainable; policies for new settlements; infusing latest technology; sustainable land-use policies;

VIII. Renewable Energy: Improving assessment of hydropower projects; full exploitation of Solar, Wind & geothermal energy potential; minimise use of carbon fuels & wood.

IX. Governance and Policy: Participatory governance; Conceiving, Implementing and enforcing land-use regulations; Transboundary cooperation.

X. Livelihood diversification: Encouraging alternative income sources - organic & modern farming you high value crops, animal husbandry & dairy; handicrafts and eco-tourism to reduce pressure on natural resources.

XI. Sustainable tourism: Managing tourism to minimise environmental damage while maximising local economic benefits; home stays; local adventure & entertainment initiatives.

XII. Sustainable Agriculture: Promoting climate-resilient farming practices for soil health and water resources management; high yield & high value crops; food preservation industry; while maintaining livelihoods.

XIII. Research, Monitoring, and Data Sharing: Scientific research; Monitoring of biodiversity, water resources, and forest cover; Data sharing platforms & creating networks for sharing knowledge and best practices among governments, research institutions, and local stakeholders.

XIV. Inclusive finance; Capacity & Enterprise Development; Supply Chain management; Adoption of corporate models for benefitting communities and preventing exploitation

Guiding Principles for Formulating Systematic Action Plan (SAP) for IHR

a. ***Policy Coherence & Convergence***: Distinct lack of connect between the Policy makers based at National Capital and the communities/ field level stakeholders who are the ultimate beneficiaries and remain pivotal in implementation. It is essential for central, state, and local policies to be coherent and based on ground realities; presently without community participation, the outcomes remain severely constrained. The ostrich approach, as was perhaps being suggested by some speakers during the round table, of slowing down development and to limit commercial activities, tourism and pilgrimage activities, is not a sustainable & not a pragmatic way forward.

b. ***Channelisation of Effort***: While there are a very large number of Govt bodies & institutions; Private organisations; NGOs & Not-for-profit institutions; as also Individual enterprises, however, most continue to work in Silos, with very little inter & intra domain linkages. This effort needs to be interlinked, channelised and directed for desired outcomes.

c. ***Technology Fusion***: It is essential to integrate contemporary technology, processes, and systems with indigenous knowledge, wisdom, and practices to prevent stagnation and unsustainable economic models in rural areas. Community awareness of the latest technology and its transformative potential is significantly constrained; it requires adequate linkage.

d. ***Funds***: The absence of sufficient financial resources to direct and channel the effort being put in by all, must be addressed. The government has allocated substantial funds to the planning process to promote these projects through a variety of initiatives. However, their optimal utilisation and effects remain uncertain, frequently becoming an electoral issue for political entities. This requires the appropriate consideration of supplementary sources, in order to effectively channel and harness private and corporate endeavours.

Setting up of Teams and Implementation

Core Team. A Core Team for SAP is to be established at the Headquarters of the Secretariat of all organisations in the Alliance at the national level. This team will consist of three components, each with a team of 2-3 resource personnel, and will be responsible for the following tasks.

- Team I. Conceptualisation and policy formulation: monitoring implementation; engaging with ministries, agencies, and organisations; initiating policy changes and refinements; intra-regional coordination.
- Teams 2 and 3. One for each region. They would concentrate on the coordination and execution of the SAP initiative in their respective regions.

It is anticipated that the roundtable initiatives will in the near future result in the establishment of strategic teams within the alliance, which will resolve the concerns at each level through systematic operational procedures.

Appendix

List of Participants

Name	Organisation
Nayanika Dutta	Balipara Foundation
Tanya Ahmad	NIUA
Rajiv Bhartari	ExPCCF, UK
Sandeep Tambe	Govt of Sikkim
Tikender Singh Panwer	Ex Dy Mayor Shimla
Rishi Sharma	WWF India
Maj Gen Jaggi Nanda	CoR India
Manasvi Srivastava	International Trade & Customs Proffessional
Swayam Prabha Das	Development Alternatives
Mohak Gupta	Development Alternatives
Archana Chatterjee	IUCN
Rahul Joshi	Retird
Anand Sharma	President IMS
Ramit Basu	Consultant- KPMG
Anita Arjundas	ATREE
P D Rai	IMI
Sushil Ramola	B-ABLE
Sandipan Mukherjee	GB Pant
Saurabh Bhardwaj	TNC
Ananya Chakrabarty	WRI India
Snehit Prakash	BORDA-SA
Hitesh	Ex Dir- NIUA
Sabyasachi Dutta	Asian Confluence
Jeet Singh	RGICS
Vishaish Uppal	WWF- India
Sandeep Tambe	PCCF -Sikkim
Arathi Hanumanthappa	Eichr GP
Prof Ravinder Zuthsi	RGICS
Sikaha Kar	CSIR-CRRI
Sumeer Bhasim	ANAAR
Malika Bhanot	Bhagirati Eco Ses Zone Member
Ashish Chandra	Consultant-PSPC

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