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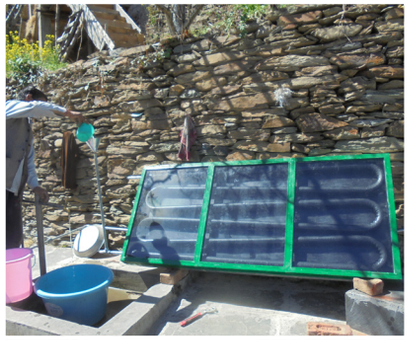
*Creating Innovative Solutions for a Sustainable Future*

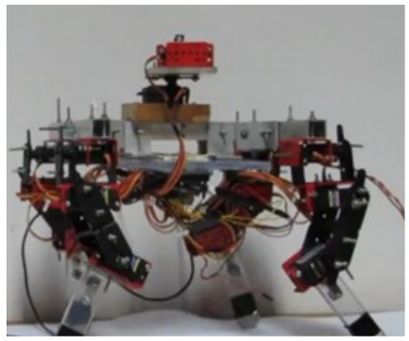
WSDS Silver Jubilee

# Him-CONNECT

## *Connecting Himalayan Innovations with Start-ups & Industries*







## Showcasing NMHS-Supported Innovations from the Indian Himalayan Region

**WSDS 2026 | 25th - 27th February 2026 | Shahjahan Hall, Taj Palace, New Delhi**

# About NMHS

The National Mission on Himalayan Studies (NMHS), a flagship initiative of the Ministry of Environment, Forest and Climate Change, Government of India, was launched in 2015-16 to address the unique environmental, developmental, and climate challenges of the Indian Himalayan Region (IHR). Recognising the Himalaya as a critical life-support system for the nation – providing water, biodiversity, climate regulation, and livelihoods – the Mission was conceived to generate Himalaya-specific scientific knowledge by supporting research projects and encouraging its translation into practical, on-ground solutions.

Spanning 11 States and 2 Union Territories, the projects supported by NMHS address the complex interaction between fragile mountain ecosystems and the socio-economic aspirations of Himalayan communities. The Mission focuses on sustaining and enhancing both natural and human capital by integrating scientific research, traditional knowledge, and community participation. As such, it plays a vital role in strengthening India's response to climate change, biodiversity loss, water stress, and livelihood vulnerability in mountain regions, while supporting national and global commitments such as the Sustainable Development Goals and climate action frameworks.

Aligned with the vision of **Aatmanirbhar Bharat**, NMHS promotes indigenous knowledge systems, local innovation, and resource-efficient technologies that reduce external dependencies and build self-reliant mountain economies. By nurturing green enterprises, skill development, and locally adapted solutions, the Mission contributes to resilient livelihoods and sustainable value chains in the Himalayan region.

Project interventions under NMHS are implemented across key thematic areas such as water resource management, Biodiversity conservation & management, Livelihood options & employment generation, Physical connectivity, and Handling of waste, including Climate change and Gender equality treated as cross-cutting priorities. This integrated focus enables the Mission to address interconnected challenges such as spring depletion, ecosystem degradation, waste accumulation, infrastructure vulnerability, and out-migration from remote mountain areas.

Since its inception, NMHS has delivered substantial outcomes on the ground. More than 250 demand-driven action research and demonstration projects have been supported, addressing water security, climate resilience, biodiversity restoration, waste-to-wealth solutions, and sustainable livelihoods. The Mission has awarded 175 Himalayan Research Fellowships across universities and institutions, creating a skilled workforce and generating high-quality scientific outputs. These efforts have resulted in hundreds of peer-reviewed publications, diverse knowledge products, and multiple patents covering innovative technologies such as plastic-to-graphene conversion, water purification systems, eco-friendly construction materials, and bio-based solutions.

NMHS has also strengthened state and community engagement through the establishment of Him-Nature Learning Centres across Himalayan States and Union Territories. These centres serve as hubs for environmental education, capacity building, and knowledge dissemination. Community-level interventions such as spring rejuvenation models, ecotourism initiatives, agro-forestry, and medicinal plant-based livelihoods have improved water security, livelihood options, and ecological resilience in mountain villages.

Scalable models and evidence generated under the Mission are now available for integration into policy instruments and for commercialization. By linking scientific evidence with policy action and community implementation, NMHS has emerged as a central platform for climate adaptation, biodiversity resilience, and sustainable development in the Indian Himalayan Region – strengthening the Himalaya for the well-being of present and future generations.

Aligned with the national vision of Vikshit Bharat @ 2047, the Mission advances a developed, climate-resilient, and environmentally secure India. By strengthening mountain ecosystems, promoting sustainable livelihoods, and enabling science-driven development, NMHS reinforces inclusive growth and long-term sustainability as core pillars of India's transformational journey toward 2047.

For more information about this Mission, please visit https://nmhs.org.in

# About Him-CONNECT

Him-CONNECT has been conceptualized as a strategic engagement platform for Principal Investigators (PIs) under the National Mission on Himalayan Studies (NMHS) and Start-ups. It is designed to bridge the gap between Himalayan scientific innovations and market-ready entrepreneurship. Conceptualised as a curated Start-up Mela, Him-CONNECT brings together Project Investigators, Start-ups, Industry leaders, Investors, Incubators, Mentors, Policymakers, and Development agencies to catalyse the translation of Himalayan research into scalable, field-ready solutions.

The initiative responds to a critical need in the Indian Himalayan Region (IHR). While NMHS has supported a wide range of locally relevant, science-based innovations, many of these technologies require structured pathways for commercialisation, deployment, and adoption. Him-CONNECT serves as a link—creating a collaborative ecosystem where innovations meet enterprise. Further to this, organizing Him-CONNECT along with World Sustainable Development Summit 2026 (WSDS 2026) will provide wide base of stakeholders with visibility and acceptance of NMHS sponsored research outcome to Himalayan and global audience/ stakeholders.

**Vision**

- Showcase NMHS-supported innovations for real-world application
- Enable start-ups and enterprises to adopt, adapt, and scale
- Facilitate mentorship, matchmaking, and investment linkages
- Strengthen policy–industry–community convergence in mountain regions

**Thematic Areas**

- Agri-innovations
- Climate-resilient Infrastructure Development
- Dairying Innovations
- Harnessing Green Energy
- Innovative Water Management / Treatment Technologies
- Sustainable Utilization of Bio-resources
- Waste to Wealth

**What Him-CONNECT envisages**

- Start-up Mela & Innovation Showcase: Selected NMHS Principal Investigators from Himalayan States and UTs present their technologies and innovations through dedicated exhibition stalls, live demonstrations, and project visuals.
- Mentorship & Matchmaking: Structured interactions with experts from academia, industries, finance sectors, incubators, and government bodies/ agencies to refine business models, understand regulatory pathways, and identify scaling opportunities.
- Flash Talks & Knowledge Exchange: Short, high-impact presentations where innovators articulate the science, relevance, and application potential of their solutions to diverse stakeholders.
- Investor & Institutional Engagement: Exposure to angel investors, startups, incubators, mentors, impact funds, CSR foundations, development finance institutions, and state start-up missions to unlock funding and partnership opportunities.

**Expected Outcome of Himalayan Solutions**

By aligning science, entrepreneurship, finance, and policy, Him-CONNECT seeks to accelerate the journey of Himalayan innovations—from lab and field trials to livelihoods and markets—ensuring that research investments under NMHS are translated into lasting developmental and environmental impact across the Indian Himalayan Region.

# List of Exhibitors/ Innovators (Project PIs)

## NMHS Principal Investigators

### Him-CONNECT – Layout Plan

| Stall No. | Innovation | Innovator/ PI | Affiliation |
|---|---|---|---|
| **Theme: Climate-resilient Infrastructure Development** | | | |
| 1 | Realtime prediction of rainfall induced landslides | Prof. Varun Dutt | Indian Institute of Technology (IIT) -Mandi, Himachal Pradesh<br>E: varun@iitmandi.ac.in<br>M: 8627974036 |
| 2 | Unmanned Underwater Vehicle for Rivers | Prof. Subashisa Dutta | Indian Institute of Technology (IIT) -Guwahati, Assam<br>E: subashisa@iitg.ac.in<br>M: 9435104598/ 9957211069 |
| 3 | Eco-friendly Road Building | Dr. Siksha Swaroopa Kar | CSIR-Central Road Research Institute (CRRI), New Delhi<br>E: siksha.crri@nic.in<br>M: 9999411171 |
| 4 | Geosynthetic Roads for High Altitudes | Dr. G. Bharath | CSIR-Central Road Research Institute (CRRI), New Delhi<br>E: bharat.crri@nic.in; bharat.varma.020@gmail.com<br>M: 9154111114 |
| 5 | Disaster Resilient Housing Techniques | Dr Aditya Singh Rajput | Indian Institute of Technology (IIT) -Ropar, Punjab<br>E: aditya.rajput@iitrpr.ac.in<br>M: 82668 03773 |
| 6 | Reaction Frame for Seismic Masonry Tests | Dr. Sanjay Chikermane | Indian Institute of Technology (IIT) –Roorkee, Uttarakhand<br>E: sanjaychikermane@gmail.com<br>M: 99174-84699 |
| **Theme: Waste-to-Wealth** | | | |
| 7 | Green Synthesis of Carbon Nanomaterials | Prof. Nanda Gopal Sahoo | Kumaun University, Nainital, Uttarakhand<br>E: ngsahoo@yahoo.co.in<br>M: 91491 35437 |
| 8 | Treated Wastewater for Hydroponic Farming | Dr. Lalit Giri | G.B. Pant National Institute of Himalayan Environment (NIHE), Almora, Uttarakhand<br>E: lalitorchid@gmail.com<br>M: 9410184792 |
| 9 | Sericulture Waste to Burn Ointments | Dr. Syed Mudasir Ahmad Andrabi | Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, J&K<br>E: mudasirbio@gmail.com, mudasirbio@skuastkashmir.ac.in, M: 9419514131 |

| Stall No. | Innovation | Innovator/ PI | Affiliation |
|---|---|---|---|
| 10 | Food Waste to Plant Nutrition | Dr. Aparna Maitra Pati | CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur, Himachal Pradesh<br>E: aparna@ihbt.res.in, aparna.maitra@csir.res.in, btc.ihbt@csir.res.in<br>M: 98160 24955 |
| **Theme: Harnessing Green Energy** | | | |
| 11 | Climate Tech for Himalayan Livelihoods | Dr. Lal Singh | Himalayan Research Group (HRG), Shimla, Himachal Pradesh<br>E: lalhrg@gmail.com<br>M: 98160-26820/ 0177-2626820 |
| 12 | Low-Cost Mineralised Water Purifier | Dr. Jaspreet Kaur Randhawa | Indian Institute of Technology (IIT) - Mandi, Himachal Pradesh<br>E: jaspreet@iitmandi.ac.in<br>M: 9805191075 |
| **Theme: Innovative Water Management/ Treatment Technologies** | | | |
| 13 | Pine Needle based Wastewater Treatment | Dr. Vasudha Agnihotri | G.B. Pant National Institute of Himalayan Environment (NIHE), Almora, Uttarakhand<br>E: vasudha@gbpihed.nic.in<br>M: 9997907119 |
| 14 | Solar Micro-Grid Drinking Water System | Dr. Anup Shukla | Indian Institute of Technology (IIT) – Jammu, J&K<br>E: anup.shukla@iitjammu.ac.in<br>M: 9906212671 |
| 15 | Decentralised Wastewater Reuse in Himalayas | Dr. Deepak Swamy | Indian Institute of Technology (IIT) -Jodhpur, Rajasthan<br>E: dswami@iitj.ac.in<br>M: 8628039502 |
| **Theme: Dairying Innovations** | | | |
| 16 | Yak Milk Cottage Cheese Processing | Dr. Rakesh Kr. Raigar | Central Agricultural University (CAU)-Imphal, Manipur<br>E: rakeshiitkgp07@gmail.com; rakeshcaepht@gmail.com<br>M: 94474 682664 |
| 17 | Tech, Dairy based Livelihoods for Women | Dr. Adil Gani | University of Kashmir, J&K<br>E: adil.gani@gmail.com<br>M: 7006599755 |
| **Theme: Sustainable Utilisation of Bio-resources** | | | |
| 18 | Bamboo Bricks for Affordable Housing | Dr. Sudipta Halder | National Institute of Technology-Silchar, Assam<br>E: sudiptomec@gmail.com; shalder@mech.nits.ac.in<br>M: 9435387403 |
| 19 | By-products from Pruned Tea Residue | Dr. Saikat Kumar Jana | National Institute of Technology, Yupia, Arunachal Pradesh<br>E: saikatmicro4@gmail.com; saikat@nitap.ac.in<br>M: 9485230608 |

| Stall No. | Innovation | Innovator/ PI | Affiliation |
|---|---|---|---|
| 20 | Packing Leaves as Plastic Substitute | Dr. Ashish Kar | TERI, Guwahati, Assam<br>E: ashishvision20@gmail.com; ashish.kar@teri.res.in<br>M: 99546 90697 |
| 21 | Rambans Plantation for Ecology and Livelihoods | Shri Sandeep Kandwal | Girish Grih Udyog Evam Resha Uttpadn Samit (GAURAS), Kimsar, Kotdwar, Uttarakhand<br>E: sankandwal@gmail.com<br>M: 9412111695 |
| 22 | Ringal/Himalayan Bamboo crafts | Dr. Rajendra Pant | Uttarapath Sewa Sanstha, Pithoragarh, Uttarakhand<br>E: uttarapath_india@rediffmail.com; omrajendrapant@rediffmail.com<br>M: 8859804914, 9451814288 |
| 23 | Livelihood Potential of Stinging Nettle | Dr. Vasudha Pant | Green Hills Trust, Almora, Uttarakhand<br>E: vasudha.pant@gmail.com<br>M: 05962 297988 (office) |
| **Theme: Agri-innovations** | | | |
| 24 | Shifting Cultivation and Coal Mining | Dr. S.K. Barik | North-Eastern Hill University (NEHU), Shillong, Meghalaya<br>E: sarojkbarik@gmail.com<br>M: 94361 00688 |

# List of Exhibitors Programme Coordinators

## EIACP-Green Skill Development Programme

| Stall No. | EIACP Centre Name | Representative 1 | Representative 2 |
|---|---|---|---|
| 25 | EIACP: HIMCOSTE and GSDP Products | Dr. Ritvik Chauhan, Information Officer, EIACP PC-Hub, HimCOSTE, Shimla, HP M. 8219939652 | Ms. Rigjin Chodden, Pradhan, Kangla Berries Khandma, Self Help Group |
| 26 | EIACP: Arunachal Pradesh and Assam | Dr. Anjan Chamuah, PO EIACP PC-Hub, DoEFCC, GoAP | Mr. James LugiPotom, GSDP Trainee |
| | | Mr. Samiran Kalita, IO, EIACP Assam | Mr. Manna Hazarika, Beekeeper |
| 27 | EIACP: Sikkim | Dr. Suman Thapa, Director cum EIACP RP Co-coordinator, Sikkim State Council of Science and Technology. | Shri. Karma Ongyal Bhutia, GSDP trainee of Microentrepreneur - NTFP Bamboo Crafts |
| | | Mr. Laxuman Darnal, Information Officer, M. 9046997253 | Mr. Uday Shanker Sharma, GSDP Candidate, M. 8986398824 |
| 28 | EIACP: GBPNIHE | Dr. Mahesha Nand, PO, M. 9627785457 Mr Kamal Tamta, IO, M. 9557085307 | Mr. John Gideon, GSDP Trainee 9027532865 |

## Small Grant Programme

| Stall No. | Small Grant Programme | Representative 1 | Representative 2 |
|---|---|---|---|
| 29 | Small Grants Programme 1 | Ms. Aradhana Goyal, Project Associate, SGP, E: aradhana.goyal@teri.res.in, M: 9868886400 | Mr. Sanjeev Kumar, Field Manager, SGP, E: sanjeev.kumar@teri.res.in, M: 9304439804 |
| 30 | Small Grants Programme 2 | | |

# Exhibitors / Innovators (Project PIs)

# Climate-resilient Infrastructure Development

## Realtime prediction of rainfall induced landslides

**Prof. Varun Dutt**
Professor
Indian Institute of Technology Mandi (IIT Mandi),
VPO Kamand, District Mandi,
Himachal Pradesh – 175005
E.mail: varun@iitmandi.ac.in

## Project Location

Villages: Kamand, Prashar, Kotropi
Block/Tehsil: Mandi Sadar, Padhar
District :Mandi
State: Himachal Pradesh

## Objectives

- To identify rainfall-induced landslide-prone areas using InSAR data, develop and deploy affordable Landslide Monitoring and Early Warning Systems (LMEWS)
- Integrate Machine Learning (ML)-based predictive models for real-time risk assessment and community preparedness.

## Key Activities / Interventions:

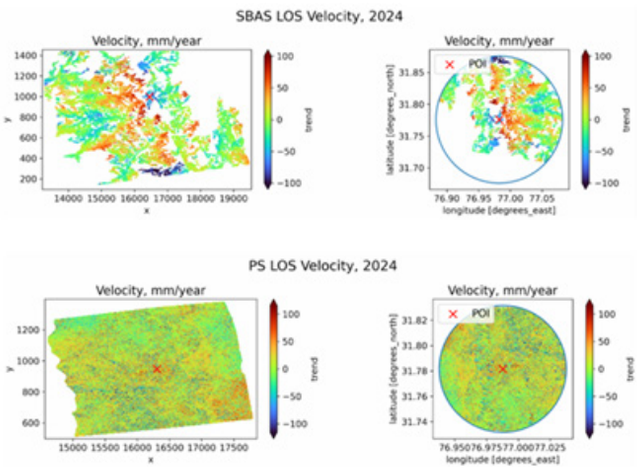
- Identifying rainfall-induced Landslide-prone Areas through Advanced Geospatial Analysis.
- Deployment of initial Landslide Monitoring and Early Warning Systems (LMEWS) in identified high-risk areas for testing and data collection.
- Refinement of ML models using initial data.
- Real-Time deployment of refined ML Models,
- Execution of Awareness and Educational Workshops.

## Key Outcomes:

- High-resolution Sentinel-1 InSAR analysis (2018–2024) identified high-subsidence zones (>60 mm/year) in Kamand Valley, guiding LMEWS prioritization.
- Three LMEWS units were deployed with DDMA Mandi, providing real-time monsoon monitoring via an integrated dashboard.
- Advanced ML and RL-based models achieved >90% predictive accuracy for landslide forecasting.
- A multimodal data infrastructure was established, supported by high-impact publications and community outreach.

## Project Impact:

The project strengthens disaster preparedness in the Indian Himalayan Region by enabling early detection of rainfall-induced landslides. It directly supports local administrations (DDMA), enhances community safety, reduces loss of life and infrastructure damage, and provides a scalable, low-cost technological model that can be replicated across other landslide-prone Himalayan states.




Sentinel-1 InSAR-derived ground deformation and landslide susceptibility mapping of Kamand Valley


LMEWS system deployed at Parashar, Segali Village

# Climate-resilient Infrastructure Development

## Unmanned Underwater Vehicle for Rivers

**Dr Subashisa Dutta**
Professor
Indian Institute of Technology Guwahati
Amingaon, North Guwahati, Guwahati, Assam 781039
E.mail: Subashisa@iitg.ac.in

### Project Location

District: Dehradun and Kameng
State: Uttarakhand and Arunachal Pradesh

### Objectives

- Develop low-cost robotic sensor systems to monitor underwater and adjacent land micro-environments in inaccessible river reaches.
- Conduct hydraulic experiments and 3D hydrodynamic–water quality modelling to establish hydrology–ecology relationships.
- Enhance Building Block and Network approaches of CIA using long-term data, landscape connectivity, and impact assessment.
- Develop decision-support tools and a real-time flash flood forecasting framework using sensor- and camera-based monitoring.

### Key Activities / Interventions:

- Conduct reconnaissance surveys, site inspections, and detailed assessments of selected river reaches.
- Design and fabricate low-cost underwater robotic systems with sensors, cameras, and communication modules for real-time hydro-ecological and flood monitoring.
- Perform hydraulic experiments and develop 3D hydrodynamic, sediment, and water-quality models to establish hydrology–ecology relationships.
- Strengthen CIA methodologies using Building Block and network-based approaches and integrate outputs into a Decision Support System.
- Facilitate stakeholder consultations and disseminate project outputs through digital platforms.

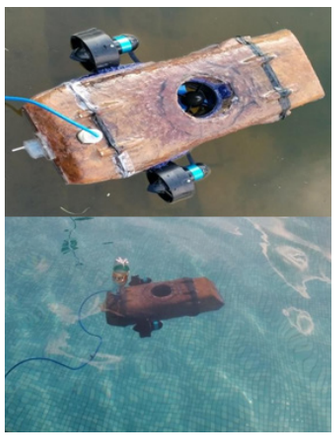
### Key Outcomes:

- Development of a low-cost robotic river monitoring system with sensors, imaging, and communication modules for real-time hydro-ecological observations.
- Improved understanding of flow behaviour and underwater micro-environments through field measurements, hydraulic experiments, and hydrodynamic–water quality modelling.
- A robust, network-based CIA modelling framework incorporating hydrology–ecology relationships for Himalayan rivers.
- Establishment of a web- and cloud-based platform for sharing models, data, and technical outputs.

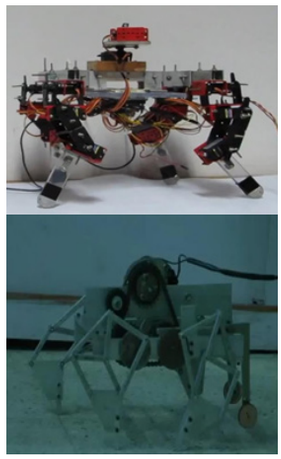
### Project Impact:

This project develops a holistic methodology to improve the water security, renewable energy, reduce the extreme hydrological vulnerability, and enhance biodiversity. As the project is generic in nature, the present methodology can be helpful for conducting CIA assessment in other basins by considering the local factors.

Prototype Underwater robot with camera, pressure and temperature sensors and (b) Testing of the Underwater robot



- Quadruped Robot with different Gate pattern
- All-terrain land robot testing



# Climate-resilient Infrastructure Development

## Eco-friendly Road Building

**Dr. Siksha Swaroopa Kar**
Senior Principal Scientist
CSIR-Central Road Research Institute
Mathura Road, New Delhi
E.mail: Siksha.crri@csir.res.in

### Project Location

| | |
|---|---|
| Villages: Jhimar<br>Block/Tehsil: Joshimath<br>District: Chamoli<br>State: Uttarakhand | Villages: Istingira<br>Block/Tehsil : Lahaul<br>District: Lahaul & Spiti<br>State: Himachal Pradesh |

### Objectives

- To demonstrate a mechanized cold bituminous road construction technology using the Mobile Cold Mixer cum Paver in cold Himalayan conditions, where conventional hot mix technology is difficult to adopt.
- To demonstrate cold bituminous road construction using tunnel muck material through a mechanized process, promoting sustainable waste utilization and eco-friendly infrastructure development in high-altitude Himalayan regions.

### Key Activities / Interventions:

- On-site cold mixing and mechanized paving using Mobile Cold Mixer cum Paver.
- Construction of trial road stretch under low ambient temperature conditions.
- Evaluation of mix quality, laying efficiency, and field performance.
- Utilization of tunnel muck as road construction material
- Cold mix production and mechanized laying using Mobile Cold Mixer cum Paver.
- Construction of trial road section under high-altitude and extreme cold conditions

### Key Outcomes:

- Successful demonstration of cold mix road construction at low temperatures.
- Improved mix uniformity and reduced construction time.
- Reduced fuel consumption compared to hot mix technology.
- Successful reuse of tunnel muck in cold bituminous road construction.
- Reduced need for natural aggregates and hot mix operations.
- Effective mechanized laying in high-altitude terrain.

### Project Impact:

- Environment-friendly Road construction with lower emissions.
- Improved road connectivity in cold and hilly terrain.
- Demonstrated suitability of mechanized cold mix technology for Uttarakhand.
- Reduction in environmental pollution and open dumping of muck.
- Lower energy consumption and greenhouse gas emissions.
- Enhanced sustainable road connectivity in Lahaul & Spiti region.

Demonstration of mechanized cold bituminous road construction using the Mobile Cold Mixer cum Paver.

Cold bituminous road construction using tunnel muck material through the Mobile Cold Mixer cum Paver at Istingira, Lahaul & Spiti, Himachal Pradesh.

# Climate-resilient Infrastructure Development

## Geosynthetic Roads for High Altitudes

**Dr. G Bharath**
Principal Scientist
CSIR Central Road Research Institute
Mathura Road, New Delhi-110025
E.mail: bharat.crri@nic.in

### Project Location

Villages: Manali-Sarchu
Block/Tehsil: Manali Tehsil
District: Kullu District
State: Himachal Pradesh

### Objectives

- To address the problem of using locally available materials in sub-base and base and enhancing their performance by means of geosynthetics.
- To provide satisfactory pavement composition for roads constructed at high altitudes, using locally available/marginal materials.

### Key Activities / Interventions:

- Laboratory evaluating the performance of the locally available materials in conjunction with geosynthetic materials.
- Development of Pavement design templates (considering the improved layer modulus).
- Evaluation of field test sections using Falling weight deflectometer (FWD) and Plate Load Tests

### Key Outcomes:

- Geosynthetic reinforcement significantly improved performance in terms of Rut depth reduction (RDR), Traffic benefit ratio (TBR), Modulus improvement factor (MIF) in pavements built with marginal materials.
- An indigenous repeated load testing facility was developed and validated with field performance data.

### Project Impact:

- Enables sustainable use of local materials and reduces reliance on imported aggregates.
- Contributes to reduced carbon footprint and environmentally sustainable infrastructure development.

Repeated Load Applicator for Pavement Performance

Laying of geocell reinforced pavement at NH-3, Manali-Sarchu road, Kullu District, Himachal

# Climate-resilient Infrastructure Development

## Disaster Resilient Housing Techniques

**Dr Aditya Singh Rajput**
Assistant Professor
Department of Civil Engineering
Indian Institute of Technology Ropar
Rupnagar, Punjab
E.mail: aditya.rajput@iitrpr.ac.in

### Project Location

Multiple locations in Himanchal Pradesh & Uttarakhand

### Objectives

- Studying vernacular housing typologies of the Northwestern Himalayan region and identifying climate- and disaster-resilient architectural and structural features.
- Assess earthquake resilience using simplified analytical, numerical, and experimental methods.
- Recommend modern interventions to enhance resilience, disseminate knowledge, and train local masons and communities to adopt best practices for climate- and disaster-resilient housing.

### Key Activities / Interventions:

- Assessment of climate-resilient architectural features in traditional housing systems.
- Evaluation of disaster-resilient structural features addressing earthquakes, landslides, forest fires, floods, and cloudbursts.
- Analytical, numerical, and experimental modeling to study earthquake resilience and propose alternative strengthening options.
- Development of modern intervention strategies to enhance climate and disaster resilience of vernacular housing.

### Key Outcomes:

- Document and technically assess Himalayan vernacular construction systems to capture architectural, material, climatic, and seismic performance.
- Build capacity and awareness among communities, artisans, professionals, and students on climate- and disaster-resilient practices.
- Integrate traditional knowledge with engineering research; develop guidelines and disseminate findings through trainings, workshops, publications, and visual models for wider outreach and adoption.

### Project Impact:

- Enhances climate resilience and disaster preparedness of Himalayan settlements by scientifically validating and promoting vernacular construction practices.
- Preserves indigenous building knowledge while integrating it with modern engineering to enable low-carbon, resource-efficient construction.
- Builds institutional and community capacity through training and outreach, supporting informed decision-making and behavioural change.
- Contributes to national climate priorities and SDGs by generating scalable, policy-relevant models for resilient mountain development.

Community Interaction by Team-CEVA at Hansa Village, Lahaul and Spiti district, Himachal Pradesh, during field visits and knowledge exchange.

CEVA team conducting a workshop for students of Cambridge International School, Kullu, on Himalayan vernacular architecture and climate-responsive building practices.

## Reaction Frame for Seismic Masonry Tests

**Dr. Sanjay Chikermane**
Assistant Professor
Indian Institute of Technology, Roorkee
Roorkee, Distt- Haridwar (Uttarakhand)
E.mail: sanjay.chikermane@ce.iitr.ac.in

### Objectives

- Development of Low-Cost Scaled-Down Reaction Frame for Seismic Assessment of Masonry and Traditional Structures.

### Project Location

Uttarakhand

**Key Activities / Interventions:**

Seismic assessment and innovation in traditional and masonry construction systems are severely constrained by the lack of accessible experimental testing facilities. Conventional reaction walls and strong-floor laboratories require heavy foundations, high capital investment, and fixed infrastructure, making them inaccessible to institutions and practitioners working in the Himalayan region. This limitation has restricted systematic study of vernacular systems such as Kath-Kuni construction, masonry retrofitting techniques, and connection behaviour—despite their relevance in a highly seismic and resource-constrained context.

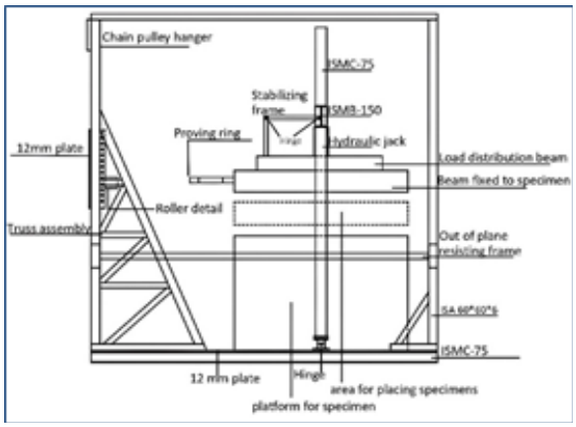
**Key Outcomes:**

The testing framework enables detailed identification of load-transfer mechanisms, failure patterns, ductility, and frictional behaviour in traditional walls, re-interpreted masonry systems. The scaled-down system costs approximately INR 90,000, nearly 10% of conventional testing infrastructure, while delivering reliable experimental results that closely match analytical predictions.

**Project Impact:**

By enabling affordable, region-specific structural testing, the system supports earthquake-resilient construction, conservation of traditional knowledge, capacity building, and sustainable development across the Himalayan region.

Side elevation of scaled-down reaction frame with loading setup




Testing of scaled-down traditional kath-kunni wall on the proposed reaction frame

## Green Synthesis of Carbon Nanomaterials

**Dr. Nanda Gopal Sahoo**
Professor
Kumaun University, Nainital-263002
Department of Chemistry, D.S.B. Campus, Nainital, Uttarakhand
E.mail: ngsahoo@yahoo.co.in

### Project Location

Block/Tehsil: Nainital
District: Nainital
State: Uttarakhand

### Objectives

- To develop and demonstrate a scalable waste-to-wealth framework for converting plastic waste into graphene nanosheets, fuels, and high-performance construction materials while enabling technological innovation, environmental sustainability, and socio-economic development.

### Key Activities / Interventions:

- Developed a nanotechnology-based process to convert waste plastic into reduced graphene oxide (RGO) and fuel through advanced upcycling.
- Enabled low-cost, scalable production of high-quality graphene for energy, electronics, biomedical, and construction applications.
- Utilized gaseous and solid by-products for fuel generation and cement reinforcement.
- Promoted sustainable plastic waste management while generating economic value in the Himalayan region.

### Key Outcomes:

The project successfully converted waste plastic into high-value graphene nanosheets, liquid fuels, and enhanced concrete materials, demonstrating a scalable waste-to-wealth model with proven energy, structural, and environmental benefits.

### Project Impact:

The project created significant environmental, technological, and socio-economic impact by reducing plastic pollution, enabling value-added utilization of waste plastics through graphene and fuel production, supporting sustainable infrastructure development, fostering skill development and awareness, and providing a scalable model for circular economy–based waste management, particularly in the Indian Himalayan Region.

Upcycling of solid waste plastic into value added product.

Collection of primary product and crude oil

## Treated Wastewater for Hydroponic Farming

**Dr. Lalit Giri**
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GB Pant National Institute of Himalayan Environment (NIHE)
GB Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora 263643, Uttarakhand
E.mail: lalitorchid@gmail.com; lalit.giri@gbpihed.nic.in

### Project Location

Districts: Dehradun and Kameng
States: Uttarakhand and Arunachal Pradesh

### Objectives

- To develop solar powered hydroponic prototype to utilize the treated water for the production of vegetables
- To standardize the protocol for cultivation of selected target species in Hydroponic technology utilizing the treated water.
- To popularize the hydroponic technique by conducting various training program to local beneficiaries in hydroponic technology

### Key Activities / Interventions:

- Development of a low-cost solar-powered drip-based hydroponic system near the Faecal Sludge Treatment Plant (FSTP), Leh.
- Optimization of treated wastewater (pH, EC, dissolved oxygen) for safe hydroponic use.
- Cultivation and comparative evaluation of tomato, cucumber, lettuce and other vegetables under treated wastewater, nutrient solution, and soil conditions. Nutritional, phytochemical, mineral, antioxidant, and heavy-metal analyses of produce.
- Received an Indian Patent for the innovative hydroponic system utilizing treated wastewater.

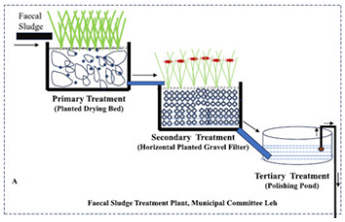
### Key Outcomes:

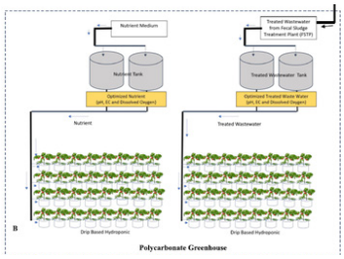
- Successful utilization of treated wastewater as a safe nutrient source for hydroponic vegetable cultivation.
- Higher yield and improved nutritional quality (lycopene, β-carotene, protein, antioxidants) in hydroponically grown vegetables compared to soil-grown crops.
- No detectable heavy metals in edible plant parts, ensuring food safety.
- Development of standardized protocols for multiple vegetable crops under cold-arid Trans-Himalayan conditions.

### Project Impact:

- Freshwater conservation in a water-scarce Trans-Himalayan region.
- Productive reuse of urban wastewater, reducing environmental pollution.
- Enhanced local food security and year-round vegetable availability in Ladakh.
- Demonstration of a climate-resilient, circular-economy-based agriculture model suitable for Himalayan regions.

Simplified flowchart: (A) Faecal Sludge Treatment Plant and its process for treating faecal sludge, and (B) growing tomatoes and other vegetables under a polycarbonate greenhouse using treated wastewater and nutrient-based drip hydroponics.




Drip-based hydroponic cultivation model for growing different vegetables using treated wastewater at Leh, Ladakh.

## Sericulture Waste to Burn Ointments

**Dr. Syed Mudasir Ahmad Andrabi**
Professor & Head
Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-Kashmir)
Faculty of Veterinary Sciences and Animal Husbandry, Srinagar, J&K
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### Project Location

Villages: Shuhama
District: Srinagar
State: Jammu & Kashmir

### Objectives

- The main objective is to develop a bioactive scaffold for the treatment of burn wounds that could ameliorate healing and reduce wound scars by remodeling extracellular matrix (ECM).

### Key Activities / Interventions:

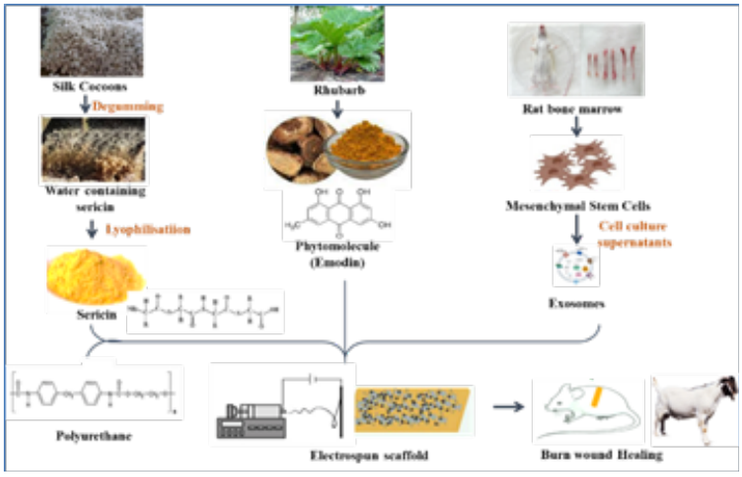
- Isolate and characterize mesenchymal stem cell–derived exosomes.
- Fabricate and functionalize polyurethane–sericin nanofibrous scaffolds with exosomes and emodin.
- Conduct physicochemical, mechanical, and in-vitro biocompatibility and migration assessments.
- Evaluate exosome release and in-vivo burn wound healing through animal studies and histopathological analyses.

### Key Outcomes:

- Developed a stable polyurethane–sericin electrospun scaffold enabling controlled co-delivery of exosomes and emodin.
- Significantly enhanced fibroblast viability, migration, and wound contraction (~99% by day 18).
- Promoted collagen deposition, neovascularization, reduced inflammation, and complete re-epithelialization.
- Achieved effective restoration of dermal architecture in full-thickness burn models.

### Project Impact:

- Developed a patented, cell-free regenerative burn bandage combining biomaterials with stem cell–derived factors.
- Accelerated wound healing, reduced scarring, fibrosis, infection risk, and treatment time.
- Enhanced functional skin regeneration via improved angiogenesis and collagen deposition.
- Reduced hospitalization and costs while offering a scalable, indigenous alternative with strong clinical and commercialization potential.




Schematic workflow of BurnRecover Bandage fabrication, showing sericin extraction, emodin sourcing, mesenchymal stem cell–derived exosome isolation, and electrospinning of the polyurethane–sericin scaffold.
The diagram also illustrates bioactive incorporation and in-vivo validation in rat and goat burn wound models.

## Food Waste to Plant Nutrition

**Dr. Aparna Maitra Pati**
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### Project Location

Villages: Nagar Panchayat Narkanda
Block/Tehsil: Shimla
District: Shimla
State: Himachal Pradesh

### Objectives

- Selection of microbial strain through biochemical characterization and enzymatic assay (pectinase, cellulase, laccase, lipase, and protease) for efficient degradation of food waste
- Formulation of microbial bioformulation using stress tolerant efficient bacteria for bioconversion of food waste into good quality compost
- Fortification of compost into high-quality bioformulation for crop improvement and its quality, toxicity and safety evaluation

### Key Activities / Interventions:

- Convert kitchen waste into value-added compost through microbial processing.
- Screen and select biocompatible bacterial strains with hydrolytic and plant growth–promoting traits.
- Develop and optimize microbial consortia–based composting formulations using suitable carrier materials.
- Evaluate compost quality, safety, and enrichment with plant growth–promoting rhizobacteria.

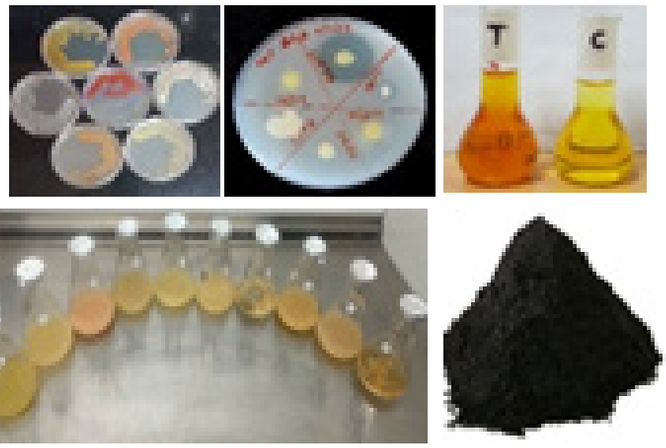
### Key Outcomes:

- Transfer the developed food-waste management process to Nagar Panchayat, Narkanda, with full operational handholding.
- Enable replication of the model across hilly municipalities in the Himalayan region.
- Support waste-to-resource start-ups using the developed technology.
- Supply enriched compost to meet high regional demand for organic manure and support sustainable agriculture.

### Project Impact:

- Directly benefits Nagar Panchayat and local communities, with potential to extend to other eco-fragile Himalayan regions through localized treatment of waste food.
- Supports local communities, environment, and public health in cold areas.
- Provides training and entrepreneurship opportunities for youth to develop high-value bioformulations with business potential.

Compost Booster



# Harnessing Green Energy

## Climate Tech for Himalayan Livelihoods

**Dr. Lal Singh**
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### Project Location

Villages: Kawar, Dhlair, Rewnsi, Budhragh, Mulhas, Port, Surala
Block/Tehsil: Rohru, Nirmand, Gohar
District: Mandi, Shimla and Kullu
State: Himachal Pradesh

### Objectives

- Assess impacts of cost-effective solar water heating on reducing household carbon emissions, forest pressure, and women's drudgery in the Himachal Himalayas.
- Build community capacity for sustainable NTFP management, harvesting, value addition, and propagation.
- Promote fodder development and household enterprises to reduce forest dependence, enhance livelihoods, and support long-term sustainable mountain development.

### Key Activities / Interventions:

- Solar Energy for Water and Space Heating
- Fodder Development and Improved Composting
- Ex-situ NTFP Multiplication and Cultivation
- Button Mushroom Cultivation
- Popular Material and Knowledge Products

### Key Outcomes:

- Installed 307 solar water heating systems, achieving ~40% fuelwood savings and reducing 2.7 t carbon emissions per household annually; SOPs for fabrication and use were developed.
- Large-scale plantation of oak and improved fodder species, along with nursery development and grassland enhancement, reduced forest dependence.
- Trained 335 households in sustainable NTFP harvesting, propagation, vermicomposting, and mushroom cultivation, supported by SOPs, training materials, and awareness tools.

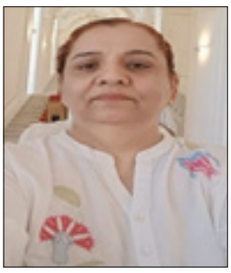
### Project Impact:

- Improved rural livelihoods, incomes, nutrition security, and employment for women, youth, and marginal farmers.
- Reduced women's drudgery, fuelwood dependence, household emissions, and indoor air pollution through solar water heating and improved practices.
- Enhanced fodder availability, soil health, and conservation of medicinal species via MAP cultivation, composting, and plantations.
- Lowered pressure on forests through integrated livelihood and energy solutions.
- Strengthened institutional linkages, scalability, and policy uptake across the Himalayan region.

Installation and Demonstration of Mountain Solar Water Heating System in Rural Areas of H.P.

Household member using Mountain Solar Water Heating System

## Low-Cost Mineralised Water Purifier



**Dr. Jaspreet Kaur**
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IIT Mandi
School of mechanical and material Engineering
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### Project Location

Villages: Kamand
Block/Tehsil: Kamand
District: Mandi
State: HimACHAL PRADESH

### Objectives

- Developed a low-cost, solar-powered water purification system with integrated mineral supplementation.
- Utilized accelerated solar-thermal energy for efficient, clean water treatment.
- Enabled off-grid, electricity-free filtration for underserved rural communities.
- Strengthened hybrid energy efficiency and scalability.
- Created strong potential for start-ups, pilot validation, and industry partnerships in water treatment.

### Key Activities / Interventions:

- Integrated solar thermal and photovoltaic energy to enable accelerated, low-cost water purification (SDG 6, SDG 7)
- Applied nanotechnology-enhanced photovoltaic systems with controlled nutrient enrichment for safe drinking water (SDG 6, SDG 9)
- Improved access to clean water and health outcomes for underserved communities, particularly women and children (SDG 3, SDG 5, SDG 10).
- Its scalable design and minimal energy requirements make it suitable for deployment in decentralized water-treatment units and rural installations.

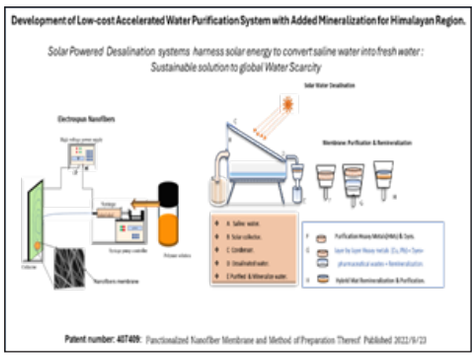
### Key Outcomes:

- Demonstrated a lab-scale prototype for remineralizing desalinated drinking water through controlled calcium ion release.
- Enabled stand-alone treatment for organic dye removal using combined thermal, mechanical, and light-driven catalysis.
- Provides a low-cost solution for wastewater treatment, supporting dye removal and detection of Cu2+ and Pb2+ contaminants.
- Validated sustained calcium supplementation over seven days, maintaining concentrations within drinking-water safety limits.
- Capable of purifying and remineralizing up to 5 L of water per cycle at laboratory scale.

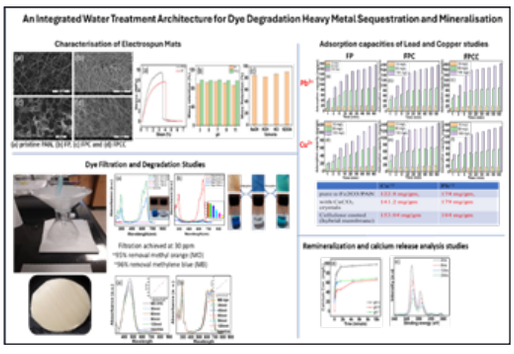
### Project Impact:

- Membrane-based and photocatalytic filtration enabled effective removal of heavy metals and degradation of organic pollutants using sunlight.
- Combined filtration and photodegradation delivered safer, clearer water without chemical additives.
- The system demonstrated stable, regulation-compliant calcium release and effective treatment of up to 5L water per cycle, highlighting strong translational potential

Development of Low-cost Accelerated Water Purification System with Added Mineralization for Himalayan Region




An Integrated Water-Treatment Architecture for Dye Degradation, Heavy-Metal Sequestration, and Remineralization.



# Innovative Water Management/ Treatment Technologies

## Pine Needle based Wastewater Treatment

**Dr. Vasudha Agnihotri**
Scientist E
G.B.Pant National Institute of Himalayan Environment-Himachal Pradesh Regional Centre, Mohal, Kullu, Himachal Pradesh
E.mail: vasudha@gbpihed.nic.in; vasudhaagnihotri@yahoo.com

### Project Location

District : Almora
State: Uttarakhand

### Objectives

- To synthesize the activated and bacterial activated carbon in bulk and their characterization.
- To standardize combined water purification system having Phytoremediation, bioremediation and fixed bed activated carbon-based process.
- To demonstrate the standardized purification system with model contaminants mixture and actual contaminated water.

### Key Activities / Interventions:

- Convert Chir pine (Pinus roxburghii) leaf litter into activated and bio-activated carbon for greywater treatment in fixed-bed systems.
- Apply integrated treatment processes—filtration, coagulation, ozonolysis, biodegradation, UV treatment, adsorption, and phytoremediation—to produce clear water suitable for non-potable use.

### Key Outcomes:

- Utilization of pine leaf litter (believed as cause of forest fire spread in mountains) for making adsorbent to remove emerging contaminants present in grey water
- The process tested to treat appx 2000-liter greywater produced in institute hostel mess per day

### Project Impact:

Improved access to clean drinking water using local technology

Part of pilot setup for greywater treatment

Greywater treatment using phytoremediation

# Innovative Water Management/ Treatment Technologies

## Solar Micro-Grid Drinking Water System

**Dr. Anup Shukla**
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### Project Location

Villages: Jagti
Block/Tehsil: Nagrota
District: Jammu
State: Jammu and Kashmir

### Objectives

- Develop power management system algorithms for optimal scheduling of remote micro grid.
- Improving resiliency and security of distribution network by developing new advanced control strategies off-grid and on-grid.
- 3-A (Analysis, Assessment and Availability), providing clean drinking water to remote areas of the Himalayan Region.

### Key Activities / Interventions:

- Rural Micro grid energy management system: Communication for monitoring and control between different energy sources.
- Improving resiliency and security of distribution network by developing new advanced control strategies.
- Design of water filter and portable water testing kit design.

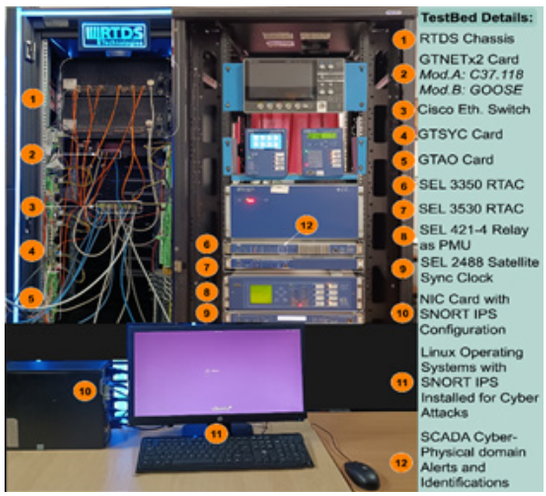
### Key Outcomes:

- Develop real-time energy management for microgrids, coordinating DERs, ESS, EVs, DGs, and loads to reduce operational costs.
- Implement adaptive ESS control strategies to support renewable integration and lower GHG emissions.
- Ensure reliable microgrid operation under disturbances, maintaining power system balance and efficiency in a smart grid environment.

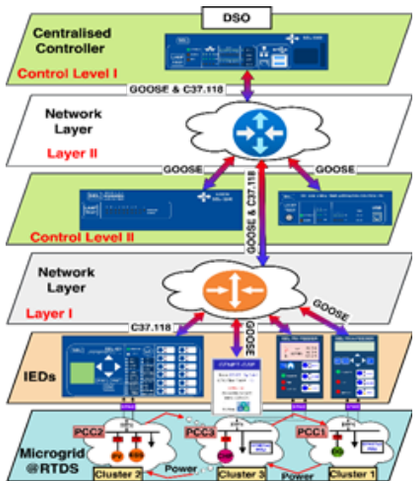
### Project Impact:

- Advances science-based control of power grids, benefiting future electric energy systems and society.
- Supports all stakeholders—solar/wind farm owners, consumers, and ISOs—by balancing generation and demand in high-RES smart grids.
- Promotes efficient, reliable, sustainable, and lower-cost energy supply for Himalayan region communities.

Testbed: Hardware setups for proposed microgrid realisation




Controller level logic/algorithm implementation for resilient operation of microgrid



# Innovative Water Management/ Treatment Technologies

## Decentralised Wastewater Reuse in Himalayas

**Dr. Deepak Swami (PI) and**
**Dr. Atul Dhar (Co-PI)**
Professor
Indian Institute of Technology
Jodhpur
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E.mail : dswami@iitj.ac.in

### Project Location

Villages : Nandli
Block/Tehsil : Kataula
District : Mandi
State : Himachal Pradesh

### Objectives

- To assess the impacts of land applications of treated wastewater on soil, plant, air, and water ecosystem services, while promoting social and cultural acceptance through active engagement of farmers, vulnerable groups, NGOs, and local and state stakeholders.

### Key Activities / Interventions:

- Decentralized wastewater treatment and effluent application in agriculture.
- Study the impact of treated wastewater on soil and sub-surface water quality.
- Assessment of uptake of emerging contaminants by crops at different growth stages. 4. Monitor the agricultural yield after the application of treated wastewater

### Key Outcomes:

- Development of guidelines and standards for the use of treated wastewater containing emerging contaminants.
- Enhance social and cultural acceptance among the stakeholders.
- Holistic analysis of treated wastewater and natural fertilizer applications on soil and sub-surface water.
- Comprehensive assessment of risk and benefits due to emerging contaminants.

### Project Impact:

- Promote “waste to wealth” practices by encouraging safe reuse of treated wastewater as a reliable irrigation source in the Indian Himalayan Region.
- Evaluate risks and benefits of emerging contaminants to address knowledge gaps in wastewater reuse.
- Build farmer awareness and acceptance of treated wastewater, supporting its adoption as a standard agricultural practice.

Prototype of Decentralized Wastewater Treatment Unit installed at the Project site (Nandli, Mandi, Himachal Pradesh)

Community awareness program held on 24 January 2026 at Nandli village, engaging villagers and stakeholders to promotez

## Yak Milk Cottage Cheese Processing

**Dr. Rakesh Kumar Raigar**
Assistant Professor
Central Agricultural University Imphal, Manipur
Department of Processing and Food Engineering College of Agricultural Engineering & Post Harvest Technology, Ranipool, Gangtok, Sikkim 737135
E.mail: rakeshiitkgp07@gmail.com

### Objectives

- To characterize the physicochemical, functional and nutritional attribute of Yak milk cottage cheese.
- Standardization and optimization of process technology for processing and packaging of Yak milk cottage cheese with indigenous technology for high yield and better quality.
- To characterize the yak milk cottage cheese for quality attribute and shelf-life assessment.
- Establishment of the prototype skid mounted production unit for the demonstration of Yak milk cottage cheese production technology

### Project Location

Villages: Village Kupup and Lachen
District: Gangtok & Mangan
State: Sikkim

### Key Activities / Interventions:

- To characterize the physicochemical, functional and nutritional attribute of Yak milk cottage (hard churpi) cheese.
- Standardization and optimization of process technology for processing, packaging of Yak milk cottage cheese with indigenous technology for high yield and better quality.
- Establishment of the prototype skid mounted production (50 L/h) unit for the demonstration of Yak milk cottage cheese production technology.
- To develop an herb/flavour fortified yak milk cottage cheese (hard churpi).
- Skill development of entrepreneurs regarding production of cottage cheese (hard churpi).

### Key Outcomes:

- Standardized and optimized process parameters for cream separation, coagulation and drying of Yak milk cottage cheese (hard churpi) with indigenous technology for high yield and better quality.
- Characterized of the yak milk cottage cheese for quality attribute and shelf-life assessment.
- Design and development of the prototype skid mounted production unit (50 L/Batch) for the demonstration of Yak milk cottage cheese production technology.

### Project Impact:

- Hygienic production of Yak milk products will help in the food safety and it prevent from contaminations.
- Training of Yak farmers of villagers in small scale processing technologies/skills will save energy, increase yield and shelf life of yak milk.
- Increased awareness and skilling in small scale processing of yak milk processing opportunities.


Prototype Yak milk cottage cheese (hard churpi) processing unit ( Capacity 50 L/batch)

## Tech, Dairy based Livelihoods for Women

**Dr. Adil Gani**
Associate Professor
University of Kashmir
Hazratbal, Srinagar- 190006, J&K
E.mail: adil.gani@gmail.com

### Project Location

Block/Tehsil: Ladakh/Pahalgam/Poonch/ Rajouri/ Gurez
District: Ladakh/Anantnag/poonch/ Rajouri/ Bandipora
State: Jammu & Kashmir

### Objectives

- Standardize and mechanize production of kalari, churpi, and kudaan using response surface methodology.
- Evaluate product quality through chemical, microbiological, bioactivity, and sensory analyses.
- Develop locally sourced packaging to extend shelf life.
- Demonstrate standardized processes and edible packaging to women of nomadic communities.

### Key Activities / Interventions:

- Developed standardized, hygienic production methods for traditional cheeses (chhurpi, kradi/kalari).
- Designed and prototyped a portable, electricity-powered mechanized cheese-making unit mimicking artisanal processes.
- Integrated pasteurization, incubation, and churning in a single chamber to reduce time and improve efficiency.
- Enabled controlled, small-scale production (5–10 L milk) suitable for household and tribal use.
- Aimed to strengthen women-led value chains by improving productivity and reducing drudgery.

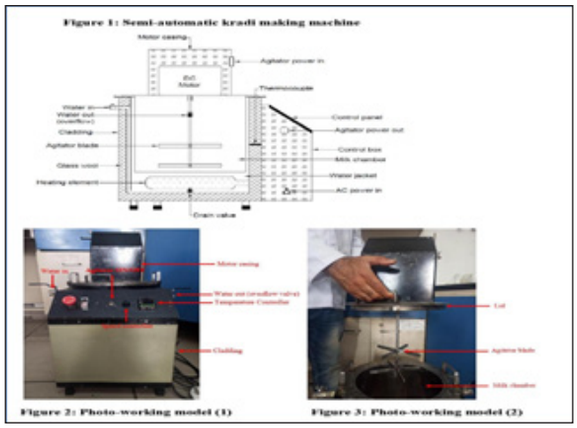
### Key Outcomes:

- Standardized and mechanized processing of traditional Himalayan dairy products, improving efficiency, reducing time and costs, and resulting in a patented semi-automatic prototype.
- Enhanced nutritional, functional, and sensory quality of products through fortification with saffron and sea buckthorn.
- Developed sustainable, locally sourced edible coatings and packaging to extend shelf life and reduce spoilage.
- Transferred technologies through trainings and demonstrations, strengthening women-led value chains and livelihoods.
- Bridged traditional knowledge with modern processing to support food security and socio-economic empowerment of tribal communities.

### Project Impact:

- The project created a significant socio-economic and technological impact by integrating scientific interventions with traditional dairy practices of the Himalayan region of Jammu and Kashmir.
- Nutritional enrichment and shelf-life extension increased product value and health benefits.
- Capacity building empowered tribal women, strengthened value chains, and improved livelihoods sustainably.

The kradi/ kalari making machine designed and developed to mechanise the traditional kradi making process.




Demonstration of the kradi/ kalari making machine to the nomadic tribal community of Aru Valley Pahalgam, District Anantnag, J&K

## Bamboo Bricks for Affordable Housing

**Dr. Sudipta Halder**
Associate Professor
National Institute of Technology
Silchar, Cachar, Silchar, Assam
E.mail: shalder@mech.nits.ac.in

### Project Location

| | |
|---|---|
| Village-I: Khurai Laishram Leikai<br>Block/Tehsil: Porompat<br>District: Imphal East<br>State : Manipur | Village-II: Fakirtilla<br>Block/Tehsil: Sonai<br>District: Cachar<br>State: Assam |

### Objectives

- Extraction of bamboo short micron fibers (BMFs) from locally available bamboo column.
- Treatment of BMFs to reduce environment effect.
- Preparation of bamboo bricks and laminated boards.
- Investigation of bamboo bricks/laminated board performance with climate change.
- Sustainability analysis of bamboo bricks/laminated boards from BMFs.
- Techno economic analysis of bamboo bricks/laminate boards.
- Demonstration of low cost and durable model house using bamboo bricks/laminates.

### Key Activities / Interventions:

- Fabricate bamboo bricks and laminated boards for housing applications.
- Conduct skill development trainings for local communities and construction workers.
- Assess sustainability and techno-economic feasibility to demonstrate cost reduction.
- Demonstrate applications in housing, transport, and household materials.
- Facilitate technology transfer to small- and large-scale industries for sustainable bamboo-based products.

### Key Outcomes:

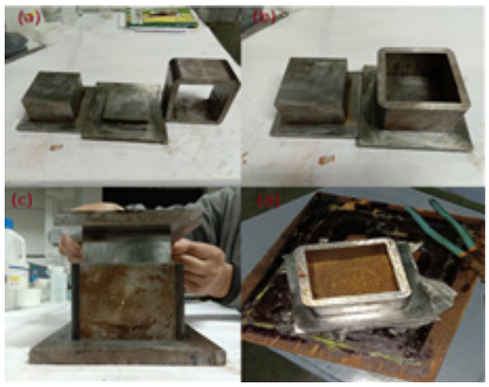
- Bamboo micro-fibres (BMFs) were successfully produced using a high-yield mechano-chemical process, with mass-production capability and surface treatments for enhanced properties.
- Bamboo bricks, laminates, and beams demonstrated superior flexural strength compared to conventional materials, achieving up to 175.63 MPa in vinyl ester composites.
- Bamboo fibre laminates showed higher strength and stiffness than wood lumber, making them suitable for structural beams and columns.

### Project Impact:

Transfer of eco-friendly technology to various groups like local construction workers, women and the local community will help encourage sustainable building practices.

Construction of Bamboo Micron Fiber based model House Prepared at NIT Silchar.

a), (b), (c) showing all three parts of the mould and their arrangement and (d) is showing compressed BMFs resin mixture.



## By-products from Pruned Tea Residue

**Dr. Saikat Kumar Jana**
Assistant Professor
National institute of Technology,
Arunachal Pradesh
Jote, District: Papum Pare
Arunachal Pradesh
E.mail: saikatmicro4@gmail.com

### Project Location

Villages: Jote
District: Papum Pare
State: Arunachal Pradesh

### Objectives

- Optimization of phenolic and antioxidants from pruned Tea plant residues.
- Development of value-added products such as soaps; sanitizer etc. using extracted phenolic and antioxidants.
- Production of Biomass pellets fuel from Pruned tea waste: A renewable energy source

### Key Activities / Interventions:

- Optimization of phenolic and antioxidants from pruned Tea plant residues
- Development of value-added products such as soaps; sanitizer etc. using
- extracted phenolic and antioxidants
- Production of Biomass pellets fuel from Pruned tea waste: A renewable energy source

### Key Outcomes:

- Value-added utilization of pruned tea residues through optimized extraction of phenolics/antioxidants and development of herbal products.
- Conversion of residual biomass into renewable pellet fuel, enabling a zero-waste circular economy.
- Creation of sustainable rural livelihood and clean energy opportunities in tea-growing regions.

### Project Impact:

- Promotes sustainable waste-to-wealth utilization of pruned tea residues, reducing agricultural waste and environmental burden.
- Enhances rural income and employment through decentralized production of herbal products and biomass-based renewable energy.
- Supports clean energy adoption and circular economy practices aligned with climate action and rural development goals.

Workshop on Formulation of Cosmetic Products using Tea extract

Introducing agricultural waste based biomass pellets and stove in different rural parts of Arunachal Pradesh

## Packing Leaves as Plastic Substitute

**Dr. Ashish Kar**
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The Energy and Resources Institute (TERI)
TERI-Northeastern Regional Centre,
VIP Road, Chachal,
Guwahati-781036, Assam
E.mail: ashish.kar@teri.res.in

### Project Location

Villages: Paham Mawlein, Mawkangi, Umklai, Umkaduh, Nartap, Chasingre, Ganol Songma
Block/Tehsil: Umling and Rongram
District: Ri-Bhoi and West Garo Hills
State: Meghalaya

### Objectives

- Awareness programme to promote packing leaves as substitute of plastic
- Capacity building on package and practice of cultivation and processing
- To increase cultivation area of Phrynium pubinerve plants

### Key Activities / Interventions:

- Established nurseries with required infrastructure and carried out large-scale plantation and management of packing leaf (Phrynium pubinerve).
- Developed value-added products from unutilized plant parts to enhance resource use and livelihood potential.
- Conducted community awareness programmes and baseline surveys to identify beneficiaries.
- Organized capacity-building trainings on nursery management, plantation practices, processing, grading, and marketing.

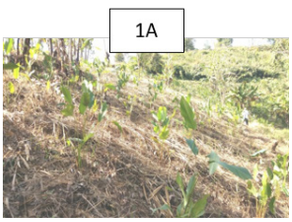
### Key Outcomes:

- Established 72 ha of plantations, four nurseries, and five demonstration plots.
- Developed five eco-friendly, plastic-substitute products and produced multilingual brochures and a technical manual.
- Conducted six training programmes and eighteen community awareness programmes.
- Promoted productive use of wastelands and intercropping in horticulture and plantation systems.

### Project Impact:

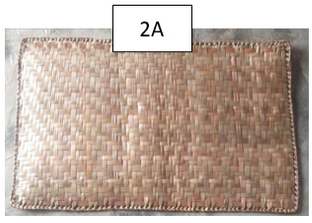
- Established 72 ha of packing leaf plantations, reducing pressure on wild populations and saving time for local communities.
- Directly benefited households, generating income from leaf sales, nursery seedlings, and value-added products.
- Improved livelihoods with significant earnings from increased leaf harvests and product diversification.
- Reduced soil erosion, improved soil moisture retention, and conserved topsoil in hilly orchards.
- Enhanced water availability in fields and enabled natural regeneration by limiting disturbance to wild packing leaf habitats.

Packing leaf plantation :- 1A: Packing leaf new plantation site ; 1B: Packing leaf plant at field

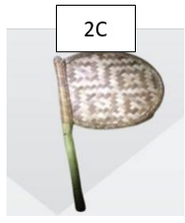




Eco-friendly value-added products from petiole:- 2A: Seating/ prayers mat; 2B: Hand fan; 2C: Bowl







## Rambans Plantation for Ecology and Livelihoods

**Mr Sandeep Kandwal**
Secretary
"GAURAS"
'Girish Grih Udyog evam Resh Uttpadn Samiti Kimsar'
Badrinath Marg Kotdwar
Bhadula complex near Beladat chauraha Ghrat Road Lalpur,
Kotdwar, Uttarakhand
E.mail: Sankandwal@gmail.com

### Project Location

| | |
|---|---|
| Villages : Kotkinda, Kasyali, Baghelgaon, Jayhari, Kandi, Amgaon, Thangar,Umroli,Pumba, Kuletha, Kanda | Block/Tehsil: Yamkeshwar<br>District: Pauri Garhwal<br>State: Uttarakhand |

### Objectives

- Prevention of Soil Erosion through Rambans Plants Plantation
- Prevention of Land Degradation through Rambans Plants Plantation
- Increase Forest Cover Area in the Region
- Increase of Fiber yield in the Villages
- Develop Income Generation Sources for the Villagers in Remote Areas
- Stop migration from villages

### Key Activities / Interventions:

- Rambans Plantation in non Agrrigated land or wasteland, landslide prone area.
- Decorticator installation.
- Field training on leaf harvesting, Decorticator running, Fiber extraction, Fiber maintenance Decorticator maintenance.
- Design development /training.
- Biogas system installation.

### Key Outcomes:

- Fibre Resource area developed,
- Value addition towards richness of the ecology system nearby plantation area/ village area.
- Fibre extraction plants are setup in the villages.
- Bio gas plants are setup in the villages near plantation sites.

### Project Impact:

- Improved the richness of the ecology
- Increased livelihood opportunities
- Increase in use of eco-friendly domestic biogas plants, leading to increased sustainability.

Rambans Plantation & Mechanical Process of Fiber Extraction

# Sustainable Utilisation of Bio-resources

## Ringal/Himalayan Bamboo crafts

**Mr Rajendra Pant**
Chief Functionary
Uttarapath Sewa Sanstha
Village- Kamtoli, Post office- Bhandarigawan,
Distt- Pithoragarh, Uttarakhand
E.mail: Uttarapath_india@rediffmail.com

### Project Location

Villages: 15 villages
Block/Tehsil: Munsyari, Kanalichina, Berinag
District: Pithoragarh
State: Uttarakhand

### Objectives

- To increase the Ringal/ Bamboo resources based on appropriate species and varieties in the homesteads and VP and degraded land.
- To diversify Bamboo handicraft products and improve their scale and quality.

### Key Activities / Interventions:

- Established bamboo (Himaltoni/Bambusa strictus) plantations across Van Panchayat and community lands to strengthen local supply chains.
- Planted over 26,000 saplings with active involvement of local communities and stakeholders.
- Promoted replacement of Gol Ringal with higher-value Dev Ringal to enhance community income.
- Supported alternative livelihoods through preparation and distribution of Ringal rakhis, benefiting marginalized SC and ST households.

### Key Outcomes:

- Successfully established large-scale bamboo and ringal plantations with community stewardship, strengthening local resource availability and sustainability.
- Shift from Gol Ringal to high-value Dev Ringal initiated, improving future income potential for local communities.
- Alternative livelihood opportunities created through Ringal rakhi production, supporting income diversification for marginalized SC and ST households.
- Enhanced community participation in plantation protection and management, contributing to long-term ecological and livelihood resilience.

### Project Impact:

- Improved livelihood opportunities through production of bamboo handicraft products
- Improved local ecology through large scale and participatory bamboo plantation


## Livelihood Potential of Stinging Nettle

**Dr. Vasudha Pant**
Secretary
Green Hills Trust
Kranti Kutir, East Pokharkhali, Almore, Uttarakhand
E.mail: Greenhills.alm@gmail.com

### Project Location

Block/Tehsil: Hawalbag
District: Almora
State: Uttarakhand

### Objectives

- Promote use of stinging nettle to improve health and livelihoods of hilly communities through awareness, skill development, and product development.
- Conduct awareness, training, and demonstration programmes on nettle-based Kunap Jala, and standardize and validate its application in selected crops of Almora district.

### Key Activities / Interventions:

- Validate nutritional value of wild stinging nettle and develop value-added food products through community engagement.
- Train villagers in quality harvesting, processing, and product development, while strengthening local supply chains.
- Develop, test, and disseminate low-cost nettle-based bio-fertilizers and bio-stimulants rooted in Vrikshayurveda for sustainable, climate-friendly farming.

### Key Outcomes:

- Dried nettle leaves were found rich in protein and essential macro- and micro-nutrients.
- Several edible and marketable nettle-based products were successfully developed.
- As a new product category, nettle-based livelihoods require sustained handholding to ensure quality and market adoption.
- Nettle-based Vrikshayurveda formulations showed potential to improve crop yield and quality in hill agriculture.

### Project Impact:

- Improved human nutrition and soil fertility through stinging nettle–based interventions.
- Developed value-added nettle food products with livelihood and market potential.
- Initial market uptake is gradual; sustained handholding, better packaging, and strategic marketing will support long-term sustainability and income generation.

Nettle harvesting

Nettle cutlet and Nettle Cinnamon Tea

## Shifting Cultivation and Coal Mining

**Prof. S.K. Barik**
Former Dean, School of Life Sciences
North-Eastern Hill University, Shillong, Meghalaya
E.mail: sarojkbarik@gmail.com

### Project Location

Multiple Locations: Batt Village (Itanagar, Arunachal Pradesh), Khulia (Ri Bhoi, Meghalaya), Lamchipp (Aizawl, Mizoram), Ungma (Mokokchung, Nagaland) and SK Para (Manu, Tripura)

Ledo (Assam) and Khliehriat (Meghalaya)

### Objectives

- Long-term ecological monitoring of shifting cultivation areas using imageries and GIS along a temporal and spatial scale; and to depict the changes in cropping pattern in shifting cultivation.
- Technology development for restoration of shifting cultivation areas in different states of northeastern India.
- Environmental monitoring and technology development for treatment of acid mine drainage (AMD) and restoration of coal mine affected areas in two states viz., Meghalaya and Assam of northeastern India.

### Key Activities / Interventions:

- Automated decision-tree algorithms and satellite data enabled mapping and long-term monitoring of shifting cultivation and coal mining areas.
- Site-specific four-tier agroforestry models and biofertilizers using indigenous microbial resources were developed.
- Integrated microbial and phytoremediation technologies piloted at AMD sites in Assam and Meghalaya.
- Selected microbial strains demonstrated strong heavy metal bioremediation, plant growth promotion, and high phytoremediation potential.

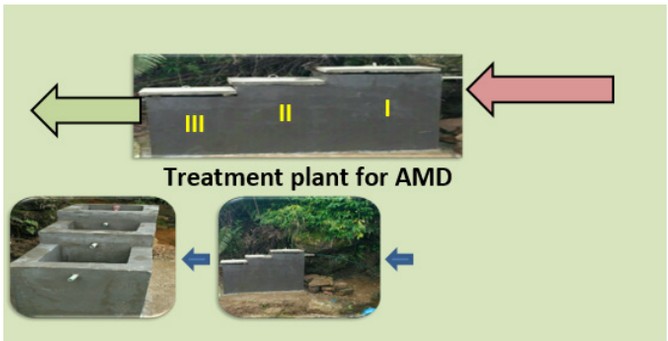
### Key Outcomes:

- Coal mine areas in Northeast India were mapped using IRS P6 LISS IV satellite data.
- A low-cost hybrid Acid Mine Drainage (AMD) treatment technology was developed and piloted for small-scale coal mine owners.

### Project Impact:

- Addressing persistent pollution caused by small privately held mines through development of AMD technology
- Scalable solutions developed helped address key challenges of shifting cultivation

Pilot AMD Treatment Plant



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