MIZORAM 2017

Proceedings of

SUSTAINABLE MOUNTAIN DEVELOPMENT SUMMIT VI

CLIMATE CHANGE & SUSTAINABLE MOUNTAIN CITIES

20th - 22nd September, 2017

Aizawl, Mizoram

MIZORAM 2017

Proceedings of

SUSTAINABLE MOUNTAIN DEVELOPMENT SUMMIT VI

"Climate Change & Sustainable Mountain Cities"

organised by:

Integrated Mountain Initiative

hosted by:

Mizoram Sustainable Development Foundation

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Preface

Shri Sushil Ramola
President, Integrated Mountain Initiative

I am delighted that you have the Proceedings of Sustainable Mountain Development Summit VI in your hands.

First of all, I would like to congratulate IMI and its state chapter Mizoram Sustainable Development Foundation (MSDF) for successfully conducting the Sixth edition of the Sustainable Mountain Development Summit (SMDS) which was attended by 320 people, with over 190 of them from outside the state of Mizoram. They volunteered their time and expertise for deliberations on the core themes of climate change and sustainable mountain cities. The resulting ideas and recommendations for action captured in this document will now be the agenda for action for IMI's Governing Council and Secretariat, along with our 8 state chapters and over 60 individual and institutional members, so that momentum isn't lost in the journey of IMI achieving its vision.

What is IMI and its vision, is a question we are often asked. As is clear to us by now, IMI is a civil society movement and an enabling platform where diverse stakeholders - individuals and institutions - come together to work on issues of mountains and realize their goals by integrating their purpose, knowledge and experience into a sustainable and holistic plan. IMI's vision of **'Making people of India proud of our Mountains'** is inclusive and strikes a deep chord among its members, state chapters, partners and all stakeholders across India, especially the mountain regions. IMI is guided by a set of values which we agreed to live by when we enrolled into IMI – being integrative, inclusive, collaborative, voluntary, democratic, open and most importantly passionate, which mountain people are known for.

IMI has pan-Himalayan focus with our members having served as policy makers, civil servants, researchers and at the grassroots. IMI recognizes the significance of their engagement in policy as a means of effecting systemic and sustainable change through assimilating knowledge and experience generated from practice in the field, scientific and social research and policymakers' perspective. Collaboratively building consensus around issues, learning from good practices and strengthening the human and institutional capacities to promote more innovative solutions locally are some of the elements of this approach.

Since its inception, IMI's flagship events, SMDS and Meet of the Mountain States (MoMS) provide two independent platforms for bringing the concerned persons from all the 10 states in IHR and the hill districts in the states of West Bengal and Assam to work towards cohesive action. From the first SMDS organized in Nainital to the subsequent events in Gangtok, Kohima, Itanagar, Leh and most recently Aizawl, the summits not only made the mountain communities aware of impacts of issues in the domains of climate change, forests, water, energy, urban development, mountain livelihoods, disasters, but also enabled them to understand the implications of the phenomena at regional and national level in terms of policy and praxis. MoMS, convened in Delhi every year between the two SMDS', is used as an avenue for sharing the outcomes of the preceding SMDS with a wider audience to influence policy and action with cooperation from all mountain states, key ministries such as Ministry of Environment

Forests and Climate Change and many other institutions such as FAO, UNDP and Swiss Development Cooperation in India.

As an outcome of the above events since 2011 and many other focused workshops, IMI adopted four themes as the most important to work in its strategic plan 2017-2020. These four themes are: **climate change, sustainable mountain cities, mountain agriculture and livelihoods and disaster risk reduction.** In each of these themes, IMI is also working on projects and programmes with support from likeminded multilateral and national institutions as partners.

The SMDS-VI at Aizawl, while it focused on the themes of climate change and sustainable mountain cities, as mentioned above, also marked the change of guard for the first time since inception of IMI through an election process which set the tone for rigor in IMI's work. The new Governing Council was announced at Aizawl and started its innings from Oct 1, 2017. I am thankful to the members and the governing council for their confidence in me to lead IMI for the next three year as its President. It is a tremendous responsibility and I dedicate to it by making sure we all work as one body, one team and one family to achieve our common goals.

"If I have seen farther than others, it is by standing upon the shoulders of giants", said Isaac *Newton. While taking on this responsibility, l*et me pay my debt of gratitude to our torch bearer and founding President Late Dr. R.S. Tolia - a visionary leader, passionate mountain man, lifelong learner, scholar, and administrator, who led by example. I also thank all the founding council members of IMI for their tremendous contribution in shaping the initial journey with many of them continuing to rededicate themselves to this great cause and the new council members who bring diverse leadership experience. I am confident that IMI will see farther upon the shoulders of these giants.

We have no shortage of challenges but we have the leadership team and the motivation to deal with them effectively. We will find innovative ways of strengthening our state chapters and engaging with our partners and stakeholders through appropriate interest groups and projects, in line with our common priorities and jointly find the necessary resources. The powerful constellation of our partners has always supported IMI whole heartedly. We are very alive to the responsibility that this trust and confidence imposes on us and so we must synergise the contributions and unique expertise of every one to realize our mission and goals.

Together we can move mountains for the mountains.

With best regards,

Sushil Ramola

Convenor's Note

Dr. Lalbiak Mawia Ngente
Convenor SMDS VI

Swinging like a pendulum, the Sustainable Mountain Development Summit oscillates from the northern corner of the Indian Himalayan Region to the tip of the north east India. After the successful hosting of SMDS V at Leh Ladakh by the Ladakh Snow Leopard Foundation, the sixth edition of Sustainable Mountain Development Summit (SMDS VI) was held at the sprawling Mizoram University campus in Aizawl, Mizoram during 20th – 22nd September, 2017. It will now swing back to the northern region of the country, wherein Himachal Pradesh will host the next edition towards the end of this year.

It was indeed a great pleasure and privilege for the Mizoram Sustainable Development Foundation to host the SMDS VI. The recent erratic rainfall patterns (and climate change), which exposed the vulnerability of the mountain cities, prompted the discussion at the summit to centre round the crucial themes of Climate Change and Sustainable Mountain Cities. The theme of Climate Change was further divided into three sub-themes: Research & Policy Gaps, State Action Plan on Climate Change and Adaptation Stories, while the theme of Sustainable Mountain Cities was also divided into the following sub-themes: Infrastructure Development, Water & Waste Management and Disaster Risk Reduction & Management.

Keynote Addresses of the two main themes were delivered by prominent experts who are the authorities on the subjects. Each breakout sessions had four selected paper presentations, wherein the discussions were very lively, informative and productive which reflected the rich regional diversity of the mountain regions of the country and their varied experiences of development at each and every level.

Three special parallel sessions were held during the summit. First and foremost was the Legislators' Meet which witnessed a galaxy of 31 legislators from eight states across the Indian Himalayan Region. They debated upon the Climate change and its impact on Indian mountain states, which culminated in the 'Aizawl Declaration'. The second special parallel session was the Policy Dialogue, on the draft 'National Policy for Indian Himalayan and Hill Regions in India', which was well-attended by the high ranking officials of the Central Government, Government representatives from the state chapters of IMI, officials of the UN and other International agencies and participants of the summit. Last, but not the least was a special parallel session on Building Partnership for sustainable mountain development, which contextualized SMDS as a platform to re-look at what have been achieved thus far, evaluate problems and challenges of the mountain communities and then move towards new ideas to find solutions by way of building partnerships across the mountain states of India.

During the summit, a plenary was devoted to Learning Session, wherein System Thinking and Landscape Governance were combined and touched upon by experts in the subjects. The other side events of the summit are Networking Bazaar and the 6th Indian Himalayan Photography Competition. Networking Bazaar brought the pan-Himalayan region NGOs, private or public organizations together to meet and network with each other, discover collaboration opportunities, as well as outreach to the general public about their work, services and programming. It also served an open forum for CBO's to

share /seek information, best practices and open dialogues on various themes. The 6th Indian Himalayan Photography Competition was an opportunity wherein photographers showcased their pictures depicting the scenic as well as cultural richness and beauty of the Himalayas.

Another important event organized in connection with the summit was the Youth Summit, which preceded the main summit. Taking the agenda for youth and sustainable development forward and as it had been organized in the SMDS-III at Kohima, Nagaland, the SMDS VI at Aizawl was preceded by the Youth Summit where 62 youth from the ten states participated and shared their opinions and perspectives. The credit for successful hosting of the Youth Summit goes to LEAD India for their support and help. During the Youth Summit, the 1st Young Mountain Filmmakers Competition also took place, wherein the young filmmakers from mountain states showcased their work on critical mountain issues like conservation, climate change, sustainability, loss of cultural identity etc. All the participants from the Youth Summit participated in the inaugural session of the SMDS VI.

The SMDS VI was inaugurated by the Hon'ble Chief Minister of Mizoram, Shri Lal Thanhawla, who emphasized the importance of such a forum to discuss how best to carry forward our sustainable development agenda which is so crucial for us. He also stress on the importance to note the factor in environmental cost in the development process as we cannot compromise on the ecological balance.

The keynote address on Climate Change was delivered by Dr. Navroz Dubash of Centre for Policy Research; while the keynote address on Sustainable Mountain Cities was delivered by Prof. Anne Feenstra, architect from Netherlands. The special parallel session of Legislators' Meet was held at the Mizoram Assembly Secretariat, which was chaired by Shri Hiphei, the Hon'ble Speaker of Mizoram and co-chaired by Shri PD Rai, Hon'ble MP from Sikkim, who is also the Councilor of IMI. The special parallel session of Policy Dialogue was chaired by Dr. Amita Prasad, Additional Secretary, MoEF&CC and co-chaired by Shri Alemtemshi Jamir, IAS (Retd.), President, IMI & Former CS, Nagaland wherein the chairman explained in details the draft 'National Policy for Indian Himalayan and Hill Regions in India'. The third special parallel session dwelled upon building partnership for sustainable mountain development.

Another interesting event during the summit was the MDoNER-NEC-IMI PLENARY session, wherein the opportunity to welcome and interact with Shri. Jitendra Singh, Hon'ble Union Minister of DONER arises. The session was chaired by Shri Alemtemshi Jamir, IAS (Retd.), President, IMI & Former CS, Nagaland. Shri. Jitendra Singh highlighted several steps taken to bring the Ministry closer to the people. He also informed the gatherings about the various inter-ministerial committees and state empowered committees formed to speed up funding for projects and urged the people to be aware of the various initiatives happening in different parts of the North East.

The valedictory session of the summit was graced by Lt. Gen. Nirbhay Sharma, PVSM, UYSM, AVSM, VSM (Retd), HE Governor of Mizoram who stressed that global warming, which is a live issue and affects the entire humanity and responsible for climate change world over, is one of the most important global challenges affecting our ecosystems. He also stressed upon the the importance of sustaining the Himalayan Ecosystem, the need to focus on disaster prevention and the need to study the adverse impact of climate change in all its dimensions and more importantly, discuss the strategies/action plan to mitigate such disaster and work towards capacity building.

In this session the Dr RS Tolia Award, which was instituted to keep Dr RS Tolia's memory and vision alive, was awarded to Ms. Rashmi Bharti for Avani and Dr. Lalbiak Mawia Ngente formally handed over the SMDS baton to Dr. Tej Pratap, Councillor, IMI, who represented Himachal Pradesh, which will host the next edition of SMDS.

For a small state like Mizoram with very limited infrastructure, resources and various connectivity challenges, organizing such an event as SMDS was a gigantic task. As a Convenor, I would like to place on record my gratitude and gratefulness to the core team of MSDF and members of the Summit Organizing Committee who worked tirelessly to make the event a success. On behalf of the Mizoram Sustainable Development Foundation, I acknowledge the untiring support of the State Government and various civil society organizations, the generous financial support of our partners and funding agencies, the guidance, support and encouragement of the Integrated Mountain Initiative. Without their support, encouragement and help, this summit would not have been possible and I also thank all the participants of the Summit. Last but not the least, I thank the Almighty for answering our prayers and for helping us realize our vision, ideas and plans in the form of SMDS-VI, which I believe, will have a fruitful and long lasting impact to the people of the Indian Himalayan Region.

Thank you.

Dr. Lalbiak Mawia Ngente

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SMDS-VI Partners

SMDS-VI IS POSSIBLE DUE TO THE GENEROUS FUNDING PROVIDED BY THE FOLLOWING AGENCIES

1. Swiss Agency for Development and Cooperation (SDC)
2. Ministry of Environment, Forest and Climate Change, Government of India
3. Ministry of Development of North Eastern Region (DoNER)
4. Government of Mizoram
5. Government of Uttarakhand
6. Government of Sikkim
7. Government of Arunachal Pradesh
8. Government of Nagaland
9. TATA TRUST – NEIDA
10. The Energy and Resources Institute (TERI)
11. International Centre for Integrated Mountain Development (ICIMOD)
12. National Bank for Agriculture and Rural Development (NABARD)

PROGRAMME SCHEDULE

DAY 1: 20TH SEPTEMBER, 2017

INAUGURAL SESSION 20TH SEPTEMBER, 2017	
Time (hrs)	DESCRIPTION
1600 - 1700	Registration, followed by High TEA and Seating of participants
1700 - 1705	Arrival of Chief Guest, Shri Lal Thanhawla, Hon'ble Chief Minister of Mizoram and Opening Song by Mizoram Cardinal Choir
1705 - 1710	Felicitation of Chief Guest and other dignitaries
1710 - 1720	Welcome Address and Summit Outline: Dr. Lalbiakmawia Ngente, Convener SMDS VI & President, MSDF
1720 - 1730	Opening Remarks and Journey of IMI: Shri. Alemtemshi Jamir, IAS (Rtd.), President IMI & Former CS, Nagaland
1730 - 1735	Special Remarks: Shri. P.D Rai, Hon'ble MI Lok Sabha, Sikkim
1735 - 1750	Address by Guest of Honor: Dr. Jitendra Singh, Hon'ble Minister of State (IC), Ministry of Development of North Eastern Region
1750 - 1825	Expectation from the Summit i) Prof. Lianzela, Vice Chancellor, Mizoram University ii) Mr. Ramesh Negi IAS (Rtd.),
1825 - 1845	Address & inauguration of SMDS VI by the Chief Guest
1845 - 1850	Vote of Thanks – Dr. John Zothanzama Organizing Secretary, SMDS VI
1850 - 1900	Group Photograph
1900 - 1925	**Inauguration of Photography Exhibition by the Chief Guest**
1925 - 1945	Departure for Multipurpose Hall, Mizoram University
1945 onwards	Live Music, followed by Dinner at Multipurpose Hall, Mizoram University

DAY 2: 21ST SEPTEMBER, 2017

PLENARY SESSION I: CLIMATE CHANGE 21ST SEPTEMBER, 2017	
Time (hrs)	Description
0915-0920	Invitation to dignitaries to be seated on the dais
0920-0925	Welcome Address – Shri Sushil Ramola, Secretary, IMI
0925-0955	Keynote Address: Dr. Navroz Dubash, Senior Fellow, Centre for Policy Research
0955-1005	Chairperson's Address
1005-1010	Vote of Thanks – Prof. Lalnuntluanga, Vice President, MSDF
1010-1015	Inauguration of Networking Bazaar: Shri. Rosiama Vanchhong, PCCF (WL), Mizoram

BREAKOUT SESSION: CLIMATE CHANGE			
Themes	Research & Policy Gaps Venue: Hall A (Administrative Conference Hall)	SAPCC Venue: Hall B (Education Conference Hall)	Adaptation Stories Venue: Hall C (Education Seminar Hall)
Time (hrs)	Chairperson: Dr. Akhilesh Gupta, Advisor, Department of Science and Technology, Government of India Co-Chairperson: Dr Rajendra Dobhal, Director General,Uttarakhand State Council of Science &Technology	Chairperson: Dr. Navroz Dubash, Senior Fellow, Centre for Policy Research Co-Chairperson:Dr S Satpathy, Ex-Director, Climate Change Division, Ministry of Environment, Forest & Climate Change	Chairperson: Dr. Kallur Murali, Director, IDRC Co-Chairperson: Ms Priyadarshinee Shrestha, Leader WWF Team Gangtok & IMI
1025-1035	Chairperson's remarks	Chairperson's remarks	Chairperson's remarks
1035-1155	Presentation 1: Protecting Climate Change Induced Internally Displaced Persons in India: Legal Gaps and Durable Solutions: Tarini Mehta Presentation 2 The Hindu Kush Himalayan Monitoring and Assessment Programme: Assessments and Science-Policy Dialogues to sustain a global asset: Mr BMS Rathore, ICIMOD Presentation 3: Formulation of policy based on research for the improvement of Traditional System of Agriculture with the ongoing changes in the climate: Meziwang Zeliang Presentation 4: Research & Policy Gaps in the Hindukush Himalayan Region: Smt.Suruchi Bhadwal,TERI Hi-AWARE Presentation 5: Connecting Society with Science and Policies for Resilience towards Forest Fires in Indian Himalayan Region: Surabhi Gumber	Presentation 1: Climate Change Adaptation Practices in Agro-ecosystems in the Sikkim Himalayas Climate change and its impact on health parameters in a Shimla district of HP, India: Ghanashyam Sharma and RavikantAvasthe Presentation 2: Responses Of Sensitive Fauna In The Face Of Climate Change In Sikkim Himalaya, India: Dr. Bhoj K. Acharya Presentation 3: Climate Change and its impact on health parameters: Dr M.P. Sood Presentation 4: Climate Change and its related issues pertaining to the state of Mizoram:Dr. James Lalnunzira Hrahsel, Project Scientist, State Climate Change Cell, MST&I Council, Mizoram Presentation 5: Implementation of Sikkim SAPCC: Shri D.G. Shrestha, Addl Director Sikkim State Council of S&T	Presentation 1: Climate Change & Urban Water Security - Views from Below: Dr. Deepa Joshi, University of Coventry Presentation 2: "Community Livelihood Nursery"– An Effective Tool to Restore Bamboo Diversity in Tripura: Sariel T Reang, Tripura Presentation 3: Soil nutrient conservation for sustainable Upland Farming: B Lalrinkima, NEIDA Presentation 4: Women as managers of risks and resources, building on work in Assam and Uttarakhand: Dr Rajan Kotru, ICIMOD Presentation 5: Promotion of Niche Value Chains and Appropriate Technologies for Sustainable Livelihoods of Marginal Communities in Uttarakhand: P. Tewari Presentation 6: An Innovative Use of Herbs in Local Health care: P Saha
1155-1230	Discussion and Q&A	Discussion and Q&A	Discussion and Q&A
1230-1300	Wrap-up Session: Co-Chairperson	Wrap-up Session: Co-Chairperson	Wrap-up Session: Co-Chairperson
1300-1400	Food Festival cum LUNCH at Multipurpose Hall, Mizoram University		

PLENARY SESSION II: SUSTAINABLE MOUNTAIN CITIES

21ST SEPTEMBER, 2017

Time (hrs)	DESCRIPTION
1410-1415	Invitation to dignitaries to be seated on the dais
1415-1420	Welcome Address – Smt. Fantry Mein Jaswal, Treasurer, IMI
1420-1450	Keynote Address: Prof. Anne Feenstra, Netherlands
1450-1500	Chairman's Address
1500-1505	Vote of Thanks – Dr. C Rinawma, Joint Secretary, MSDF

BREAKOUT SESSION: SUSTAINABLE MOUNTAIN CITIES

Themes	Infrastructure Development in Mountain Cities Venue: Hall A (Administrative Conference Hall)	Water & Waste Management in Mountain States Venue: Hall B (Education Conference Hall)	Disaster Risk Reduction & Management Venue: Hall C (Education Seminar Hall)
Time (hrs)	Chairperson: Prof. Anne Feenstra Co-Chairperson: Ms. Mandira Kala, PRS Legislative	Chairperson: Mr. R. P. Gurung, CEO, cotourism and Conservation Society of Sikkim (ECOSS) Co-Chairperson: Er. Lalrothanga, MES - Director, CCDU, PHED Mizoram	Chairperson: Prof. Janki Andharia, Dean of Jamsetji Tata School of Disaster Studies, TISS Co-Chairperson: Mr Praful Rao, Councillor, IMI & President, Save the Hills
1520-1530	Chairperson's remarks	Chairperson's remarks	Chairperson's remarks
1530-1650	Presentation 1: Tackling Climate Change and Making Mountain Town/Cities Smarter Through Climate Resilient Infrastructure: Pradeep Mehta, Director CHINAR Presentation 2: 'Incorporating the best international learning in Infrastructure Dev., Disaster Management and IT to build Smart and Sustainable Mountain Cities in India': Mr NSN Murty, Partner & Leader - Smart Cities, PwC Presentation 3: Sustainable Mountain Cities: Mr Anoop Nautiyal Presentation 4: Nexus between Climate, Infrastructure & Urbanization: Dr. Amir Bazaz, IIHS Bangalore Presentation 5: Automobile Ecosystem: Siddharth Rasaily, UD&HD, Govt of Sikkim	Presentation 1: Water in Himalayan Towns - Lessons for Adaptive Water Governance: Dr. Anjal Prakash, Programme Coordinator, HI-AWARE, ICIMOD Presentation 2: Application of geo-spatial technology for Sustainable land use planning and management based on water resources in Kawnpui: F Lalbiakmawia, PHED, Mizoram Presentation 3: Mr.Avinash Pratap Singh, Project Manager, Waste Warriors, HP Presentation 4: Waste Management in Aizawl city: Er. Valbuanga, PD, SIPMIU Presentation 5: Solid Waste Management – Gangtok: Ms. Priyadarshinee Shrestha, Team Leader, WWF	Presentation 1: Citizenship as negotiated through infrastructural spaces in Darjeeling Municipality and the need to expand the planning landscape: Roshan P Rai Presentation 2: Community Based Disaster Risk Reduction and Management in Mizoram: Dr. Lalrokima Chenkual, Assoc Prof, ATI Presentation 3 : Landslides in Sikkim: GC Khanal, Addl. Director, SDMA Sikkim Presentation 4: Laws, Acts, Rules and Regulations concerning the mountain states: Er. Zohmingthanga, AMC Presentation 5: Mr. Pankaj, Development alternatives New Delhi
1650-1720	Discussion and Q&A	Discussion and Q&A	Discussion and Q&A
1720-1740	Wrap-up Session: Co-Chairperson	Wrap-up Session: Co-Chairperson	Wrap-up Session: Co-Chairperson

MDoNER-NEC-IMI PLENARY 21ST SEPTEMBER, 2017	
Time (hrs)	Description
1730-1800	Arrival of Guests and Participants
1800-1805	Welcome Address – Shri. Alemtemshi Jamir, IAS (Retd.), President IMI & Former CS, Nagaland
1805-1815	NEC-IMI Partnership by Shri C. Kharshing, IA & AS Planning Adviser, NEC
1815-1825	Special Address by Shri. Lalmalsawma, IAS, Chief Secretary, Mizoram
1825-1835	Special Remarks by Shri. P.D. Rai, Hon'ble MP, Lok Sabha - Sikkim
1835-1855	Plenary Address by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Development of North Eastern Region (MDoNER)
1855-1900	Vote of thanks by Dr. Lalbiakmawia Ngente, Convenor SMDS VI & President, MSDF
1900 onwards	Inauguration of Cultural Program by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) , MDoNER followed by Dinner at MZU Multipurpose Hall

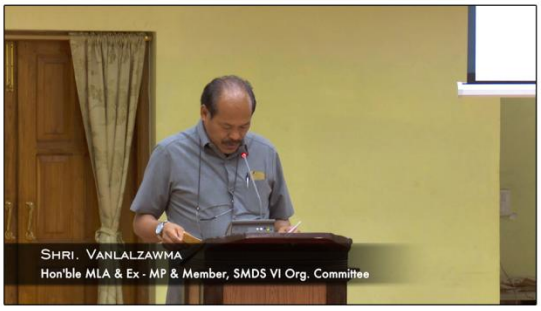
DAY 3: 22ND SEPTEMBER, 2017

PLENARY SESSION III: A PRACTITIONER'S PERSPECTIVE 22ND SEPTEMBER, 2017	
Time (hrs)	Description
0905-0910	Invitation to dignitaries to be seated on the dais
0910-0915	Welcome Address – Shri Amba Jamir, Councillor, IMI
0915-0945	Keynote Address on 'Systems Thinking': A Practitioner's Perspective: Shri Snehil Kumar, LEAD India
0945-1015	Keynote Address on 'Landscape Governance': Shri BMS Rathore, ICIMOD
1015-1035	Q&A on the Address
1035-1040	Vote of Thanks – Dr. Lalmuanpuii, Finance Secretary, MSDF

BREAKOUT SESSION		
Session	Policy Dialogue Venue: HALL A (Administrative Conference Hall)	Building Partnerships for Sustainable Mountain Development Venue: Hall B (Education Conference Hall)
Time (hrs)	Chairperson: Shri. Lalmalsawma IAS, Chief Secretary, Mizoram Co-Chairperson: Shri Alemtemshi Jamir IAS (Rtd.), former Chief Secretary, Nagaland	Chairperson: Dr. Gopal S Rawat, IMI Co-Chairperson: Dr Tej Partap, Councillor, IMI
1055-1100	Chairperson's remarks	Chairperson's remarks
1100-1110	Contextualization of the Meet: Shri Alemtemshi Jamir	Contextualization of the Session: Shri Krishna Singh Rautela, Development Consultant, ADB
1110-1140	Keynote Address: Dr. Amita Prasad, Addl. Secretary, Ministry of Environment, Forests and Climate Change	Keynote Address: Dr. Vincent Darlong, IMI & Ex-CPO, IFAD
1140-1225	Open Discussion and Q&A	Open Discussion and Q&A
1225-1240	Summary & next steps: Shri. Lalmalsawma	Summary & next steps: Dr Tej Partap, Councillor, IMI
1240-1245	Vote of Thanks: Dr. C. Vanlalramsanga (Secretary, Planning and Programme Implementation, Govt of Mizoram)	Vote of Thanks: Prof. Lalnundanga, Mizoram University & Member, Summit Working Committee

LEGISLATORS' MEET
22ND SEPTEMBER, 2017

Time (hrs)	DESCRIPTION
0900 - 0930	Arrival, Registration and Tea
0930 - 0935	Welcome and Opening Remarks by Shri. Hiphei, Hon'ble Speaker, Mizoram Legislative Assembly
0935 - 0940	Contextualisation of the Meet: Shri.P.D. Rai, Hon'ble MP, Lok Sabha- Sikkim
0940 - 1000	Keynote address by Ms. Mandira Kala, Head of Research, PRS Legislative
1000 - 1115	Open Discussion: Constituency Specific Chaired by Shri. Hiphei, Hon'ble Speaker, Mizoram Legislative Assembly Co-Chaired by Shri Jitendra Chaudhury, Hon'ble MP Lok Sabha, Tripura East • Challenges posed by Climate Change in the Constituency • Adaptation mechanisms in the State • SAPCC initiatives in the State • Policy level interventions required on Climate Change
1115 - 1125	Summary and next steps: Shri Conrad Sangma, Hon'ble MP Lok Sabha, Tura, Meghalaya Adoption of the Aizawl Declaration: Shri.P.D. Rai, Hon'ble MP, Lok Sabha- Sikkim
1125 - 1155	Presentations by Funding agencies
1155 - 1200	Vote of thanks: Shri. Vanlalzawma, Hon'ble MLA & Ex-MP and Member, Summit Organising Committee



SUMMARIZATION 22ND SEPTEMBER, 2017	
Time (hrs)	DESCRIPTION
1400-1405	Invitation to dignitaries to be seated on the dais
1405-1410	Welcome Address – Dr. Rajendra S Koshyiari
1410-1415	Opening Remarks – Shri. P.D Rai, Hon'ble MP Lok Sabha, Sikkim
1415-1515	Summarization: • Climate Change • Sustainable Mountain Cities • Youth Summit • Policy Makers' Dialogue • Legislators' Meet • Mountain Partnership
1515-1525	Concluding Remarks – Dr.Satyadeep Chettri, IMI
1525-1530	Vote of Thanks – Dr. Laltanpuii Ralte, MSDF
1530-1600	High Tea

VALEDICTORY SESSION
22ND SEPTEMBER, 2017

Time (hrs)	DESCRIPTION
1605-1630	Seating of participants and dignitaries
1630-1635	Arrival of Chief Guest And the Guest of Honour
1635-1645	Choir : The Leprosy Mission Choir
1645-1650	Felicitation of Chief Guest and other dignitaries
1650-1705	Address – Shri Alemtemshi Jamir IAS (Rtd.), out-going President, IMI & former CS, Nagaland
1705-1715	Presentation of R. S. Tolia Award : Ms. Fantry Mein Jaswal
1715-1720	Distribution of Prizes : Secretaries, MSDF
1720-1730	Presentation of the new IMI Team – Shri Krishan Singh Rautela, R.O IMI
1730-1740	Speech: New President, IMI
1740-1750	Speech by Shri. Lalmalsawma IAS, Chief Secretary, Mizoram & Working Chairman, SMDS VI Organising Committee
1750-1800	Handling over the SMDS Baton: Dr. Lalbiakmawia Ngente, Convenor SMDS VI & President, MSDF (& Speech from the new Host)
1800-1810	Speech by the Guest of Honour
1810-1830	Valedictory Speech by the Chief Guest
1830-1835	Vote of Thanks – Prof. Lalnuntluanga, Vice President, MSDF
1835-1840	Departure of Chief Guest
1840-1845	Departure for Multipurpose Hall, Mizoram University
1845-2030	Musical Extravaganza and Cultural program followed by Dinner

1. SUMMIT PROCEEDINGS AND DELIBERATIONS

A. DAY 1: WEDNESDAY, 20 SEPTEMBER 2017

INAUGURAL SESSION

- Welcome address
- Opening remarks and journey of IMI
- Remarks on SMDS
- Remarks on policy in mountain states
- Inaugural Address

B. DAY 2: THURSDAY, 21 SEPTEMBER 2017

TECHNICAL SESSION I: CLIMATE CHANGE

- Understanding climate change in local context

BREAKOUT SESSION I: RESEARCH AND POLICY GAPS

- Protecting Climate-Induced Internally Displaced Persons in India: Legal Gaps and Solutions
- The Hindu Kush Himalayan Monitoring and Assessment Programme (HIMAP) Assessments and Science-Policy Dialogues to Sustain a Global Asset
- Fallow Management in Shifting Cultivation: A Review of Opportunities and Challenges and the way forward in North East India by taking the Institutional Economics Approach
- Research and Policy Gaps (around CCA) in the HKH Region and a glimpse into HI-AWARE

BREAKOUT SESSION II: STATE ACTION PLAN ON CLIMATE CHANGE (SAPCC)

- Climate Change Adaptation Practices in Agro-ecosystems in the Sikkim Himalayas
- Responses Of Sensitive Fauna in the Face Of Climate Change In Sikkim Himalaya, India
- Climate change and its impact on health parameters in a Shimla district of Himachal Pradesh situated in the foothills of Himalayas, India.
- Climate change in Sikkim Himalaya: Implementation of Sikkim State Action Plan on Climate Change

BREAKOUT SESSION III: ADAPTATION STORIES

- Community Livelihood Nurseries (CLNs) – An Effective Tool to Restore Bamboo Genetic Resources in Tripura
- Soil Nutrient Conservation for Sustainable Upland Farming: Introduction of Nitrogen Fixing Trees in Horticulture Orchard
- Strengthening Women's Roles as Risk and Resource Managers at the Frontline of Climate Change
- Use of Herbs in Local Health Care by Traditional Healers of Kanchanpur in Tripura

TECHNICAL SESSION II: SUSTAINABLE MOUNTAIN CITIES

- Sustainable Mountain Cities

BREAKOUT SESSION I: INFRASTRUCTURE DEVELOPMENT IN MOUNTAIN CITIES

- Sustainable Mountain Cities
- Incorporating Technology to build Smart and Sustainable Mountain Cities in India
- Citizenship as negotiated through infrastructural spaces in Darjeeling Municipality and the need to expand the planning landscape.
- Nexus between Climate, Infrastructure and Urbanisation
- Understanding Mobility Through the Evolving "Automobile Ecosystem" of the Twentieth-Century

BREAKOUT SESSION II: WATER & WASTE MANAGEMENT IN MOUNTAIN STATES

- Water in Himalayan Towns: Lessons for Adaptive Water Governance
- Application of Geospatial Technology for Sustainable Land Use Planning and Management Based on Water Resources in KawnpuiTown, Mizoram, India
- Waste Management in Aizawl City
- Waste Warriors' Work
- Zero Waste Himalaya

BREAKOUT SESSION III: DISASTER RISK REDUCTION & MANAGEMENT

- Disaster Risk Reduction & Management – Laws, Acts and Regulations Concerning the Mountain States: Roadmap to Stability for Aizawl City
- Community Based Disaster Risk Reduction & Management in Mizoram
- Rural Habitat in Mountainous Regions: Challenges for Disaster Resistance and Sustainability

MDoNER-NEC-IMI PLENARY

C. DAY 3: FRIDAY, 22 SEPTEMBER 2017

LEARNING SESSIONS : SYSTEMS THINKING AND LANDSCAPE GOVERNANCE

- 'Systems Thinking': A Practitioner's Perspective
- 'Landscape Governance'

POLICY DIALOGUE

- Draft National Policy for Indian Himalayan and Hill Regions in India

BUILDING PARTNERSHIPS FOR SUSTAINABLE MOUNTAIN DEVELOPMENT

LEGISLATORS' MEET

- Climate change and its impact on Indian mountain states
- Aizawl Declaration

VALEDICTORY SESSION

A. DAY 1: WEDNESDAY, 20 SEPTEMBER 2017

INAUGURAL SESSION

WELCOME ADDRESS

Dr. Lalbiak Mawia Ngente,
Convenor, SMDS VI and President, MSDF

Dr. Lalbiak Mawia extended a hearty welcome to everyone gathered to the sixth edition of SMDS on behalf of IMI and MSDF. He stated that the themes of Climate Change and Sustainable Development could not be better timed and Mizoram as the host state, where mountains are still green, rivers pure, air fresh and skies starry, only instils in us the energy to work to preserve nature's goodness. Then, he gave a brief outline of the Summit proceedings. He asked all delegates to actively participate in the discussions so that the objective of the summit as a knowledge sharing platform could be met. He stated that all mountain people should take it upon themselves to deliver optimum solutions through whatever tools available at their disposal. He concluded by saying, "If you want to walk fast, walk alone. If you want to walk far, walk together." The mountain people of this country want to walk far and achieve great things. And for this we have to work together to realise our common dreams."

OPENING REMARKS AND JOURNEY OF IMI

Shri Alemtemshi Jamir, IAS (Retd.),
President, IMI & Former CS, Nagaland

Mountains in India are known for their scenic beauty and as summer retreats. However, how often do we think of how valuable they are to us? Mountains in general and the Indian Himalayas in particular have played a vital role in the cooling of Planet Earth. The Himalayas also act as the fresh water tower of India, home to innumerable perennial rivers that have been cradles of civilizations. The Himalayas occupy 60% of the Indian landmass, possess 65% of India's forests and contribute hugely to ecosystem services. About 4% of India's population that inhabit the mountain regions, face many challenges- most importantly, disasters. Some other issues face the region are- poor economy, lack of adequate infrastructural development, unstable connectivity both communication and transportation.

A few people who understood the need to tend to the mountain regions got together to form a Non-Governmental Organisation. The IMI was formed with the vision of making the people of India proud of their Mountains. It is a movement where diverse stakeholders work on issues of Mountains and enable people and institutions to realise their potential. We have a governing council at the top, a secretariat, 8 state chapters, 53 members, 13 institutional members and have held 19 national and regional workshops. IMI is member of the Working Group on Skill Development in Mountain Regions under NITI Aayog. We have also undertaken a project under National Mission on Himalayan Studies and been part of the process of formulating a State legislation to mainstream Sustainable Development Goals in Sikkim through consultations and workshops. We have numerous partners such as - the Ministry of Development of North East Region, NEC, MoEFCC, GB Pant Institute of Himalayan Studies, Ladakh Autonomous Council, WWF, GEF, GIZ, FAO, ICIMOD, Tata Trust and Governments of various Mountain States- and we look forward to their sustained support.

REMARKS ON SMDS

Shri PD Rai,
Hon'ble MP, Lok Sabha (Sikkim)

The SMDS has been convened to have a deep conversation about the issues that are plaguing our mountain states. The extent of damage faced due to natural disasters today is incomparable with the impacts of calamities a few years ago. I request everyone present here to understand the urgency of the issue and engage actively in the discussion, for every view, every comment is valuable to us. The importance the issue garners is quite evident from the progressive increase in participation by Legislators from both Union and State level, at the Legislators' Meet conducted as part of the Summit.

REMARKS ON POLICY IN MOUNTAIN STATES

Shri Ramesh Negi, IAS, Chairperson,
Delhi Commission for Protection of Child Right

The deliberation during the Summit shall surround analysis, innovation, structures, policy formulation and experiments undertaken by the community, academia and the Government, on the themes of this Summit. I would like to highlight the issues which have a bearing on policy and relate to control of resources by the community and ways to make the whole process more inclusive and participative. Any process cannot be absolute but has to be dynamic and responsive.

For instance, with regard to mountain cities we may have many solutions such as technological solutions around the world. However, when it comes to the functioning the unfortunate part is cities turn out to be signals of disparity. If a city has marginalised population that has no land, is not able to manage its waste- it is far from sustainable. As far as the Mountain Cities are concerned we have issues related to disasters and natural resources and we are in the process of rectifying and putting things right. City resources whether land or water, have to be participative and inclusive. Scientific management of resources and conservation are as important too. I believe resource planning forms a significant part of our discussion during the Summit.

Another aspect to be taken into account is that very often policy makers and solution givers are outsiders and do not understand the extent of feasibility at the local level. If we are going for equitable and sustainable development, the capacity to replicate and implement at the local level should be looked into on priority.

INAUGURAL ADDRESS

Shri Lal Thanhawla,
Hon'ble Chief Minister, Mizoram

"*Hon'ble MP Mr. Rai, Mr. Alem my long time friend, Ramesh Negi, Lalbiak Mawia Ngente, other distinguished delegates and participants from across country, ladies and gentlemen, friends- thank you for inviting me to the 6th edition of Sustainable Mountain Development Summit. This is an important forum to discuss how best to carry forward our sustainable development agenda which is so crucial for us. We know development is a must but at what cost? As we go about the development process we need to always factor in environmental cost and cannot compromise on ecological balance.*

We are living in a world of constant change and instant communication. Things have changed so fast in the last few years that many-a-times it has been impossible for majority of us to catch up with the change. However, in all this one thing is clear- the importance of Sustainable Development. Most resources that we use today are finite and hence have to be used judiciously. Our natural forests have been meeting demands of people since time immemorial. Today due to increase in demand most forests have become depleted, even a traditionally forest rich Mizoram has only 1% dense forests, rest are all depleting fast.

In fact, as a result of this, the Government of Mizoram some twenty years ago evolved a "New Land Use Policy" to enhance this and give new formula for working class and farmers. This policy offers farmers substantial financial assistance and technical know- how and asks them to choose a vocation they prefer from amongst an array of allied activities such as cattle rearing, horticulture and poultry farming so that this distress on forests can be arrested. With this program in place for the last two decades, we have achieved lot of success. This New Land Use Program is all embracing because it looks at challenges such as global warming, environmental degradation, scarcity of water etc. and ways to arrest its effect on land.

The 17 SDGs with 169 targets adopted by the 193 member states, through eradication of poverty, ensuring health and wellbeing and the like, aims to bring an equal, just and secure world to its people by 2030. Together the goals are achievable and mountain states should be one of the major contributors. North Eastern India in particular is a biodiversity hotspot. Today, the whole world knows that the North East acts as the transition zone between Indian, Indo- Malayan and Chinese bio-geographic regions and it is the geographical gateway for much of India's flora and fauna. As result of its biodiversity richness, the region boasts of high endemism and holds a large number of rare species which are under serious threat.

Another challenge is rapid urbanisation and lack of judicious planning which have led to considerable stress on limited natural resources. Geotechnical investigation and sustainable development of city infrastructure should be undertaken, especially in the capital city of Aizawl. All vulnerable areas need to be mapped. We need to create awareness and garner the support of everyone- Government, private agencies, corporate bodies, NGOs and Civil Society Organisations.

Our approach to Sustainable development, which is defined as wise use of resources to meet the needs of the present generation without compromising on the needs of future generations, has to be holistic. This year we have been facing unprecedented rains and floods since the month of March. With climate change and global warming staring us in the face, such a Summit bringing together all stakeholders instils in us that fighting climate change is doable and shall not just remain in our wish list. It is my honour to inaugurate the Sustainable Mountain Development Summit VI in Aizawl. I wish the Summit all success and thank the organizers for giving the State of Mizoram an opportunity to host this meeting. I wish every one of you a pleasant stay. Thank you very much."

B. DAY 2: THURSDAY, 21 SEPTEMBER 2017

TECHNICAL SESSIONS

TECHNICAL SESSION I: CLIMATE CHANGE

Keynote Address: Dr. Navroz Dubash, Senior Fellow, Centre for Policy Research
Chairperson: Shri S. T. S. Lepcha IFS, PCCF and Managing Director, Uttarakhand Forest Development Cooperation

KEYNOTE ADDRESS: UNDERSTANDING CLIMATE CHANGE IN LOCAL CONTEXT

Dr Navroz K Dubash

Climate change issues and how to locate them in the local context is essential. At the same time, it also important and might be somewhat intriguing to understand the debate on climate change at international level, what considerations are being talked about, where that debate stands and what we might expect from such debate- what is Paris Agreement in a nutshell?
Any talk on climate change cannot proceed without deliberating on what the impact on the Indian Himalayan Region is. Equally important exercise is to discuss we respond to climate change with attention to local context.

Global Climate Politics: The Climate Trilemma
The steady increase in Global temperature has been recorded. The efforts to address the complex climate challenges through international deliberations has been a slow and cumbersome process. At the centre of global climate politics is the Climate Trilemma. Trilemma is a situation with three objectives out which only two can be achieved satisfactorily at any given point of time. Three objectives are:
Environment- Environmental objective is concerned with the 2 degree goal- limiting the global temperature rise to 2 degrees which is considered the threshold of dangerous warming
Equity- For developing countries the concern is that whatever happens as a result of climate change should not limit their access to cheap and reliable energy for development, which is the equity objective
Economics- For many developed countries the issue is competitiveness. Developed and industrialised countries are growing at a rate slower than developing countries and hence question why they should assume obligations that slow down their growth.
Depending on which two problems you want to solve, the solutions will differ. If the goal was to achieve the environment and equity objectives, you would divide the carbon production in a fair manner where each country has a cap on carbon production and upon reaching the carbon cap, they have to buy more carbon from a country that can "lend". The problem with this solution is that the USA and most of the Europe will have to come down to zero emission the very next day and pay a lot of money to the developing nations. Hence this solution is rejected and a counter proposal concerning the environment and economical objective is tabled whereby the developed nations commit to some extent and expect the developing nations to do the rest to achieve the 2 degree environmental objective. Naturally, the developing countries find this solution unfair. This sums up the debate that has been going on for the last 15-20 years. The only solution left then, is for every country to commit to what they think is feasible according to them considering development and competitiveness points of view. We reach this point where every country commits to doing what they think is feasible and we cross our fingers and hope that eventually this would be sufficient to meet the 2 degree goal. This is basically where the Paris

Agreement has concluded. We essentially have a situation where the countries have to take care of their national circumstances and then there are some mechanisms to try to ensure that the national efforts meet the global goal.

Paris Agreement

Paris Agreement calls for each country to produce Nationally determined contributions'(NDCs) which are Bottom-up pledges where each country sets up what it is willing to do to meet the global target as opposed to Top-down pledges where each country is told what the global target is and how much each country is supposed to do to achieve it in accordance with the agreement in the convention. These nationally set targets are to be updated every five years. To complement these national pledges, a "Ratchet" mechanism is set in place for Global aggregate "stocktaking" of country pledges every five years to see where we have reached compared to where we should be.

In addition to that a Transparency mechanism is built in to compare how each country is doing with respect to the emissions and technical expert review is also set in place. These NDCs, most importantly, are mitigation and adaptation practices- efforts to, both, reduce greenhouse gases and adapt to the effects of climate change.

Transfer of finance and technology support for developing countries from developed countries has long been a theme in the climate change negotiations and it did not process much further in the Paris Agreement.

There are two questions with respect to Paris Agreement:

Will the numbers add up? Will the NDCs, national pledges get us where we want to reach. A projection by UNEP Emissions Gap Report 2015 indicates that we are 15-20 % short of where we should be.

Will it be fair, particularly for countries like India? The Paris vision is that first, a global virtuous cycle will be created – a few countries will make ambitious pledges and when some of them make good progress towards achieving them other countries will follow the suit. This is what the hope at global level is.

At the national level the hope is that as countries start on achieving the NDCs, they will realise that climate action is actually not very costly, that the mitigation and adaptation efforts can be synergistic with the development efforts. There is hope that as countries learn by doing, there will be a stronger co-benefit dynamic generated where climate change mitigation goes hand in hand with development effort

So the idea is that rather than setting an overall global target and then imposing it upon the countries, the Paris Agreement posits that let's get started and hopefully we will realise that it's not as hard or certainly not as expensive as we thought it would be.

Impact of Climate Change in the Himalayan Region

Indian Himalayan Region has seen1.7 – 2.2^{o} C rise in temperature from 1970s level by 2030 *(INCCA, 2010) which is quite higher than the global average*. 5-13% increase in rainfall in and 2-12% increase in intensity of rainfall *(INCCA, 2010).* However, this is just the average. What this masks is the variation which is much higher in certain pockets

Water- Yield increases by 5-20% overall, but as high as 50% in parts of Jammu & Kashmir and Uttarakhand *(INCCA, 2010)*. There are uncertainties in projection of ice cover and runoff but glacial shrinkage increases with "very high confidence" (IPCC AR5: 243).

These changes spell out changes in lives and livelihoods of mountain communities as the Himalayan region is particularly dependent on climate sensitive systems. Projections point to 50% of forest grid undergoing change in some way. Agricultural yield varies by region and crop but there is considerable risk crop flooding in NE. There are effects on human health with a larger "transmission windows" for vector-borne diseases. Biodiversity- Bird migration patterns and Snow Leopard contraction

Few Responses to Climate Change:
State Action Plan on Climate Change

SAPCCs were formulated a few years ago by most Indian states. These were remarkable documents in that no other country did something like this as early as we did but one of the challenges of being the early movers was that the knowledge of how to do it was thin and as a result there is a lot of scope for changes in these plans. There are a few ideas along which we can revisit the SAPCCs.

How do we think of Climate Change, given the fact that climate change cannot possibly be the overriding determinant of how we think about development. There are a lot of other issues concerning sustainable development, other drivers of natural resource management. Considering all these factors, how do we integrate climate change into development planning to take it seriously while not pretending that other issues that we used to be worried about are no longer relevant. How do we integrate these two sets of issues and how we make sense of 'mainstreaming' climate change into sustainable development? One Approach to do this is to focus on multiple stressors of natural systems.

Multiple Stressors Approach takes into consideration the fact that there are multiple stressors which affect natural resources, like water. Some of these stressors would be land-use change, population growth, urbanisation, industrialisation, and then, additionally, climate change effects over time. The second issue is that there are multiple objectives that need to be achieved. These can be, for instance, adequacy, quality, equity, sustainability, resilience, democratic governance. Finally, Cross-scale linkages- linking outcomes with drivers
Physical Context including Climate → Natural Resource → Infrastructure/Institutions →Users
Example for Water, there is a series of stressors, like global climate change mediated through local regional impact which affect the water in streams- the physical context. There are factors like geology, topography etc. Then there is land use change which come from a series of intermediate variables- land, labour, & commodity prices, policy which, in turn, are shaped by a set of political economy factors. They are also shaped by population growth, industrialisation and other such factors. So there is a complex story of how natural resource like water is shaped. There is also a set of mediating institutions which might be allocation rules, infrastructure, whether your water is imported, how you deal with the waster etc. All this is taken in account by the end users- agricultural users, industrial users and the households and the decisions made by them shapes the series of outputs. This is a complex way of looking at the problems but it is necessary because for a large scale transformative change, we need to map the entire story in a causal way because if we attribute every change to climate change, even though it might be being driven by industrial use pattern or the other way round- ignoring climate change and attributing changes to local factors- we are going to be looking and working with wrong information. We need unpack the problems much more carefully and Multiple Stressors Approach is one way of bringing together climate change and sustainable development. It takes into account climate change as one of the factors while not making it the overwhelming factor.
Science of climate impacts at downscaled level needs to be thought about. What are the state specific, district specific areas of vulnerability? Science is still improving on this. While we project impact of climate change into future, there are some impacts which are beginning to be felt here and now. Climate impacts are beginning to be felt and it is very difficult to ascertain the degree of impact being due to climate change or due to any other factors. There is now 'Attribution Literature' which tries to quantify the degree of causality for events, particularly weather events, due to climate change. Some interesting climate developments are taking place in science and that should feed into our understanding of climate change impacts

State Plans tended to devolve back to project by project, relatively incremental approach and that is partly because the work was handed back to state departments. The need of the moment is to think about integrative ideas across departments that can lead to transformative change across themes and sectors such as agriculture, forests, water etc. It is difficult to achieve this as it calls of different set of people and regions to come together which is why a forum like IMI is important.
There is a need to build institutional capacity to undertake all this work. We have this unfortunate system where in accordance with the output to be generated, people are brought in for short term and often the consultants, instead of complementing the state's work, end up doing the work. The consultants need to function in a manner complementary to state's work and the core of the work needs to happen in such a manner as preserves the institutional memory within the state. Simultaneously there's need for ability to attract finance in combination with the idea of transformative change.

Financing Transformative Action: 'Direct Access' to the Green Climate Fund

Green Climate Fund is the main international mechanism for funding climate change action and it remains under exploited by India. There is a lot of scope for programmatic action across the Himalayan States as there are common themes across state action plans. Is there a way then to build long term funding Long term funding around shared areas of concern and a programmatic theme which despite focussing on climate change, remains rooted in local development context. This sort of an idea can help support long term institutional capacity rather than a project by project approach. The Green Climate Fund is an opportunity to do this because it is keen to move from a project to programmatic funds. The mechanism to do this is that they have set up in every country- 'National Implementing Agencies' such as NABARD in India and they can apply directly for a long term programmatic funds so that they don't have to apply for funding again and again. Scope of the work and approach can be defined regionally. So far, NABARD has adopted the short term project approach. This is an underexplored opportunity. India has been arguing for years at the international process that climate change funding is not an aid, it is an entitlement because it is largely that the developed countries that have caused the problem. Therefore, we should be in control of how this money is used, it should be consistent with our development agendas. Even though we have come up with a good argument, we actually haven't come up with a good idea about what to do with that money. So this is a good opening to think about what could be some of the common themes to work on across the Himalayan states.

In Conclusion

Climate change is a long term issue that emerges to the surface only when something very visible happens- like a series of unnaturally recurring natural disasters. It is real. We don't know precisely what the impacts on downscaled levels are going to be which makes planning for climate change difficult. Therefore we need to work really hard at downscaled science of impacts and harder at diffusing this science. While effectiveness of the international mechanisms is work in progress, we need to work on both the mitigation and adaptation processes. Main thought is that we have to work on mainstreaming climate change planning into state planning. We have to pay attention to climate futures in our policy planning but also pay attention to local context and development objectives because they continue to be relevant with or without climate change. We have to find a way to bring these two together. There is a great opportunity for regional transformative action and the commonalities across state plans provide a good entry point for that.

CHAIRPERSON'S ADDRESS:

Shri S. T. S. Lepcha IFS

Since the theme of the Summit is on climate change and the sub themes also focus on research policy gaps and some of the indigenous practices of adaptation, livelihood and coping strategies bases on indigenous knowledge of practices, some of these practises can be focussed on while panning for climate change challenges. In agriculture, one of the areas increasingly getting affected by climate change, we have a number of practices that are rooted in traditional wisdom of the communities. Dry land cultivation of rice, focus on millet and legumes cultivation are some of the Himalayan state friendly practices that we can adopt. These practices have various benefits and advantages like low water requirement and health food.

One very important species which is generally neglected because it is classified as narcotics is Hemp. Hemp is a multi-purpose plant which has multiple uses- all parts of the plant can be marketed in one way or the other- and benefits for environment- it absorbs more carbon dioxide per sq metre than broad leafed trees. It is also resistant to destruction by wild animals, reducing human-wildlife conflict. It needs only round of weeding as compared to multiple rounds required with other crops saving a lot of time for women who are chief cultivators in mountain states. Despite having so many benefits, it is still considered a narcotics. Similarly, there are livelihood opportunities in making use of the medicinal plants species and species of plants that have use in handloom industry as natural dyes. Use of locally available resource material for construction is one another opportunity that can be explored. There are many livelihood opportunities available for people in Indian Himalayan Region because of the richness of natural resources this region has been endowed with. One of the obstacles in capitalising on the natural resource based livelihood is poor infrastructure support facilities which do not make for an environment conducive for profitable livelihood systems.

We have to think about Carbon Locking and Carbon Sequestration and better forest management techniques. At the same time, we need to think about behavioural changes that need to accompany the change in techniques and practices. Therefore, we need policies being made for mountains to change in alignment with changing needs of the mountain communities and the effects of climate change. State planning needs to take into account a prioritisation of issues specific to each state in light of the climate change effects. Such planning and thinking about climate adaptive practices will help us to not only make use of innovative livelihood opportunities that accrue because of the vast wealth of natural resources but also to address climate change challenges through such innovative adaptation practices.

BREAKOUT SESSION I: RESEARCH & POLICY GAPS

Chairperson: Dr. Rajendra Dobhal, Director General,
Uttarakhand State Council of Science &Technology (UCOST)

Protecting Climate-Induced Internally Displaced Persons in India: Legal Gaps and Solutions

Tarini Mehta,
Human Rights & Environmental Lawyer

Experts estimate that between 50 million and 250 million or even 1 billion people may migrate by the year 2050 due to climate-induced displacement. Available data on internal displacement due to climatic factors indicate that there is twice the number of internally displaced persons than refugees globally. It has been observed that during 2008-2013, 166 million people worldwide were displaced due to disasters and this number is likely to rise due to the impact of global warming. Currently, policies are implemented as a knee-jerk response to IDP movements, leading to different levels of protection for different groups. There is no central authority for the implementation and monitoring of protection and assistance measures for IDPs, giving rise to co-ordination problems in responding to their protection needs.

The situation of climate change induced IDPs in India is particularly precarious, as there is lack of clarity regarding the concept and definition of climate change induced displaced persons. In the Indian Himalayan Region, the loss of bio-diversity and agro-diversity will render populations vulnerable and reduce their ability to cope with the rapid, expected changes. Pastoral communities will be highly affected due to changes in the biophysical changes such as timing of rainfall, grass production, persistence and melting of snow in rangelands and the availability of water near grazing areas. With earning opportunities declining and traditional livelihoods and skills at threat, coupled with food insecurities and adverse health impacts, migration to cities will increase in the coming years.

Considering the gravity and scale of the problem, it is imperative that a comprehensive legal and policy framework be put in place for the protection of climate change induced IDPs, in conformation to accepted principles of human rights and refugee law. Key issues identified in addressing climate-induced internally displaced persons are:

Recognition gap: Lack of recognition of persons displaced due to climate change and environmental reasons. Persons displaced due to slow-onset disasters are particularly at risk due to this

Knowledge gap with regards to people migrating due to slow-onset disasters

Policy gaps: Institutionalization of compensation and risk transfer for loss and damage due to climate change; and policies based on a climate change-social vulnerability index

Human rights gap: Need for adoption of human rights approach and framework

The Hindu Kush Himalayan Monitoring and Assessment Programme (HIMAP): Assessments and Science-Policy Dialogues to Sustain a Global Asset

BMS Rathore,
Country Focal Person, ICIMOD

As per the 2007 IPCC AR4 Report, climate change is the most prominent force of global change in the modern era. While global scenarios indicate susceptibility of mountain regions to climate change, the knowledge base on vulnerable sectors is limited. The Hindu Kush Himalayan Region is seen as 'a data gap' area, lacking consistent long-term monitoring. In the context of this, the HIMAP initiated by ICIMOD, will provide a comprehensive assessment of the HKH region based on learning from the Arctic (AMAP); assess the current state of knowledge and identify key messages and recommendations for decision makers. It will be an ongoing process, which will be repeated every four to five years and will assist future National monitoring and reporting of the HKH countries on SDGs.

Initial key findings from the programme since its initiation in 2013 are given a follows:

The HKH region is projected to warm more compared to global mean change over the 21st century, and warm more rapidly at higher elevations with current level of GHG emissions

In most parts of the region, glaciers are thinning, retreating, and losing mass—a trend that is projected to continue, with possibly large changes in the timing and magnitude of glacier melt runoff. In a 1.5 degree scenario, around one third of ice mass in the HKH will be lost

Climate change is expected to drive consistent increases in the total runoff of the Indus, Ganges and Brahmaputra. In the Indus increase will come from increased glacier melt, while in the Ganges and the Brahmaputra it is expected to come mainly from precipitation.

With the current level of deforestation, by 2100 only about 10% of the land area of the Indian Himalaya will be covered by dense forest (>40% canopy cover) and almost a quarter of the endemic species could be wiped out.

Energy development policy in the HKH remains focused on supply and growth—it does not yet centre on sustainability, despite the region's huge potential for renewables.

Traditional food systems are replaced by rice and wheat, leading to declines in dietary diversity and nutrition security.

In addition to remoteness, poor accessibility, dependence on natural resources, and demographic factors, conflict and ethnicity-based discrimination are major drivers of poverty in the region, with a distinct gender dimension.

Policy and practice should focus more on the links among climate change adaptation, disaster risk reduction, and the Sustainable Development Goals.

Fallow Management in Shifting Cultivation: A Review of Opportunities and Challenges and the way forward in North East India by taking the Institutional Economics Approach

Meziwang Zeliang, Ditho Kathiry, Atoho Jakhalu, Mhabemo N Patton, Kenilo Kessen, Thsope Medo, Vekho Tunyi and Dimusie Pojar

Shifting cultivation, commonly referred to as *jhum* cultivation in India, is an agricultural system which involves rotation of field rather than of crops. In the North Eastern Region (NER) of India, ranked 6th among the top 25 biodiversity hotspots in world, *jhum* occupies a distinct place in the interconnected web of the culture and socio-economic set-up of the tribal population. With the increasing population pressure, the sustainable fallow period of *jhum* cycle which ideally lasted for 15-20 years has drastically shortened to 3-5 years, leading to increasing land degradation. Amidst this discourse on pros and cons of *jhum* cultivation, there is an urgent need to reframe the debate in order to move forward in identifying research and development interventions that can stabilize declining upland agro-ecosystems. It would require an in-depth examination of the benefits *jhum* cultivation as a form of agro-forestry having two distinct phases – cropping and fallow phases.

Three cases presents the prevailing fallow management practices and outlines the vast opportunities and challenges pertaining to the current *jhum* conversation and rehabilitation efforts;

Success of Alder-based (*Alnus nepalensis*) agro-forestry which has shown immense potential and opportunities of silvi-culture in tackling soil degradation.

The success of improved *jhum* system adopted in Nagaland has not been found in Arunachal Pradesh due to the state's poorly defined land tenure system and land-use policy.

The Ministry of Agriculture and Co-operations, Government of India in the 8th and 9th 'five-year plan' charting out plans to encourage sustainable agriculture by up-gradation of the *jhumia* families has not been successful due to the non-involvement of the communities practicing *jhum* system of farming, especially during conceptualization and any formulation of programs

The issue of land tenure in shifting cultivation has been greatly emphasized in the Nagaland State Action Plan for Climate Change. *Jhum* cultivation can be made economically and ecologically viable by adopting agro-forestry based fallow management practices, as long as, the three key factors are taken into consideration: land tenure and security, the cultural attribute of the community, and the policies and rules (both formal and informal).

Research and Policy Gaps (around CCA) in the HKH Region and a glimpse into HI-AWARE

Suruchi Bhadwal,
Senior Fellow, Climate Change and Earth Science Division, TERI

Policy and planning for climate change requires clear contextualization of adaptation for intervention at national and sub-national scales. However, the process is not simple due to complexities and inter-linkages between biophysical and socioeconomic systems. Spatial understanding of risk for adaptation planning is limited due to lack of information, mechanisms, and periodicity of data collection – no proper inventorisation, demarcation of risk zones, GLOFs and threats, documenting moraines etc. There is absence in clarity on the epistemology of adaptation, whether policies are aimed at building adaptive capacity or resilience, or whether to push for development "plus" approach. Degree of detail is required before any intervention can be planned to ascertain the associated costs for action-cost-benefit analysis, to draw risk abatement curves and the contribution from each option chosen.

The Hi-AWARE Project co-sponsored and managed by UK AID and IDRC, focuses on enhancing the adaptive capacities and climate resilience of the vulnerable in the mountains and plains of the river basins of the Hindu Kush Himalaya (HKH) region, through the development of robust evidence to inform people-centred and gender sensitive climate change adaptation policies and practices. In India, the project will work towards amalgamating science and technology and on-ground techniques leading to co-production of information. It will work on building regional climate models and analysis. The data studied from AWS installed in Sikkim, Delhi and Uttarakhand will provide background data for climate policy and planning. While scientific data plays an important role for informed decision-making on climate change, it is important to accommodate the human space within the policy framework to understand perceptions of vulnerability and coping mechanisms of people living at risk.

Key Impacts are:

In high altitudes, wetlands, other water bodies and springs are shrinking leading to low water availability during dry season. Apple production affected

Torrential rainfall during monsoon found to be detrimental for crop productivity; frequent landslides – impacts water sources causing scarcity during dry seasons

Flash floods reduce soil fertility due to erosion of top soil and landslides result in rill and gully formations.

Decline of groundwater table is observed in flood plains

Forests are being depleted/lost during floods and through other anthropogenic activities which is the main source for firewood

Increasing demand for energy, but higher temperatures: power plants unable to operate to the fullest in Teesta

Pastoral lands are available in higher altitudes than before in Upper Gangetic Basin.

Issues Identified in the Session

Climate induced displacement (CID)

Lack of evidence to support link between 'climate induced displacement and migration'

Debate on the categorization of CID – within environmental displacement?

Recognition gap - persons displaced due to climate change and environmental reasons

Knowledge gap - people migrating due to slow-onset disasters

Policy gaps

Institutionalization of compensation and risk transfer for loss and damage due to climate change

Policies to be based on a climate change-social vulnerability index

Human rights gap: Need for the adoption of a human rights approach and framework.

Hindu Kush Region (HKH) seen as 'a data gap' area, lacking consistent long-term monitoring - Climate change, snow, water resources, biodiversity, energy, food security, poverty, adaptation

After mid-century - decline in total run off in Indus basin due to decline in glacial melting

Loss of biodiversity due to deforestation – forest cover reduced by 10% (by 2100); extinction of a quarter of endemic species

Energy development policy in the HKH focused on supply and growth— not centred on sustainability, despite the region's potential for renewables

Food insecurity – replacement of traditional food systems by rice and wheat

Substantial overlapping of vulnerability and poverty

Shifting cultivation – debate between sustainability of *Jhum* cultivation vs land degradation taking into account its cultural ethos, social fabric and every aspect associated with Naga life and their society

Contextualization of adaptation - Adaptive capacities or resilience or development agenda?

Solutions Suggested

Compensation for losses for marginalised groups with inaccessibility to resources

Risk pooling and risk transfer mechanisms - shift economic risks from an individual or organisation to insurer
Compensation for non-economic losses – culture, way of living, damage to social capital, psychological and mental
Regional energy cooperation is critical to achieve both rapid development and energy self-sufficiency
Institutional capacity on adaptation to increase till it fits to purpose at each level of governance
Policy and practice should focus more on the links among climate change adaptation, disaster risk reduction, and the Sustainable Development Goals Cooperate at all levels across the HKH region (people to people, business to business, and government to government) for sustainable and mutual benefits
In national, regional, and global decision making institutions and processes, recognize and prioritize the uniqueness of the HKH mountains and its people
Jhum improvement to be made from a socio-cultural perspective rather than a scientific one – Success stories from Nagaland (agro-forestry) and Meghalaya
Three key factors for good fallow: land tenure system, the cultural attributes of the community and policies and rules
Action Points
Creation and institutionalization of Climate change Social Vulnerability Index (SVI) in all levels with pre and post displacement policy mechanism based on SVIs
More engagement of the parliamentarians in understanding and defining 'migration' or displacement due to extreme events, for example due to landslides
Institutions & Processes: Building a community of practice while breaking silos
Interdisciplinary Research: down scaled science, diffusion, awareness
Policy, Programs and plans: SAPCC Common theme/action across IHR states; Mountain specific policies
Availability of knowledge through data sharing and documenting local adaptation process
Development of Monitoring Learning and Evaluation Framework for measuring climate adaptation

BREAKOUT SESSION II: STATE ACTION PLAN ON CLIMATE CHANGE (SAPCC)

Chairperson: Dr. Navroz Dubash,
Senior Fellow, Centre for Policy Research
Co-Chairperson: Dr. S Satpathy,
Former Director, Climate Change Division, MoEF&CC

Climate Change Adaptation Practices in Agro-ecosystems in the Sikkim Himalayas

Ghanashyam Sharma and Ravikant Avasthe
The Mountain Institute India

Agriculture is the mainstay of Sikkim Himalayas, where more than 90% farmers follow traditional cultivation practices, contributing 17% of the gross state domestic product. The innovative, agro-biodiversity rich, organic-based farming system developed over time by local and indigenous farmers have the potential to be high yielding and sustainable. Over the past few decades, climate change has shown pronounced impacts in the ecologically fragile mountain areas of the State. One of the most visible impacts is due to change in precipitation patterns. Erratic rainfall contributes to soil erosion, landslides, floods and sedimentation in the downstream. This results in decreased soil fertility, crop yields and crop damage. The farmers' perception revealed issues such as- increase in warm days; unpredictability of rainfall patterns; changing crop seasons; increased frequency of drought; frequent warmer wind flows and depleting water sources.

Vulnerabilities observed are:

- Inconsistent crop yield and decrease in quality; alteration of crop cycles
- Outbreak of pests and crop diseases
- Reduced available soil moisture and soil nutrients; loss of soil fertility
- Loss of fields due to flash floods, landslides and rill/gully formations
- Increased risk of extinction/ threatened crop species

Adaptation and mitigation:
Adaptation practices are significantly influenced by farm size (*Bari*/*Khet* land, agro-forestry), family size for farming, farm income, self-produced food sufficiency and resource investment. Some existing options of adaptation are water management practices for irrigation, land terracing, agro-forestry development, and crop diversification and farm diversification. Farm diversification includes bee-keeping, season and off-season horticulture, high value cash crop production, livestock husbandry, poultry and floriculture. Additionally, farmers in the dry belts of South and West Sikkim have adopted rain water harvesting; pond conservation; utilization of excess drinking water for vegetable production; storage tanks to augment irrigation facilities and popular "*Dhara Vikas Initiative*". As part of mitigation measures, the Government of Sikkim has banned burning of crop residues. Integration of agro-forestry, farmland and livestock into agricultural production systems, cultivation of higher diversity of locally adaptive traditional crops, improved varieties of crops (developed by farmers), improved water and soil management are some important areas of improvement.

Responses Of Sensitive Fauna in the Face Of Climate Change In Sikkim Himalaya, India

Bhoj K. Acharya and Basundhara Chettri,
Department of Zoology, Sikkim University, Sikkim

Climate change and its impact on biotic and abiotic components of ecosystem is a global concern. It is reported that the earth's surface has warmed up by 0.6 °C for the past 100 years, and with the current rate of emission of greenhouse gases the global air temperature is likely to increase by 1.5 °C to 4.5 °C by the end of 21st century.

The most prominent impact of climate change on biodiversity is the alteration of the natural distribution limits of floral and faunal communities. There are clear evidences of northward shift of distribution of species pushing their ranges towards poles or higher elevation, and species with southern and montane distribution are rapidly disappearing from lower elevation and colonizing sites at higher elevations. Over the years, the impacts of climate change have been experienced in Sikkim Himalayas with evidences of various climate induced effects and the responses of different sensitive faunal groups.

Climate change has been felt worldwide and its impact is clear on different organisms and ecosystems. While some species have adapted to this global phenomenon, population decline have been reported in many species threatening their existence. More extensive studies are necessary to understand the precise effect of global warming on fauna. Understanding responses and adaptation exhibited by species in order to survive and reproduce in such altered environmental conditions in the Himalayas will aid in their conservation.

Climate change and its impact on health parameters in a Shimla district of Himachal Pradesh situated in the foothills of Himalayas, India.

Dr. M.P.Sood, Dr. Omesh Kumar Bharti

Shimla is a hilly district situated of Himachal Pradesh with a population of 6.2 Million and is a tourist destination. The data for this thesis was collected from many sources- reports, registers and personal interviews with health functionaries. The data collected was tabulated, cross validated and analyzed to assess the health situation of the district and the progress towards MDGs.

An analysis of the temperature of Shimla district since 1976 till 2004 (28 years), shows that there has been a rise in average temperature by 1.1^0 C. This increase in temperature has caused a sharp decline in average snowfall from 272.4 cm in 1976 to 77.2 cm in 2004, thus jeopardizing the availability of water in the region.

The recent outbreak of jaundice that killed more than 20 persons in 2016 and affected the health of hundreds of others was attributed to a dry river bed that failed to dilute treated sewage water and lead to heavy contamination. Hitherto unseen mosquitoes and flies have made their appearance in this cold district and the number of cases of respiratory (phrangitis, laryngitis and asthma) and diarrheal diseases have been on the rise over the years. Prevalence of respiratory diseases was highest with 14.58% followed by acute diarrheal diseases with 6.17%.
Thus, the increase in temperature has led to decreased snowfall and water availability in the hill state of Himachal Pradesh and is further likely to become a hub for dreaded diseases that breed through mosquitoes.

Climate change in Sikkim Himalaya:
Implementation of Sikkim State Action Plan on Climate Change

D.G. Shrestha, Additional Director,
Sikkim State Council of Science and Technology, Sikkim

Sikkim Himalaya, shaped by the young mountains with unstable slope and fragile ecosystems, is threatened by the consequences of climate change. There has been enough evidence of temperature increase in the state such as- winters getting warmer, springs drying up, glaciers losing mass, crops losing yields, increased mosquitoes prevalence in winter etc. Climate change has impacted agriculture, livelihoods, health and many other sectors. Identifying climate change as a serious concern, the Government of Sikkim has taken a proactive and systematic approach towards the formulation of the State Action Plan to address climate change since 2009. The SAPCC of Sikkim identifies key concerns of the state in the context of climate change and suggests measures towards amelioration.

The SAPCC was released in 2015 by the State Government. Five Working Groups for each sector of concern were formulated:

- Water
- Agriculture, horticulture and livestock
- Forests, wildlife, and eco-tourism
- Promotion of energy efficiency
- Urban and rural habitats and communities

However, it has been understood that the SAPCC is not a static document and needs to be updated taking into consideration developments in other sectors like health, where we can see the impacts of Climate change. For the implementation of SAPCC, different activities have been supported and major successes achieved under SAPCC through implementation of policies, programmes, projects and schemes. Spring shed Development Programme (DharaVikas) was initiated in 2008 to revive and maintain dying springs of the Sikkim. DharaVikas has helped alleviate the problem of rural water scarcity by reducing surface runoff and allowing more water to recharge underground aquifers. This ensures increased discharge from springs. This is a robust climate adaptation strategy for drought-prone districts of South and west Sikkim, where springs and streams used to dry up every year between the months of March and May.

Further, United Nations Development Programme (UNDP) is providing technical support to the state Government for implementation of State Action Plan on Climate Change under the 'Strengthening State Strategies for Climate Actions' project, in collaboration with SDC & MoEFCC, Government of India. In the Climate actions of UNDP (2016-18), three sectorial departments viz. Land Revenue and Disaster Management Department (LR&DMD), Forests, Environment and Wildlife Management Department (FE&WMD), Rural Management and Development Department (RM&DD) and the nodal department for Climate Change i.e, Department of Science, Technology and Climate change (DST&CC) have been given the task to work on priority areas of climate action. In continuation, GIZ Initiatives have also been taken up in Sikkim to provide technical support to the Forest, Environment and Wildlife Management Department, Govt. of Sikkim for conservation of Oak forest of Sikkim. The GIZ CCA-NER project has supported the Government of Sikkim on Mapping and Climate modelling of oak forests of Sikkim with climate projection and its impact by 2030 and 2050 using different climate scenarios. The project has also taken up the feasibility study on beekeeping development program in Sikkim in 2016. Another priority area is glacial study and the Sikkim State Climate Change Cell is actively engaged in subjects related to Glaciology and Glaciers lake outburst floods (GLOFs).

Issues Identified in the Session

- Challenges faced in Implementation of SAPCC
- SAPCC are mostly Stand Alone Plans in States
- Lack of alignment of SAPCC with Development Planning
- Alignment of SAPCC with NAPCC
- Inclusion of 'learning from community' in the SAPCC is still a gap
- Funding Mechanism for SAPCC need to be strengthened
- No standard Monitoring and Review Mechanism for SAPCC Implementation is available
- Correct & High Resolution Climate Data for SAPCC planning still missing in some States
- Sectorial Vulnerability Mapping
- Lack of Trained Manpower
- Translation of Outcomes into Action is missing

Solutions Suggested

- NAPCC should take cognizance of Specific State Issues
- State Planning should refer to SAPCC and there must be continuous monitoring and review
- State Govts must align SAPCC with Development Plans; they should not be mutually exclusive
- Dedicated Funding Mechanism & Funding Agency are required
- Community Adaptation Practices should be documented
- Quantification of Climate Change Impact in Agriculture should be taken up
- Enhanced participation from State Governments
- Sources of Finance: States, Green Climate Fund, Other Implementing Agencies
- Enhancement of State Capacities for better understanding, and operationalization of the Plans.

BREAKOUT SESSION III: ADAPTATION STORIES

Chairperson:	Dr. Kallur Murali, Director, International Development Research Centre
Co-Chairperson:	Smt Priyadarshinee Shrestha, Team Leader, WWF-India, Khangchendzonga Landscape Office

Chairperson's Remarks: Dr Kallur Murali

Dr. Kallur Murali stressed upon the urgency to understand the ground level situation in the Indian Himalayan Region and think of ways to preserve the lives of the 50 million people living in the region. He spoke of how with changing circumstances, those who depends on the rivers have been impacted as well.

Climate Change has impacted the livelihoods of people, especially women. People have left in search of better opportunities elsewhere, while women have been left behind to bear the brunt. The past decade has seen unprecedented floods and the growing tourism industry has impacted the lives of people. This also poses a threat to drinking water.

Community Livelihood Nurseries (CLNs) – An Effective Tool to Restore Bamboo Genetic Resources in Tripura

Sariel T Reang,
Centre for Forest- Based Livelihoods and Extension (CFLE)

Originally home to 19 species of bamboo, Tripura now has more than 23 species of bamboo. There are a large number of rural communities dependent on bamboo for fuel, food and housing. The benefits of bamboo include their high nutritive value, their tendency to grow fast, the fact that they are considered to be 'green gold'. There are 1500 documented uses.

The rapidly vanishing bamboo patches in Tripura and the decrease in bamboo stock is posing a threat to dependent communities and industries. Thus, the establishment of Community Livelihood Nurseries is helping in the restoration of bamboo stock in the state. Community participation is being greatly encouraged by CFLE. These societies are being engaged to develop quality planting material of 14 commercial species of bamboo under the guidance of CFLE. The CNLs have proven to be successful and the small nurseries on homesteads have been established by CFLE at 80 places across Tripura through the provision of mother plants and field demonstrations. Rural farmers have also been trained in how to grow bamboo and sell it to other states.

Societies such as the Mars Socio Welfare Society (MSWS), the Vaidyaraj Herbal Growers Society (VHGS) and the Nagaon Bamboo Growers Society NBGS) have more than eight CFLs operational under each of them. They also bring in income ranging from Rs. 40,000 to Rs. 480,00 (supplied to agencies within and outside the state. These nurseries will help in restoring bamboo genetic resources in the state, and the availability of bamboo planting stock even after gregarious flowering can facilitate the restoration of bamboo resources in the hill regions of the North-Eastern states.

The way forward would include cultivating bamboo as a crop, encouraging farmers further to adopt bamboo cultivation and to also link them with industries, create awareness regarding environmental and agricultural impacts of bamboo, and ensuring a participatory approach (including the government, NGOs and the community) to set up bamboo nurseries in the state and making it available around the year.

Soil Nutrient Conservation for Sustainable Upland Farming: Introduction of Nitrogen Fixing Trees in Horticulture Orchard

Vanlalruata J. H., Lalrinfeli R. and Lalrinkima B.,
North East Initiative Development Agency (NEIDA)

NEIDA works towards enhancing livelihood opportunities and improving the quality of lives of households through direct field engagement in the field of agriculture and horticulture, among others. As a part of this, they carried out an intervention based on intercropping of nitrogen-fixing tree species (NFTs) on horticultural orchards at Mualthuam North, Lunglei District in the agricultural season from 2015-2017.

The problem identified was that of low nutrient content in the soil, top soil erosion and a low fallow cycle. The need to maintain contouring spaces was seen as crucial. Thus, as an intervention, two species of NFTs (Flemingia Macrophylla and Tephrosia Candida) were introduced into the plot. In 2016-2017, 0.1 MT of NFTs were planted. NEIDA is targeting 200 acres in 2017-2018.

A total of 100 orange saplings and 60 suckers of banana were planted as the main horticulture crops. Some seasonal vegetables were also planted to act as cash crops for additional income. Over the course of the 24-month pilot project, the main activities taken up on the field included the establishment of demonstration plots to showcase improved management practices, the setting up of rainwater harvesting systems, and the developing of a suitable agriculture extension service model at the village.

The pilot project resulted in a 0% incidence of nitrogen deficiency. An average of Rs. 15,000 formed additional income for each farmer in the first cycle of harvest after the intervention. A baseline carried out showed an income of approximately Rs. 8,000 from the sale of bananas from one acre (around 200 trees). The different NFTs which formed hedgerows, were found to supplement soil nutrients and improve the efficiency of the system (better root growth) without the use of chemical fertilizers.

NEIDA pointed out the limitations as being the inability to determine the effect of NFTs on citrus plants as a result of the short duration of the study. Soil erosion data was not captured due to the limited scope of the study.

Strengthening Women's Roles as Risk and Resource Managers at the Frontline of Climate Change

Dr. Rajan Kotru, ICIMOD

The population of the Himalayan belt is approximately 60 million. Due outmigration in large numbers, women who remain in the mountains invariably end up becoming the decision makers and key resource managers on the ground. They also end up facing the impacts of climate change disproportionately. The outmigration of men also ends up increasing the pressure on women to carry out labour-intensive tasks such as threshing, land preparation, seedbed preparation etc., which leaves them with very limited time to engage in community activities and other income-generating activities. Despite their increased responsibilities, the women also still deal with unchanged institutions, policies and markets. ICIMOD works with partners at various levels to facilitate the development of women in the Himalayan region (these include policy makers and policy-influencing forums).

Rural women in the Himalayan region possess critical mountain-specific knowledge, experience and the technical know-how for the sustainable management of agriculture, livestock, and natural resources. These invaluable skills need to be recognized and harnessed for adaptation to climate change.
Men need to be as involved in gender sensitivity as women are. It is vital for men to recognize the responsibilities and potential of women and to support their role in adaptation to climate change. The capacities of national as well as local-level organizations need to be built to integrate gender in the adaptation planning and implementation processes.

ICIMOD has developed a specific framework to ensure a comprehensive view and development of gender transformative change in the Himalayas. At first, customized studies are undertaken to understand the gender gaps and governance issues. These include range lend studies and a study on migration. Next, there are case studies and quick studies carried out to keep the momentum going. These could be in relation to rangelands, SHGs or even entire institutions. The purpose of these are also to come up with issues as well as innovations on the ground. Innovations should come from the ground. There is a need to build knowledge based on success stories from the ground. Thus, success stories are carried forward in peer articles, website etc. After these steps, there is the mainstreaming of data which is carried out based on all the information gathered.

Some of the ways in which women's capacities have been enhanced are by making them financially literate and building their leadership capabilities, including more women in decision making bodies, strengthening their access to credit, introducing women-friendly technologies and increasing the frontline women staff.

Some innovations women in the Himalayan belt have been equipped with are community flood early-warning systems, solar powered irrigation, invasive species management and value chain development, building knowledge on savings and insurance to mitigate loss in climate-related disasters amongst others.

There is still a long way forward and some of the recommendations made by ICIMOD include-
Creating or influencing enabling policies for harnessing women's potential
Securing investments for enhancing women's adaptive capacities
Strengthening civil society participation and building local capacity simultaneously – there needs to be a landscape-based approach rather than an isolated one

Use of Herbs in Local Health Care by Traditional Healers of Kanchanpur in Tripura

Poulami Saha, JRF,
Centre for Forest-Based Livelihoods and Extension (CFLE)

The use of traditional herbs continues to be common among tribal societies for treating different ailments and also to promote sustainable land use management. CFLE Agartala has developed a participatory mechanism for the tribal healers involving ex-situ conservation and documentation of traditional knowledge. With a large part of the population relying on traditional practitioners, the main aim is to promote traditional medicines and preserve traditional knowledge, while generating forest-based livelihoods for the growers and practitioners.

The Kaviraj Herbal Gardens have been set up under the Vaidyaraj Herbal Growers Society (VHGS) to facilitate the practice of traditional healthcare and to generate income. Several rare species of herbs have been collected for conservation by more than 55 traditional healers across different tribes of Tripura.

The participatory mechanism developed ensures the conservation of endangered, threatened and rare species of herbal plans in a sustainable manner, it evolves the importance of biological diversity of herbal medicinal plants in the traditional health care management system.

Training programmes have been carried out by the VHGS in collaboration with the CFLE to promote herbal gardens in different parts of Tripura.

Issues Identified in the Session

- Fall in bamboo cultivation in Tripura
- Categorization of bamboo as timber leading to restrictions in procuring the same
- Reduction of the cycle of shifting cultivation
- Erosion of soil in the lower Himalayas
- Projects are not long enough to determine their advantages
- Feminization of Natural Resource Management
- Scientifically collected and relevant data is lacking. Especially in terms of standardization of such data
- Migration is a pressing issue in the Himalayas
- Increase in frequency of environmental shocks – Lack of preparedness
- Patriarchy as a hurdle towards women becoming independent

Solutions Suggested

- While implementing a framework, ensure the availability of correct evidence and involvement of the right stakeholders
- Plans need to be at a landscape level. It is at scale and not at a village level. Isolated examples and interventions lead to problems in scaling up.
- Ecosystem services need to be sustainable
- There needs to be standardization while implementing a policy.
- There is a need to look for the right policy forums to influence
- Cultivation of bamboo to curb soil erosion – Conservation of top soil
- Cultivation of Nitrogen Fixing Trees (NFTs)
- 'Gender Integration' to be made an important component of programmes
- Build community resilience using community and applied science
- Community flood early warning system (This can be scaled up. Currently applied in Assam)
- Application of SMS based market information system
- Promotion of traditional knowledge (traditional usage of medicinal plants and herbs)

- Recognition of local healers and their skills
- Ensure sustainability of strategies that are being drawn up

Action Points

- Participatory approach towards establishing bamboo nurseries (Involving stakeholders such as the Government and NGOs)
- Monitoring of soil moisture content and organic carbon content
- Work with local communities to build resilience
- Improve Financial literacy and leadership
- Create women-friendly technologies (currently a big lacuna)
- Establish disaster preparedness methods
- Creating/influencing enabling policies for harnessing women's potential
- Securing investments for enhancing women's adaptive capacities
- Strengthening civil society participation and building local capacity – There needs to be a landscape-based approach rather than an isolated approach
- Need to work towards the standardization of strategies
- Bamboo promotes livelihoods of people
- Empowerment of women as well as men – collective empowerment and sensitization

TECHNICAL SESSION II: SUSTAINABLE MOUNTAIN CITIES

Keynote Address:	Prof. Anne Feenstra, M.Arch., Kathmandu-Delhi-Amsterdam
Chairperson:	Dr. C. Vanlalramsanga, Secretary, Urban Development, Government of Mizoram

Keynote Address:Sustainable Mountain Cities

Prof. Anne Feenstra

Prof Feenstra shared the experience accumulated over time by working in Hind Kush Region (HKR) and an exercise in fundamentally rethinking the long term future of Mussoorie via 4D scenario building.
We often forget the lessons that we can learn from HKR. Some fundamentals- while looking at the vulnerabilities in the mountains, it is important to look at striking the balance and keep the momentum for collaboration for change, going. It is also important to look at differing arguments.

Experience in Kabul, Afghanistan

Countries like South Africa, Brazil, Mexico, Indonesia, Turkey, China and India are undergoing high economic acceleration which means that in the phase of development that we are in, the demographic pressure on our cities is getting rather urgent. India is in the growth stage- death rate continues to decline, birth rate has begun to decline after the boom phase has passed. The gap between the birth and death rate is growing due to advancement in medical science. India will continue to see the growth in population. At the same time, there are cities like Detroit in USA which are shrinking. 200,000 people left Detroit. Mountain cities in India continue to see out migration of people but that is not like Detroit in USA. The mountain towns and cities continue to grow. Population growth rate in cities analysed over a period of ten years has been about 20 to 50% or 60%. African cities are growing at a rate higher than Asian. Kabul has grown faster than any other city in the world- at about 600%. This is because a lot of people who fled from Afghanistan either returned because they wanted to come back or were deported from other countries to which they had gone. Majority of these people came back and settled in Kabul because it is a city. A city promises money and progress. With a huge influx of people into the city of Kabul, madness began. The city has grown without proper planning and without any thoughts to maintaining the cultural traditions in building designs.
This brings us to making sense of urbanisation and understanding where did this promotion campaign come from. Is it good to be urbanised? Combining this with systems that are in place for planning, and what we have is organised chaos. Planning laws and systems in India have been inherited from the British who are not very good planners.

Experience in Kathmandu, Nepal

In Nepal, builders used to buy a small piece of land, build a high rise building and market it really well which is why these buildings became very popular. Then the earthquake happened and suddenly these high rise buildings were not so popular anymore. It's strange that sometimes to see the obvious, we need to go through the loss of nine lakh human lives and half a million houses. This made Nepalis see that Himalaya is really fragile and rather than designing against earthquake, they should design with earthquakes. This follows in line with the Buddhist thought.

Making sense of the organised chaos- solutions for the problems for mountain cities on the planet have to come from Asia. Compared to Asian mountains, mountains in the rest of the world are much lower in altitude and problems. Designing with mountains, designing with earthquakes is what we have to do here and if we are able to develop methodologies for this, then the rest of the world can follow us.

Experience in Mussoorie, India: Planning for Mountain Cities through 4D Scenario Building

We undertook an exercise, thanks to IMI at the Mountain Cities Workshop in Mussoorie in 2014. If we really want to make sense of a place and come up with possible scenarios for the future of the place, then maybe we need to take a bigger step in time. That's what we did with Mussoorie- fundamentally rethinking the long term future of mountain cities via 4D scenario building. First thing to do was homework or what one might call research. Research in Mussoorie. The number of permanent residents in Mussoorie is almost forty thousand but in good seasons, it almost doubles. It has a large number of students also. This means seasonal fluctuations in the population of Mussoorie result in sharp variation through the year in the demand for water and resources as well as the waste generated. Mapping land use and estimating the waste generation was also an important part of the work. Secondly, what is really important while planning is to listen. Listening to the local people is crucial. The real stakeholders- the mountain people- often do not have the opportunity to voice their views which is why it becomes even more important to make efforts to listen to the views of the people while planning for them. Also, it is really important that we get more and more young people more and more engaged with the planning process. It is really important for the next generation to have a full understanding of the issues and use their energy, enthusiasm to come up with solutions that are better than those formulated by older, wiser and more experienced people. How do we change policies? How to get the city dwellers and planners together to plan? Create a platform for such engagement. Then comes, mapping which in India is associated to military operations and considered discrete. We mapped forests, human settlements, water sources, infrastructure for Mussoorie. 2-D mapping is fairly easy. How do we get this to 4-D? We built a large physical model of that depicts the physical contours of the city and then added layers to human settlement, water bodies, etc. A lot of people who have been coming to Mussoorie for many years were of the opinion that it was the first time they understood the issues of the cities. We are not trained to think in terms of 4-D maps. We think in perspectives and perspectives in mountains keep changing which is why it is important to paint a real picture of the reality, in order to understand it better and plan for the future better. The next step is to share it.

We need to think about smarter solutions to problems of mountain cities. Problems of waste, vehicular congestion have to be thought about and solved. There is a government initiative in California, USA where waste sewage water is being used to generate electricity and clean water. This is just one of the many practices that are being used worldwide. We need to think about such solutions and do so within the state plans because the central planners based in plain cities do not fundamentally understand the problems of the mountains. The solutions for the problems of the mountain cities need to find funding within the core funding of the mountain state itself.

Scenario Thinking for the Future of Mountain Cities

There are three scenarios for a future vision:

Pure Air- In this scenario for the city, the pristine air quality of the city is hoped to be preserved by tacking the problems of the air pollution which persist in the various phases of the city. Pollution by vehicles is a major contributor in this aspect followed by burning of coal and waste related stench. Hence, the urban transport has been radically redefined and retrofitted for a pedestrian friendly system rather than one which favour vehicular mobility. In this scenario, the city is remodelled with new multi-modal transport hubs which are the meeting points of cable cars, buses, electric cars and roads. This helps decongest the city and minimise the travel time.

Smart Water- Exploring the theme of smart and efficient water systems demands a more critical look at the various sources of water and ways of treatment and reuse of water for meeting the demands of various processes. Mountains often have an abundance of fresh water supply but that also requires

efficient management. If we have certain amount of water, then how do we design our buildings in a way that they absorb the water, harness it. How do we do this?

Organic City- Processes form a vital component of any system. Hence this scenario focus on the various input and output process of the mountain city. From the very birth of the element to its final form, the cradle to cradle theory has been applied to certain processes of the city.

Ultimately all of us have our own families, communities. One has to wonder where does one fit in. For architects and planners, more is not more. If we build more and more then it's not more, it's only sprawl. We need to have a vision for mountain cities and the most important thing in South Asia is implementation. Maybe, we can do something about it.

Chairperson's Address

Dr. C. Vanlalramsanga,

Prof. Feenstra raised an important question- Is it good to urbanise? In practice, we do not decide on urbanisation. We do not have much choice in this matter but what we do have choice in is addressing how we urbanise and in monitoring the process of urbanisation. So policies in terms of monitoring urbanisation especially in context of mountain cities is critical. Most of the mountain cities today are bursting with population growth which is why the challenges faced by them are quite unparalleled. What we need is action on four levels. At local level, we need awareness and capacity building of local level. At regional level, we need to work together as a team, as the Indian Himalayan Region. At national level, we need to have a credible policy to address these challenges. What we have now is Ministry of Environment Forest and Climate Change framing a policy at national level but that might not be the solution for urbanisation issues in mountain cities. What we would need is a national mountain specific policy under Ministry of Urban Development also. Globally, we know Rio Summit adopted the agenda of sustainable development but not much has moved forward since then. We need to work together on that.

BREAKOUT SESSION I:

INFRASTRUCTURE DEVELOPMENT IN MOUNTAIN CITIES

Sustainable Mountain Cities

AnoopNautiyal
Founder Chairperson, Gati Foundation, Dehradun

With the surge of urbanization, India's Cities are undergoing extensive transformations. Numerous flagship schemes launched by the Ministry Of Urban Development (MoUD) like the Smart Cities Mission (SCM), The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Pradhan Mantri Awas Yojna (PMAY) are aimed at providing urban-centric solutions in our country. Capital-intensive and technology-driven solutions are the rage, racing to change our urban landscapes. Nation-wide Competitions and scorecards designed by the Quality Council Of India (QCI) such as Swatchh Survekshan are ushering in a spirit of competitive federalism.

One main area focus when it comes to our cities, especially in the Mountain States, has been identified as 'Sustainability'. There is a need for an integrated and inclusive urban model of sustainable governance for mountain cities. The agenda of the presentation was to look at the Basket of most pressing Waste Issues with regard to Mountain Cities in India.

The traditional theory of 4Rs of Waste Management states the basic steps-Reduce Recycle, Reuse and Recover. Five Key factors identified to contribute most to growing challenges of sustainability in cities are:
Population explosion- The Census points out that Population in India will rise to 170 Cr by 2051
Urbanisation- Currently 30% of India's population lives in Urban areas. This is expected to increase to 50% by 2051, as per Census 2011

- Construction
- Consumption
- Transportation

The Swatchh Survekshan 2018, as mentioned earlier, is a nation-wide cleanliness Survey and Competition. All 4041 Statutory towns and cities of India are covered by the Survey. The three main components of the survey include:
Level of Service- answers to the Survey to be provided by City authorities
Citizen Feedback
Independent Assessment- to be carried out by the QCI
However, regrettably, the Survey does not talk about the 4Rs of Waste Management. 25 Cities from across Indian Himalayan Region (IHR) were covered in Swachh Sarvekshan 2017, of which only 3 cities were ranked among the top 100. They are: Shimla at 47, Gangtok at 50 and Leh at 100. Uttarakhand performed the worst amongst the 25 cities.

This strategy adopted by the Survey allows the civic authorities to employ their own methods to achieve cleanliness. This Survey creates a template on to parameters to quantify cleanliness. However, this question remains- How do we handle waste in Gangtok viz-a-viz in Gandinagar?

The Model adopted by Indore which came first in Swachh Sarvekshan 2017 is interesting. Indore was a dirty city, but turned around on revolutionary mode in a very short span. Some of the steps taken were:
Segregation at source

Motivated governance by the Municipal Commissioner- In the governance of any city, the two most important people are the Municipal Commissioner and Mayor of the city.
85 ward Darogahs were involved in door- to- door garbage collection
A fee of INR 60 was collected every day and streets swept thrice a day.
They removed all big dustbins in the city, which helped avoid ill-aimed dumping of waste in bins through car windows.
They also engaged in Creative Messaging.

The model undertaken by the District Magistrate of Uttarkashi is also an example of local Innovation. The city is home to 30,000 people. The city authorities promised to hand out smart phones to those who dispose garbage properly. Coupons were also issued for segregation of waste and lucky draws held. Hence, it is up to administrators to bell the cat and motivate the citizens to join in the initiative.

'Incorporating Technology to build Smart and Sustainable Mountain Cities in India':

Mr Anveshi Gutta,
Director, Smart Cities, PwC

Mountain cities face more challenges than plains. Some of them being, climate change, solid waste management, transportation and congestion of roads, mining effects, water security, telecom connectivity, tourism impact especially during the peak season, natural disasters etc. The focus here has been on four areas:
Climate change: The issue surrounding climate change is that factual data is unavailable yet and there exists a need to tap information. Coordinated data bases are a prerequisite. Extensive scientific research, monitoring of vulnerability and risk assessment are means and effects of gathering adequate data. The extent of leveraging technology also depends upon availability of data sources.
Solid Waste Management: Mountain cities lack the benefits of economies of scale. Operations of Solid Waste Management need a relook in mountains, because even fuel expenses are higher than that of plains. Innovations are the need of the hour. Tourist data numbers are also needed to analyse waste generation in these cities.
Natural disasters: With climate change and increasing disasters in the mountains, an end- to end study of the entire cycle is necessary. Response mechanisms have to be enhanced.
Telecom Connectivity: Limited access to connectivity has to be addressed. Policy shifts are most important tools to achieve uninterrupted connectivity.

Sustainable development can be measured in terms of both environmental impact and longevity. The four steps that form part of creating a sustainable ecosystem are:
Citizen engagement and participation
Institutional capacity for the initiative
Analysing impact of ecosystem on economy
Revenue generating streams of technology should be able to keep it sustainable in the long run.

Some attributes to a smart city:

- Institutional Infrastructure - Physical Infrastructure
- Skill Development - Social sector focus- Health, education and environment

Technology is just an enabler. However, GIS is important and telecom penetration is a necessary prerequisite for geospatial connectivity.

Citizenship as negotiated through infrastructural spaces in Darjeeling Municipality and the need to expand the planning landscape.

Roshan P Rai,
Darjeeling Himalayan Initiative

Darjeeling Municipality in the Eastern Himalaya wasestablished in 1850 and later planned for 10,000 to 20,000 people in the 1930s. It today occupies a physical space of 11.6 square kilometres with a population close to 1,20,000(2011 census). The census data does not factor in the large floating population of migrant workers, students and tourists. As most other mountain cities, the challenges of limited resources and high cost of investment exist in Darjeeling as well. It also ignores the expansion of the town into rural scapes. Networks of water and waste flows remain contained within the limited colonial infrastructure planned for 20,000 people and we are still continuing with this system of water and waste management. Also, water is contaminated by sewage flow and does not reach the entire geography of the present municipality boundaries resulting in water stress and contamination.
Access to or exclusion from these infrastructure is based upon the placement of households in the core or the periphery of the municipality and is further complicated with the altitudinal variations of settlements as water and waste flows are based on gravity. This variation in access corresponds with differing notions of citizenship of people and communities within the Darjeeling municipality. The fast eroding rural- urban interface brings in an additional challenge of governance where the physical geography of the municipality does not correspond to the social geography of the town.

The presentation critiques the limitations of centralised planning within existing municipal boundaries. The crisis can simply be explained by how water is distributed through the cities- water first drops off in defence areas, then reaches the residential school and in the end the rest of the citizens get access. How can a city exclude people from a network of water and yet, call them citizens and collect taxes? The limited reach of the physical infrastructure is challenged by narratives of communities living in the periphery, and questions of equitable access and citizenship arise. Peripheral voices challenge notions of inclusion, equity and sustainability in the context of the centralized planning of Darjeeling Municipality.

In Darjeeling there are about 90 urban springs that people use, but the municipality has not integrated these yet. The reason given by the authorities is that, the Municipality is located at higher reaches, while these springs are found at lower areas of the district. One such example is the community that lives around the Laldighi spring. They have created their own Community collection, preservation and distribution systems. The community also manages its springs and has even adopted its own liquid waste management system. Yet, to our utter disbelief, somewhere down the line they were designated as slums.

Another example would be of the South-Western slope, the Mangalpuri region where half the community is designed as rural and the rest as urban. They have access to only contaminated water in the upper reaches. This community manages its own spring and has got a pump system to distribute it to 200 households.

The pressing need is to look at mountain cities as sum of its parts. Cities cannot be planned in isolation. They have to be planned as per their geographical landscape. An inclusive and integrated landscape approach to planning beyond narrow definitions of physical networks and boundaries is proposed for Darjeeling. This micro-analysis of Darjeeling Municipality finds resonance in other mountain cities and towns in the Indian Himalaya and beyond who face similar infrastructural challenges in complex social and physical geographies.

Nexus between Climate, Infrastructure and Urbanisation

Dr. Amir Bazaz,
IIHS Bangalore

The nexus between urbanisation, infrastructure development and human well-being has been well articulated in academic and practice literature. Literature acknowledges the vitality of adequate social and physical infrastructure in supporting the urban economy and human/natural well-being. In the light of climate change and climatic variability, the urban-infrastructure-well-being-climate-change inter-linkages become very complex and pose phenomenal policy and practice challenges.

Complex inter-linkages of the three have been drawn based on insights from the 5-year long Adaptation at Scale in Semi-Arid Regions (ASSAR) project, a part of an IDRC and DfID-funded climate adaptation research program – Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA). The presentation focuses on the provision/ improvement of adequate social and physical infrastructure in the context of deeply embedded structural vulnerabilities. This will be crucial for urban regions, particularly in the light of improving the effectiveness of developmental interventions. Some of the key policy touch points that cities should focus on while thinking about managing the complex connections between urbanisation, infrastructure development and human/natural well-being are:

- Focus on major taking points such as population at the periphery, biodiversity hotspots, springs and coastal areas.
- There is a pressing need to be cognizant of cost-benefit analysis
- Facilitate an environment where people can create and sustain assets, be it environment, knowledge or any such asset.

Points to be kept in mind from a local point of view:

- Stay in a pattern that already exist and don't change the landscape. This will maintain consistency in the long term
- In-situ development is the best way to adopt city development plans
- Focus on entitlements and service delivery, which are the rights of every citizen. There is also a need to make the system accountable.
- Create an active platform to enable engagement by citizens which is also legitimized by the state

Understanding Mobility Through the Evolving "Automobile Ecosystem" of the Twentieth-Century

Siddharth Rasaily
Urban Development & Housing Department, Gangtok

Transport plays a crucial role in urban development by providing access for people to education, markets, employment, recreation, health care and other key services. The existing reality, however, is that urban transportation systems in most developing cities are far from ideal. The most visible and frequently mentioned transport problem of a city is its traffic congestion, Accessible and affordable public transport service and safe infrastructure for non-motorised transport such as cycling and walking are lacking in most developing country cities. The number of private vehicles has been increasing continuously and dominates the roads. As a result, the transportation sector is heavily responsible for public health issues in cities such as air pollution (acidification, smog), noise, greenhouse gas emissions, and road accidents. While transport enables the economy to grow, if not well managed, it can also retard growth and the efficient delivery of essential social services. The lack of comprehensive planning of transport systems, without due consideration to social, economic, environmental and cultural elements of the city, can result in physical breaks in the fabric of communities and reinforce social exclusion. The

impact on quality of life and the environment cannot be underestimated. One way to breakdown the complexities of mobility and mobility planning in the current scenario is to look into the story of the automobile in its various forms and its contribution and effect on the mobility challenges that we are facing today.

Understanding mobility through the evolving 'automobile ecosystem' of the twentieth-century is an attempt to describe the automobile dependency on our lives from how our houses and lives are planned or designed around the automobile to how the cities have evolved as ecosystem for the automobile enabling the economy to grow and thus keeping us more dependent on the automobile ecosystem. How improving this ecosystem further induces an increase in automobiles and the only way out is to create not only other modes of mobility but also an entire ecosystem around the chosen modes of mobility along with a change in our lifestyle and the way we think.

Mobility in the hills and mountain cities are completely different from that of the plains for the following reasons: In the plains mobility within the urban area is horizontal in nature however in the hills/ mountain cities mobility is from one elevation to another elevation through a series of change in elevation. This single factor completely changes the mobility requirement and planning in the hills. Due to the topography of a hill the length of the distance can be exaggerated or shortened due to the nature of the topography like moving from one side of the hill to the opposite of the hill the distance can get exaggerated since one has to move around the hill. On the plains it is always constant. The cost of creating any form of mobility ecosystem in the hill is always more expensive than the low-lying counterpart by many folds. The fragile ecosystem of the hills/mountains has its own form natural disasters like landslide, flash flooding, earthquakes, etc. and thus mobility issues around it.

These features pose a unique set of challenges for mobility planning. Thus it is up to us from the hill & mountain community to start looking for solutions, start research for viable alternative modes of mobility and most of all start sharing information for the benefit of the entire mountain community.

ISSUES IDENTIFIED:

- Assessment may not always lead to change in practices. What are the problems with regard to Sustainable Mountain City development that technology can address?
- Structural issues are at the heart of sustainable development in Mountain cities
- Lack of equitable access and Fragmented Governance structure
- Prevalence of health issues due to water contamination is against the fundamental idea behind cities, that 'Cities are solutions'
- Ecological excesses and necessity for research and data to explain issues and ideas better, especially with drastic impacts of climate change today
- How vital is the need to accumulate assets and role of Government? For example, need for a National Reconstruction Authority following the recent devastating Earthquake in Nepal

SOLUTIONS SUGGESTED:

- If leaders take responsibility, assessment tools like Swachh Sarvekshan can be used as a catalyst to develop and promote a sustainable ecosystem
- Involvement of Institutions plays a major role.
- Revenue generation needs to come from ongoing initiatives.
- Community adaptation stories can be mainstreamed and made more politically relevant.

BREAKOUT SESSION II:
WATER & WASTE MANAGEMENT IN MOUNTAIN STATES

Chairperson: Mr. R. P. Gurung, ECOSS & Councillor, IMI
Co-Chairperson: Er. Lalrothanga, Director, CCDU Government of Mizoram

Water in Himalayan Towns: Lessons for Adaptive Water Governance

Dr. Anjal Prakash,
Program Coordinator, HI-AWARE, ICIMOD

The urban centres in the Hindu-Kush Himalayan (HKH) region are growing rapidly. Eight cities from the HKH Region (including Mussorie, Devprayag, Singtam and Kalimpong from the Indian Himalayan Region) were taken up for study under HI-AWARE. Administrators of each city were asked their water budget. While municipalities had an idea of how much water was coming in for usage, they were unaware of the quantity of water being used.

Despite each of these cities receiving high rainfall, almost all of them have reported issues in water supply. This makes for an alarming fact. The mountain cities are often not prepared to deal with the massive floating population that comes with the influx of tourists. For instance, there exists a massive demand-supply gap in Mussorie. Supply during tourist season goes down to as low as 16 Lt per capita per day. During off-season, there is only a 1% shortfall of water. However, this goes up to 47% during the tourist season. There also exists a strong nexus between tanker mafias and municipalities, which poses a problem. It is believed that the water supply is kept inefficient only to ensure the tankers have work. This way, the people have to rely on the private sources for water, leading to big profits for the tanker mafia.

Only a negligible number of people store rainwater on their rooftops and practice other forms of rainwater harvesting. Infrastructure (like pipes), in many towns in India, were last laid when the British were here. After that, there has been no planning process to upgrade or strengthen this infrastructure within urban planning. Women and girls often have to travel long distances to collect water. The quality of water is not very high in many cases.

In places such as Singtam, piped connections and PHE water supply is only for older inhabitants and those who own the houses. Adaptive measures taken by people include buying private water connections or forming a strong relationship with the ward commissioner. The power wielded by the person who regulates water becomes an issue.

Recommendations:

Municipalities should have a strong idea of the water demand and supply of the cities. Though they know how many water connections are provided, these connections do not represent all the people in the wards. Thus, their understanding of this should be made strong and they should have the means to collect the relevant data.

There needs to be a bioregional plan to manage water. Outer, environment and day-to-day planning of municipalities should co-exist

Protection of springs should become an integral part of the plans of municipalities

Seasonal carrying capacity of the cities should be known. There should be an estimation of the floating population based on the seasons in order to factor in the same into their planning process to be able to cope with the same

Water quality is a major issue. Biological water contamination is easy to manage. However, there needs to be a proper structure of communication between different parties to ensure that the correct treatment of the water is carried out. Municipalities should emphasize more on these aspects and should carry out frequent IEC (Information Education and Communication) programme

Application of Geospatial Technology for Sustainable Land Use Planning and Management Based on Water Resources in KawnpuiTown, Mizoram, India

F. *Lalbiakmawia, M. Lalruatfeli and*
Shiva Kumar, Mizoram University

It is crucial to include water resources in land use management. Land and water resource management should be integrated using scientific inputs and analysis of these land and water resources. Geospatial planning incorporates spatial as well as non-spatial data to generate realistic water and land resource management plans. This makes it a crucial tool.

Land use and water resources management planning in the hilly terrains is not an easy task as it involves a lot of parameters to be taken into account. The study area comprises large percentage of land which comes under shifting cultivation, which is the main system for farming at the present stage. Planning in such system of cultivation is a major task. Therefore, geospatial planning is necessary due to its ability to incorporate both spatial and non-spatial data for generating realistic and successful land and water resource management plans. Identifying the significance of various natural resources in sustaining the livelihood of the locals and considering strategic utilization and management according to their capability is an important input during the planning process. Expansion of habitation and construction of link roads to the cultivable areas are also important factors which need to be approached through consensus of various sectors. The present study has proved that remote sensing and GIS can be utilized effectively for formulating sustainable development plan based on land and water resources.

Waste Management in Aizawl City

Netralal Jaisi, Deputy Program Director, SIPMIU,
UD&PA Department, Mizoram

Municipal Waste is divided into domestic, commercial and industrial waste. Thirty-nine percent of the waste generated in Aizawl city is biodegradable waste. However, there is no segregation at source.

he collection and disposal of construction and demolition waste is not as per guidelines. Disposal of solid waste is not as per guidelines as it is directly dumped into the landfill. The waste is also handled manually, which constitutes a major health hazard. There is also a lack of awareness among residents and civic authorities regarding waste disposal.

There is an Aizawl Solid Waste Resource Management proposal along with an Aizawl Master Plan: Vision 2030. Concepts for the former has been derived from documents such as the Municipal and Solid Waste Management and Handling Rules of 2000 and 2016, Recommendations by the Supreme Court for Solid Waste Management in Class-I cities, Guidelines of JnNURM and UIDSSMT by the Ministry of Urban Development, a study on the good practices of Kulithalai Municipal Corporation in Tamil Nadu and of WOI Municipal Corporation in Maharashtra during 2013-2014 and Study Report on e-Waste (Good Practice) of SWM by Task Force, Planning Commission, Government of India, May, 2014.

A six-month long pilot project was carried out in Aizawl in five local councils in 2014-2015. Following this, capacity building and awareness programmes were carried out. A Sanitation Task Force was formed and trained in solid waste management (including waste collection training and house to house public consultation).

Some of the other activities undertaken were door to door collection of waste, task force house visits, improvement of garbage transportation and exposure tours on solid waste resource management.

Waste Warriors' Work

Avinash Pratap Singh,
Project Manager, Waste Warriors

By 2041, 15,000 square kilometre of land will be required for waste disposal. There is an urgency to curb the generation of waste. Waste Warriors has made the locals of Dharamshala responsible for the collection of waste from shops and tourist areas. This ensures taking ownership of the upkeep their surroundings. Ideally, solutions should be found within the community and the capacity of the community should be built.

Dharamshala is a town with a population of approximately 60,000 people. However, like most other mountain cities, it too faces a big tourist population. The Waste Warriors project is based in Upper Dharamshala. Waste Warriors began this project in 2009 by going to gather the waste themselves. They collect waste from higher areas, segregate it and bring it down. They believe in direct action. At the beginning they used to have 200 mules carrying down the waste from a height of 2800 meters. Now, there are 600 mules used for the same.

There is a need for a basic system and infrastructure to ensure proper waste management and to give people the option not to litter. A 'Waste-Drop' point was set up and the people are now encouraged to bring back the waste that they have and deposit it here rather than discard it high in the mountains. All shops have been encouraged to segregate their own waste. There are now 42 dustbins in Dharamshala city that have been funded by the people.

Reducing amount of waste going into landfills through segregation and showing pride of being able to manage waste and promoting waste management is a big part of ensuring the message reaches more people.

Waste Warriors has eight workers who collect 20 tonnes of waste from 200 establishments. A user fee is also levied. On an average around Rs. 22,300 is collected as user fees over three months. This is how the organization sustains itself as of now. Waste Warriors believes in reducing the amount of waste going into landfills. They ensure this by segregating any waste that they can.

There aren't enough people talk about waste in India. This is a dialogue that needs to begin and starting this dialogue in schools is an effective way of spreading awareness. The organization has also made murals on walls along Dharamshala to spread the message of waste management.

There is a training programme that is carried out for teachers to give them a basic understanding of waste. Waste Warriors also has a module-based student programme that has reached more than 1 lakh students. A clean-campus initiative is in place where children are taught how to manage waste, after which they carry this out on their own. There is also a children's day activity where a series of fun activities (painting, wealth out of waste etc.) surrounding waste management are carried out to educate children. This helps build the dialogue surrounding waste.

Zero Waste Himalaya

Priyadarshinee Shrestha, Team Leader, WWF India
and Kanchendzonga Wildlife Conservation Project

Gangtok has seen a lot of cosmetic clean up, but there has been little focus on processing waste and recycling in Gangtok. The floating population is huge, adding to the problem of waste management. Due to limited land, it has been difficult to make a landfill site. The new landfill in Gangtok has been built over the previous one. Dumping over the historic waste can have disastrous consequences.

In 1997, there was a landslide in Gangtok which was caused by the accumulation of garbage and plastic bags. This led to the establishment of the Garbage Control Act. Subsequently, garbage vats were removed from the town area to prevent people from dumping waste, and door to door collection started. Fines are levied on those dumping waste in jhoras. Ban of plastic bags too has been implemented. Trade license renewal for commercial bodies has been linked to the payment of the garbage fee in advance to ensure it is paid.

Under the ADB Project, waste segregation is to be expended to other wards. However, all the waste still ends up in the landfill. There is a pressing need to revisit the meaning of "Swachh". There has been a massive shift in lifestyles. Consumption and wastage has increased manifold. Waste which has no solution (non-biodegradable) is a lot more in circulation. A bit of planning and investment of time can help reduce the same. We need to bear in mind that recycling is not always the solution. Only a small amount of plastics used go into recycling.
Some of the steps taken in Sikkim to this end are:

- Complete ban on Styrofoam disposals.
- No plastic bottles used in government functions – green protocol.
- Lachen has banned pet bottles. First village to have done this.
- Segregation at source in Arithang Ward in Gangtok successfully carried out. It is one of the most populated and centrally located wards in the city, which goes to show that this is something that can be replicated and scaled up.

There is a need to look beyond cleanliness drives and shifting of the problem. There is a need to look at closed loop economies. Extended producers should be made more accountable and responsible. Companies should be made responsible for their products even after they have been sold and used.
Clean production and design solutions should be thought of. For instance, the serving of food on plates made of leaves is a viable design solution.

The SDGs have already laid down targets and India is a signatory. The thought process is in place, solid waste management rules are in place which speak of mandatory segregation at source, social responsibility, take back mechanisms etc. These just need to be taken forward to the next level and implemented in a methodical manner. To work towards sustainable development, we first need to question how sustainable we are.

Issues Identified in the Session

- Huge gap in demand and supply of water
- Cities are not prepared to deal with the massive floating population
- Unequal distribution of water
- Long distances travelled by women and girls to gather water

- Not enough conversations surrounding the problem of waste
- Segregation of municipal waste (at source or otherwise) remains a challenge
- Unsanitary disposal of waste makes for a major health hazard
- Cosmetic clean up is taken up but the processing and recycling of waste is not looked into
- High cost of collection/recovery/disposal of waste due to the terrain
- Change in consumption patterns – more packaged material that leads to more waste generated

Solutions Suggested

- There should be extended producer responsibility, e.g, Sikkim Milk Union takes back the milk packets as it is made of good quality. It is not 100% successful, but it is an attempt at extended producer responsibility
- Bioregional planning of water management
- Use of GIS to map areas with ground water availability is important in identifying sources of water
- Module based learning programme to make school students aware of the issue of waste and how to tackle it
- Learning from the waste management practices in other towns/cities
- Ban on plastic bags
- Creation of litter-free zones (such as MG Marg in Gangtok)
- Hefty fines on dumping of garbage and littering
- Ward-level sanitation committees
- Green protocol for Government functions – no plastic bottles (carried out in Sikkim)
- Ban of packaged water (Lachen Village, North Sikkim)
- Pilot for segregation at source (Arithang Society, Sikkim)

Action Points

- Water source conservation and protection and source diversification
- Spring protection for sustainable water supply
- Floating population should be taken into account in the government planning processes
- Train shops to segregate their waste
- Make the message clear and visible to the people
- Awareness on waste disposal and management needs to be taken up on priority with citizens. Change in attitudinal and behavioural change is key
- Need to think of better alternatives to the use of bottles/Styrofoam cups and plates and PET bottles. Recycling is not always the solution
- Hold companies accountable for the packaging/waste they produce
- Alternative design solutions
- Attempt to achieve the targets laid down within the Sustainable Development Goals (SDGs)
- Solid Waste Management Rules 2016 has already laid down necessary action

Change will not come if we wait for some other person or some other time.
We are the ones we've been waiting for.
We are the change that we seek - Barack Obama

BREAKOUT SESSION III:
DISASTER RISK REDUCTION & MANAGEMENT

Disaster Risk Reduction & Management – Laws, Acts and Regulations Concerning the Mountain States: Roadmap to Stability for Aizawl City

Er. Zohmingthanga,
Aizawl Municipal Corporation

The roadmap to stability for Aizawl city is based on two important actions undertaken by the Mizoram Government which includes the formation of Landslide Policy Committee headed by the Mayor, and implementation of Aizawl Municipal Corporation (Site Development and Slope Modification) Regulations, 2017. The DRR targets planned by the committee has been categorised for three terms:

Short term targets (1-2 years) which will work towards at developing regulations for slope modification, adding technical experts to the municipality, preparing hazard maps, policy review to consider geologic hazards in land allocation, landslide monitoring and warning systems

Mid-term targets (2-4 years) will aim to attain approval from state government for new regulations proposed by the Landslide Policy Committee

Long term targets (4-6 years) will look at enforcement of development/slope modification regulations, sewerage control and treatment, and control of solid waste management to prevent blockage of natural and human-made drains

The Aizawl Municipal Corporation (AMC) will ensure that site development permits are obtained by individual households, central and state government and semi-government departments/organisations, excluding the Defence Ministry, for construction of buildings. The Aizawl Municipal Corporation Geologic Review Board which will be established, as per the regulation, will be responsible for reviewing geotechnical reports accompanying site development permit applications made under the regulations, in addition to AMC staff review.

The review board will also oversee:

- Rainy season site development restrictions
- Notification of adjacent plot owners
- Maximum permissible slope
- Correcting unsafe conditions
- Requirements of Cuts/Excavations which covers cut slopes (un-retained), retained cuts, requirement of fills (gradient of slope, fill material and compaction), drainage, disposal of excavated material

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has - Margaret Mead

Community Based Disaster Risk Reduction & Management in Mizoram

Dr. Lalrokima Chenkual, Associate. Prof.
Administrative Training Institute, Aizawl

Community Based Disaster Risk Reduction and Management approach is currently practiced and given lot to thrust as community empowerment and the right to participate is central to good preparedness and mitigation. Appropriate disaster prevention and mitigation builds on people's strengths and tackles the causes of vulnerability as it looks at non-structural aspects and also emphasis on community as the main actor in disaster mitigation. Taking into account the inadequacy of government machinery to prevent considerable loss of life and property, due to lack of timely response, it is realized that communities need to work out a plan to prevent losses. Involving the community in the preparedness phase not only increases the likelihood of coordinated action by the communities to help in mitigating disasters but also brings the community together to lessen the impact of disaster.

Disaster risk reduction at the community level is very relevant in Mizo society, and this may be illustrated by the following points;

Firstly, the close-knit homogeneous society having no class distinction and discrimination on grounds of caste, religion and sex has helped strengthen the principle of self-help and cooperation for the fulfillment of social obligation and responsibilities

Secondly, *Tlawmngaihna*, Mizo code of morals and conduct, a highly prized virtue and philosophy of life expressed as self-less act of kindness, hospitality, altruism and chivalry and self-sacrifice for the service of others has added to the social resilience of the community

Thirdly, Christianity and the church administration provides a feeling of oneness in spirit, and a sense of equality and fellowship which has helped bind Mizos together through various church activities, thus strengthening the social capital during disasters

Lastly, the presence of strong community based organisations and NGO network have strengthened mobilization and delivery of services and resources during disasters

There is a need to streamline the spirit of *Tlawmngaihna* for systematic management of disasters at the community level in Mizoram. This can be achieved by involving district administration and village councils during the process of making disaster management plans and constituting disaster management committees.

Humankind has not woven the web of life.
We are but one thread within it.
Whatever we do to the web, we do to ourselves.
All things are bound together.
All things connect. – Chief Seattle, 1854

Rural Habitat in Mountainous Regions:
Challenges for Disaster Resistance and Sustainability

Pankaj Khanna,
Development Alternatives, New Delhi

Traditional approach to habitat organically evolved from wisdom of understanding the environment and pressures of exposure to natural systems. Local communities adapted their housing design in harmony with nature in terms of planning design and materials. Locally available resources were used for construction and maintenance with social systems that regulated the exploitation of forest resources. The design and built quality offered excellent climatic response while providing high sensibility for seismic vulnerability based on decades of design evolution. It also provided an aesthetic identity of the region showcasing local craftsmanship.

Increasing aspirations of mountain communities, with economic growth, is changing the habitat in mountain states. This is reflected in the peoples' pursuit of *pucca* houses using cement, steels and bricks and further pushed by the government. Public infrastructure with the 'one-size-fits-all' model has limited options to replication of RCC frames lacks climatic, cultural sensitivity and durability. The race for RCC structures has enforced availability of expensive burnt clay bricks in the mountainous regions, while perpetuating below-average construction skills. Environmental regulations have been bypassed with spiralling demand of materials in urban areas, thus increasing exploitation of natural resources – stone, timber and sand. The pursuit for *pucca* infrastructure has also reinforced the false comfort of seismic safety with little understanding of seismic design with modern materials in engineers and masons.

With communities caught between old and new, forgetting the old and not understanding how to use the new, there is an urgent need for collaborative action. Imperatives for future action include:

Integrated policy for sustainable mountain habitat. This would require a link of habitat and development, and natural resource management to avoid conflicts between conservation and sustainable use of resources; with science and technology inputs in promoting Resource Efficiency. Emphasis on collaborative framework of research, social science and market based institutions to enhance mountain specific technology incubation for new materials.

Access to materials and skills through decentralized production nodes for building materials; employment generation and skill upgradation to benefit local economy. Retrofitting buildings to reduce vulnerability of existing structures, safety in affordable manner coupled with training of engineers and masons in safe building practices. Hybrid approaches using scientific application with natural materials aimed at enhancing durability of traditional mountain architecture should be explored

Issues Identified

- Mizoram, a multi-hazard zone with the steep landscapes
- Aizawl Municipal Committee has no geologists; added to that; no technical/geographical data (inc hazard zonation maps)
- Construction practices don't take into account the impacts of ill-informed construction practices in terms of slope cutting, filling etc. Issues of enforcement with respect to regulations and mandates provided
- Participation of community in DRR – the main player/deciding factor for hazards to become disasters – community as victims/first responders of disasters

- Period of isolation due to geography during disasters – 5 days in hilly area
- Changing habitat in the mountain states – location, design, materials used – increased physical vulnerability??
- No knowledge of retrofitting by the local contractors and masons
- One-size-fits-all crisis, in pursuit of 'pucca', urbanisation, environmental regulations
- Little understanding of seismic design at community level

Solutions Suggested

- Developing new infrastructure will require landowner to obtain No Objection Certificates which are verified on ground
- Proper site plan added to the engineers' site development plan and presented to geotechnical team before the construction. This will be reviewed by the geologic review board (1 geotechnical persons + 2 geologists)
- Notification of adjacent plot owners
- Mandates for construction – eg. no constructions beyond 60 degrees gradient, types of cutting, mechanisms for filling
- Strengthening capacities – Homogeneity, religion, strong NGOs, moral spirit of *Tlawmngaihna*, social institutions etc
- Local technology + Scientific application for sustainable mountain housing/habitat

Action Points

- Integrated Policy
- Science and Technology inputs in promoting resource efficiency linking habitat development and natural resource management
- Mountain specific research and technology incubation for new materials
- Habitat and Enterprise development
- Access to materials and skills
- Decentralized production nodes for building materials with implications on local economy benefits
- Retrofitting technology and training of masons and engineers
- Hybrid approaches to housing and infrastructure through scientific application to natural materials and traditional building systems

MDoNER-NEC-IMI PLENARY

Chief Guest:	***Shri. Jitendra Singh,***
	Hon'ble Union Minister of DONER
Chairperson:	*Shri Alemtemshi Jamir, IAS (Retd.),*
	President, IMI & Former CS, Nagaland

Shri Alemtemshi Jamir welcomed the Minister which was followed by a brief address by Shri PD Rai. Shri Rai highlighted that IMI be a vehicle to bring together the mountain states for the development of the region.

Dr.Jitendra Singh, Minister of State (I/C)- MDoNER

The 11 states started with common woes, but over time this has changed and states feel some are better than the other. The Union Government has received several requests for a Ministry for the Himalayan States from the 3 states which are not a part of DoNER. The chronological development of Ministry of DoNER is the existence of a specialised department and the NEC much before the Ministry was eventually formed. The NE Industrial Promotion Policy is in circulation in Cabinet but the northern Himalayan states are already moving letters for a similar policy. However, the constraints of the Himalayan states are common. For instance, budget for 10 kms of road construction in Gujarat will only be appropriate for 4 kms of road in the Himalayan states. Additionally, climatic constraints of monsoon add to the infrastructure challenge.

The beauty of NER is an unguarded secret now. The aspirational India or young India is looking for equitable development- at par with those living in other parts of India and the world. The priority now is to bring all states at par and the government is working towards it. One of the first observations made by Prime Minister Modi soon after taking office was that all regions should grow to ensure India grows. The government has also taken up railroad construction in the north-eastern states other than Sikkim. The government is committed to the hill states and the priority is obviously visible. As Minister of DoNER, while visiting Shillong-the NE headquarters, he recalled that the public called on him just to confirm that a Union Minister is visiting. When the PM was informed that no PM since Morarji Desai had visited NER, PM Modi visited. PM Modi visited J&K within 2 days of flooding, celebrated Diwali with the flood victims which show that the PM would do anything for the states asking.

There is much more to learn from NER than rest of the country. Mizoram's literacy is second only to Kerala. The best of scholars in many Universities are from NER. Sikkim's SGDP growth rate is about 20%- which is possible because of discipline, literacy, culture and customs which have made the States focussed. The women are comparatively more empowered in NER. JNU has over 700 students from NER which is more than any other individual state.

To bring the Ministry closer to the people, the Ministry has taken several steps including visits by students to the Ministry. The resident commissioners of the 8 NER states have been made a part of the Ministry and assist in coordination, liaisoning and monitoring of activities. Senior officers of the Ministry also conduct monthly campslike camp offices in 1 state of the region to address the challenges and grievances.

The ministry has also formed inter-ministerial committees and state empowered committees to speed up fund availability for projects.

- A first of its kind, regional road corporation- North East Regional Road Corporation devoted primarily to maintain and construct roads in the NE was formed with a separate budget from the centre.
- Waterways have been developed which has reduced cost of transport under the Indo-Bangladesh agreement.
- First train to Bangladesh is also being rolled out. Air connectivity to Nagaland, Aizawl and Shillong has also improved under the current Government.
- Intra-regional connectivity is poorer than regional connectivity and therefore, helicopter services are being developed.
- State of art sports university is being developed in Manipur.
- Dr.Kalam Research Centre to be set up in Meghalaya
- Brahmaputra Centre at Guwahati University to undertake research in the region has been set up and the first project is to study disaster risk in the region
- Air clinics have been set up as well with a funding of INR 125 cr. These helicopters serve as OPD in remote regions to give access to healthcare

Innovation and entrepreneurship should be encouraged in the North-East. Organic agriculture and tourism have huge scope in the region. Homestay tourism needs to be developed. Several practices can be emulated across the region and IMI platform can be used.

With the rapidly changing world, aspirations of the young Indians are also changing and we must all come together with new ideas and new ways to implement programs to ensure the young of NER are not left behind.

Dr Jitendra invited and encouraged questions from the young participants of the Summit. The discussion with the Hon'ble Minister focussed on making access to education closer to home, making the transportation and communication infrastructure more effective. The key outcomes of the discussion are as follows:

There are various initiatives happening in different parts of the North East and the different State Governments are urged to be aware of these initiatives and take cues from them to implement in their respective states.

Addressing a question on the vetting process of proposals sent in for the North East Venture Fund, the Hon'ble Minister spoke of there being around 60 proposals in the pipeline. There is a helpline and a separate desk at the DoNER ministry for any queries the youth may have. The partnership will depend on the form of entrepreneurship. The Ministry is trying to bring in a dynamic system where they will contribute based on how lucrative the business appears. This is to help the youth learn the skills of business. One does not become an entrepreneur simply by investing after attending a business summit. They need to gauge the profitability of what they are investing in. This is one of the lessons young entrepreneurs should learn. To know what kind of investment and entrepreneurial set up is suitable in which region can be worked out with a bit of counselling, research and inputs, since each area has its own potential

A Film and Television Institute that is going to be set up in Arunachal Pradesh. The North East having such scenic spots would do well to have a Film and Television Institute to encourage more filming in the region.
Students from Sikkim often have to travel to Guwahati or Kolkata to give entrance tests. Similarly, those in Leh have to fly down to Delhi to do so. Since the Ministry of DoNER also works on the development of education in the North East region, there have been demands from other hill regions as well to make provisions for exam centres. The Hon'ble Minister, also being in charge of the Ministry of Personnel is trying to work with the UPSC to arrive at a solution to this. However, they require a minimum number of candidates to set up such centres.

Farmers from Arunachal Pradesh often feel discouraged when there is a fluctuation in prices and when their produce isn't sold as planned. A question on whether the DoNER Ministry could work with the Agriculture Ministry and the state government to provide a minimum support price to the farmers for a period of five or ten years, till the setting up of infrastructure such a cold storages and processing units, was raised. Engaging in a PPP model might be helpful as private parties could help relieve the financial crunch by engaging with PSUs. The funding can come from the private parties and the infrastructure and technical knowhow could be provided by the government.

Lack of proper communication outreach and optic fibres, which also end up impacting services such as banking, in remote parts of the North East has been taken note of. The concerned ministries are on the job to take care of the issue at hand.

C. DAY 3: FRIDAY, 22 SEPTEMBER 2017

LEARNING SESSIONS

SYSTEMS THINKING AND LANDSCAPE GOVERNANCE

Chairperson: Shri Sushil Ramola, Councillor, IMI

Systems Thinking and Landscape Governance

Mountain systems are complex and any development activity within this landscape will have positive and negative socio-economic and environmental implications. As different subsystems are closely interlinked, management tools that tackle only a single component or segment will not be effective. To respond to the challenges and threats, holistic, participatory and integrated approaches that address all aspects of sustainability are required. The specific needs and inter-linkages of different aspects of sustainable mountain development, such as water, biodiversity, waste management, disaster risk management, transport and infrastructure etc., must be taken into account. The session on system thinking and landscape governance provided a conceptual and applied understanding of systems thinking as a way to grapple with the complexity of sustainable development.

Keynote Address on 'Systems Thinking': A Practitioner's Perspective

Shri Snehil Kumar, LEAD India

What is the logic behind data collection – to ascertain the theories we want to prove, or are we collecting data what the ecosystem is throwing at us? How do we convert data collected overtime into information? These questions pose an important point in the context of guiding mechanisms for development, and answering these questions requires a systems approach. Systems thinking is an approach that looks at a system – an ecosystem, built environment, university campus etc as a whole, identifies its parts and understand the inter-relationship between the parts. The approach enables people to see the processes of dynamic change rather than static "snapshots/events".

Mountain regions, cities, villages are constantly changing with time, and this will require a systems approach to understand the underlying forces of change. Examination of data collected for over 20-30 years can help establish the dynamism of what is happening and also enable identification of factors influencing the change. The process will also enable an understanding of the behaviour datasets on issues of climate change, migration, deforestation etc, and the direction in which it is moving after a certain point of time.

There needs to be a certain change in our approach to resolving issues; from linear traditional thinking to circular systems thinking – from fragments to whole, symptoms to causes, short term to long term, parts to relationship between parts, and problem solving to problem understanding. The traditional reactive approaches used by politicians, bureaucrats and government officials for solving development issues - for instance water crisis, often have negative effects. However efficiently, solutions provided to problems, without an understanding of long team effects, leads to creation of patterns. Providing solutions without with focus on patterns alone will not solve the issues. It requires looking at systems and structures underneath. For instance, resolving issues on agriculture would require an examination on

the aspirations of youngsters, mindsets of people, political framework involved and whether educational systems support agricultural practices and technology. The mechanism should also take into account the mental morals of people, and what they think about the system. This is important as it helps understand the patterns which are reflective of the symptoms of a problem. Most of the problems, the way we describe it, are actually symptoms. Migration, change in climatic patterns are symptoms of the underlying issues in the system.

Rules of system thinking:

Today's problems are yesterday's solutions. Some of the great solutions that were created in the past are facilitating huge problems today. For instance the Green Revolution that was initiated to solve the issue of food security has led to complete use of chemicals in our foods

The harder you push, the harder the system pushes back:
The more urbanization we do, the more migration we will have which will led to lack of facilities in urban settings
Behaviour grows better before it grows worse
Easy way out usually leads back in

Cure can be worse than the disease: Fossil fuel emissions vs. first generation biodiesel emissions – emissions from first generation biodiesels will account for 57% of the total EU bio-fuels market in 2020
Faster is slower – Fast growth

Cause and effect: Not closely related in time and space. The effect of deforestation is felt in a very long time frame. Our ability to see the cause and effect in the same space is very limited. Data needs to be established

You can have your cake and eat at too but not all at once. It's the growth important or is it the well-being of the environment and the people
Dividing an elephant in half does not produce two small elephants
There is no blame

The Way Forward:

Systems Thinking talks about leverages with view that small changes can produce big results. However, the areas of highest leverage are often the least obvious. The example of navigating a large ship can help elucidate the point. Direction of ships are changed with the help of a small rudder which is influenced by a trim tabs. Important leverage while using systems approach includes understanding goal of the system; mindset or paradigms – structure, rules, culture; and power to transcend paradigms.

The power of paradigm/mental model shift:
A new level of thinking
"The significant problems we face cannot be solved at the same level of thinking we were at when we created them"
Resilience is the ability of a system to bounce back from any perturbation.
Systems have to be managed not only for stability and productivity but also for resilience
Systems have a way of self-organizing and create hierarchies

Keynote Address on 'Landscape Governance'

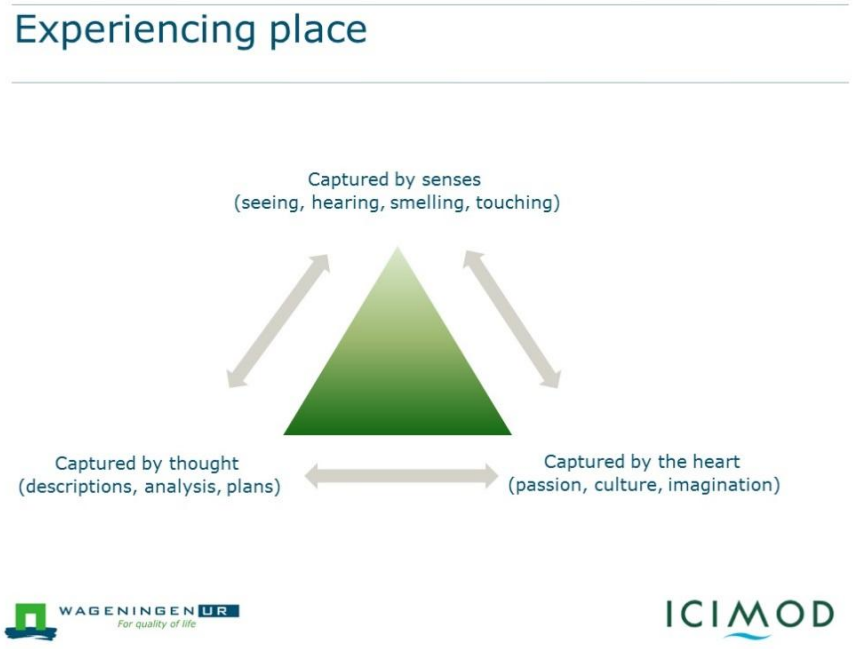
BMS Rathore,
Country Focal Person, ICIMOD

Landscape is about possibilities. It is about the scale and not the narrowly defined boundaries. It is about getting your connects. Landscape goes beyond the physical, beyond what can be touched and seen and experienced, and includes those sometimes transient and elusive influences which help to shape the environment. Landscape possesses not only the physical elements of geography, geology, flora and fauna, but also the products of civilisation which are scattered across the land itself – rural communities and cities, and all the detritus those communities produce. But landscape is also history, the people who trod the ground before us, and the events which took place at other points in time. Beyond the tangible landscape lies another which is *perceived* rather than seen, a landscape in which all of preceding time continues to exist.

What landscapes really are

- Socio-ecological systems
- Built upon multiple Relationships
- Across actors, sectors, scale
- Rooted in place

If landscapes are to be considered as sets of overlapping ecological, economic and socio-cultural networks, then their governance should have a network character, in which spatial decisions can be taken by different actor networks, but rooted in place. There are different ways to experience a place and this has been highlighted in Figure 1.



What landscapes have become

Losing the integrity of the places in terms of the ecology, it is cut into pieces

Framed within administrative boundaries, sometimes it is inevitable but many of the species, process does not understand these boundaries

Cutting up ecological, social, cultural and economic connects. Trade routes no longer exists in the Himalayas and we need to accept that there will be changes with peoples aspirations
Creating confusion and conflict – Unclassed state forests (USF) in the NE. Nearly 50% of the state forest area is under USF where you have competing claims an example of the tragedy of the commons. Two steps – who is the carer of this area, who manages, who owns- rights , common property are becoming conflict

What is conflict governance?
It is about getting the stakeholders together and looking at who is thinking what.
How easy is this?
Moving from problem solving to problem understanding to shared understanding on how easy or difficult it is.

Landscape Journey
A process tool that brings together multi-disciplinary/inter-sectoral team(s) in a given landscape to develop holistic appreciation and understanding of landscape elements /issues at different scales, for shared understanding, visions, and synergy for integrated actions. It involves:
Interaction with Landscape elements (nature, people, culture, economy, traditions etc.)
Interactions across actors, sectors, scales
Breaking silos across disciplines
Connecting science with policy and practice
Self-connect – Space within the landscape journey to get a deeper connect with the environment

5 elements of landscape governance in Himalayan Context: Past present and future of scenarios of Landscapes – internal and external factors
Think and act integrated landscape
Achieve coherence in landscape diversity
Make institutions work for the landscape
Create landscape market value
Manage landscape resources sustainably

The landscape Landscape Yatra Kailash Landscape journey being used for integrated planning, implementation and now for monitoring and evaluation.

For IMI, integration lies at the very core of its work. Can this process be used prior to the summit next year where the stories and perceptions across the multiple stakeholders to bring the richness of what is actually happening on ground. Landscape Yatra can be used as process to seek integration across sectors/disciplines for sustainable mountain development. It is very much embedded in systems thinking because landscapes are very complex but not so complicated to understand.

When one tugs at a single thing in nature,
He finds it attached to the rest of the world – John Muir

POLICY DIALOGUE
Draft National Policy for
Indian Himalayan and Hill Regions in India

Chairperson: Dr. Amita Prasad,
Additional Secretary, MoEF&CC
Co-Chairperson: Shri Alemtemshi Jamir,
President, IMI

Shri Alemtemshi Jamir, President, IMI

The policy draft has great intent and covers a wide range of issues related to sustainable development of mountain resources and livelihoods, but there are areas that can still be further substantiated with collective thinking and inputs from different stakeholders.
At Implementation level:
There is lack of villagers-friendly implementation plans and associating villagers in implementation of the plan activities
There is lack of resources; both Technical inputs and adequate Finance
Lack of sound and villager friendly monitoring and evaluation mechanism
The long awaited demand for Constitution of Himalayan Development Authority to consider the issues and concerns of the Himalayan region and its people may be considered in the Mountain Policy
The policy objectives section need to be strengthened; the way the section has been written now, does not do justice to the intent behind framing of this document.
There must be clearer integration of the scope of this policy on various issues covered with the scope and ambit of existing legislations already addressing those issues; this policy must serve to strengthen the empowering provisions of such existing legislation and

Dr Amita Prasad, *Additional Secretary, Ministry of Environment, Forest and Climate Change*

Dr Prasad presented the draft of the Draft National Policy for Indian Himalayan and Hill Regions in India to the audience and shared Ministry's priorities and key initiatives. She invited comments on the policy draft during the session, shared the challenges in the policy framing process and some of the initiatives relevant for Indian Himalayan Region.

There has been no policy as such for the mountains till now. There has been talk about it. It has been deliberated by NITI Aayog, the erstwhile Planning Commission. We have been talking about it since 1991. All of you present here are aware of the diversity of the resources, people, flora and fauna and our dependency on this region, especially Indian Himalayan Region for the river system. We are not talking about the western and eastern ghats here even though we have included them in the policy. The problems of western and Eastern Ghats may not be similar to the problems of IHR. Even every state in Himalayas is not same. Himalayan region of north eastern state is different from other Himalayan states of Uttarakhand, Himachal, Jammu and Kashmir. The land, soil, topography, food practices are very different.
The policy is still in the process of being finalised, it is still in the process of being framed. We have been working on this for the last six months. The comments and feedback are welcome. No ongoing scheme of government addresses issues of the mountain. All existing policy measures focus on conservation. The policy is being framed by the Ministry of Environment, Forest and Climate Change

and we are looking at it with respect to three key points- sustainable development or sustainable use of resources, conservation of resources and, climate change and climate resilient policy. There are other issues relating to roads, water which we feel we may not be able to address. There might be many gaps in the policy which can be substantiated with the feedback from this session.

Existing Gaps and Challenges faced by IHR

Each place in IHR is different, each village is different and people in the mountains are very fierce about their traditions and cultures. So far, there is no Mountain specific Policy and Strategy. There is a policy for north east but nothing for mountains of India as a whole.

Extent of funds and their coverage under various Schemes and Programmes negligible.

Activities performed in the Mountain regions have direct or indirect effects on downstream population. Construction of dam at high altitude affects regions of the plains. Floods in Bihar have partly been because Nepal has had massive deforestation in the recent past.

Poor Infrastructure such as roads, transport, markets, communication and civic amenities

Comprehensive status and consolidation of Data not available on ecological status, Biodiversity and Ecosystem Services, Environmental Quality – Air, Water, Soil and Impacts of Climate Change. The kind of data that is required for framing a policy for mountains is not available.

Further there is a dearth of R&D Applications from lab to field- there is a lack of technologically innovative solutions that can be scaled up. The initiative that we have seen have been on very small level which fail when it comes to scaling them up.

Issues of the Mountains and Hill Regions

The reality in mountains seems to be grim. There are many common problems that the whole of IHR faces that are being addressed in the policy document. Some of these are:

Pressure of Development & Urbanization: Cities of mountains are under immense pressure. Forty percent of the population in Mizoram is based in Aizawl. Similarly, Dehradun is densely populated. Migration to urban centres can no longer be ignored. People are migrating to the cities because there is some certainty of income generation which is somehow not possible in the villages.

Over Exploitation of Natural Resources: Himalayas are a treasure trove of biodiversity and natural resources.

- Sustainable Energy Needs
- Forest Conservation
- Man Animal Conflict
- Environmental Degradation
- Connectivity/Road, Rail and Transport
- Technology Diffusion
- Basic Education/ Skill Development
- Lack of Employment
- Migration
- Water
- Natural Disasters

Historical Perspective on Sustainable Mountain Development in India

Over the years, various Committees/Working Groups constituted by Planning Commission for the development of Himalaya have made recommendations for a policy for the mountains. B.K. Chaturvedi Committee in 2013 made this recommendation. This attempt is being made now.

In 2017, NITI Aayog has identified five thematic areas and constituted Working Groups for sustainable development in Himalayas. These groups are:

- Inventory and Revival of Springs in Himalayas for water security at Department of Science and Technology
- Sustainable Tourism in Indian Himalayan Region (with emphasis at heritage tourism) by NITI Aayog
- Shifting Cultivation Towards transformation Approach by National Institute of Rural Development and Panchayati Raj
- Strengthening Skill & Entrepreneurship Landscape in Himalayas at Ministry of Skill Development and Entrepreneurship
- Data/ Information for informed Decision Making by Multiple Stakeholders at G. B Pant National Institute of Himalayan Environment & Sustainable Development (GBPNIHESD)

The Current Measures for Development in Mountains and Hill Regions

Ministry of Environment, Forest and Climate Change is undertaking several measures along the following four pathways:

A. Bio-Diversity Conservation

Scheme on Biosphere Reserves which includes 7 Biosphere Reserves in Himalaya out of 18 reserves in the country. The fund of 13 crores is too small for 7 reserves. This scheme talks about landscape approach, livelihoods and skill development but the funding allotted is too less to cover these sectors.

Establishment of Protected Areas which are 25 National Parks & 98 Sanctuaries in this region along with Eco-Sensitive Zones around these Protected Areas. The Eco sensitive zones are being looked at on a case to case basis as per the Supreme Court order.

Ministry has undertaken Inventory of biodiversity (flora and fauna by Botanical Survey of India (BSI) and Zoological Survey of India (ZSI)) and categorisation of Rare, endemic, endangered and threatened species in Himalaya with IUCN

Biodiversity Conservation and Rural Livelihood Improvement Project (BCRLIP)- five of these are in action out which three are in Himalayan region.

GEF-UNDP Project on Medicinal Plants

Conservation of Lakes and Rivers-

B. Forest Conservation

Forest Conservation and Afforestation through Forest Departments- Clean India Mission and action through National Afforestation Eco-Development Board (NAEB). Apart from this, State governments undertake their own plans.

C. Climate-Change

Climate Change based studies through Two National Missions:

National Mission for Sustaining the Himalayan Ecosystem (NMSHE) of DST

Climate Change Action Plans through State Governments

D. Heritage Conservation

Scheme for Development of Cultural Heritage of the Himalayas, Ministry of Culture which aims to promote, protect and preserve the cultural heritage of the Himalayan region spreading in Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh through research, documentation, dissemination, etc.

Sustainable Development Goals (SDGs) and Mountains

Sustainable Development Goals (SDGs) identified from Rio+20 Summit have replaced the Millennium Development Goals which we couldn't achieve. Now we have to achieve these SDGs by 2030. 3 SDGs specific to Mountain Ecosystems are:

SDG-6 : Availability & sustainable management of water & sanitation for all

SDG-15.1 : Target by 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands
SDG-15.4 Target by 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

National Biodiversity Targets and Mountains

The Rio convention in 1992 had three major outcomes on biodiversity, climate change and desertification. Climate Change took precedence over the other two outcomes. That is because climate change agenda has clear quantified objective of keeping the global temperature down. However, when we discuss biodiversity conservation there is an inherent and natural conflict as we have uses for land for various purposes, main being agriculture, and simultaneously we have to increase the proportion of protected areas to ten percent. Currently in India, we have five percent protected areas, some states have more than five percent too. So because of this inherent conflict biodiversity becomes much more difficult to achieve as the quantifying the outcome is difficult. Further we have desertification. If biodiversity conservation has been poorer cousin of climate change then desertification is the poorest cousin of all three. Government of India has not even made an action plan on this in the last four years. There is no commitment to this agenda. The three conventions have had their own journey. Climate change has IPCC. Biodiversity has IPBES which talks about nature. IPCC is the one which is widely known.

We have 20 National Biodiversity Targets as per the international convention but we have scale down to 12 which are relevant for our country and the following targets are specifically relevant for our mountains:

Target 3: Strategies for reducing rate of degradation, fragmentation and loss of all natural habitats are finalized and actions put in place by 2020 for environment amelioration and human wellbeing

Target 6: ‘’Ecologically representative areas under terrestrial and inland water which trends in PA covering four legal categories (National Park, Wildlife Sanctuary, Community Reserve and Conservation Reserve)

Target 8: By 2020, ecosystem services especially those relating to water, human health, livelihoods and wellbeing are enumerated and measures to safeguard them are identified

Target 11: By 2020, national initiates using communities’ traditional knowledge relating to biodiversity are strengthened

Simultaneously, we have two missions for Himalayan region. National Mission for Sustaining the Himalayan Ecosystem (NMSHE) has been initiated by Department of Science & Technology (DST) as part of 8 National Missions. NMHSE aims to conserve biodiversity, forest cover and ecological services values in the IHR, to evolve management measures for sustaining and safeguarding the Himalayan glaciers. NMSHE implemented through 6 Task Forces:

Task Force 1: Natural and Geological Wealth
Task Force 2: Water, Ice, Snow including Glaciers
Task Force 3: Forest Resources and Plant Diversity
Task Force 4: Micro Flora and Fauna and Wildlife and Animal Population
Task Force 5: Traditional Knowledge System
Task Force 6: Himalayan Agriculture through the following coordinating & collaborating institutions:

- Wadia Institute of Himalayan Geology, Dehradun
- National Institute of Hydrology, (NIH) Roorkee
- GBPNIHESD
- Wildlife Institute of India, Dehradun
- Jawaharlal Nehru University (JNU), New Delhi
- NRM Division ICAR, New Delhi

Similarly, National Mission on Himalayan Studies (NMHS) was launched in September 2015 as Central Sector Grant-in-aid Scheme to address key issues relating to Conservation and Sustainable Management of Natural Resources in the IHR with the objectives to:

Build scientific and traditional knowledge through demand driven action research

Strengthen technological innovations leading to sustainable management of natural resources of Himalaya

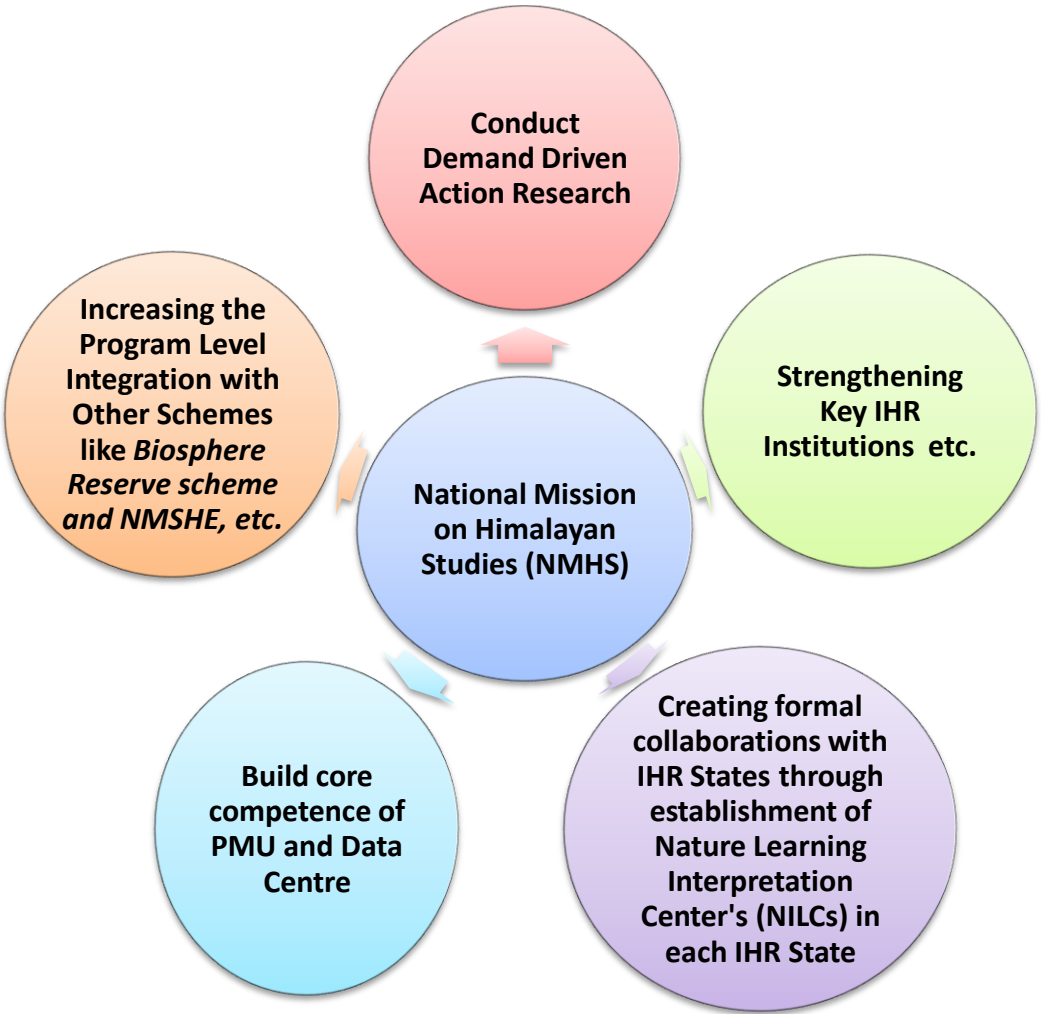
Ensure ecological, water, & livelihood security

Create science-policy-practice connect through a network of policy and practitioners

Demonstrate workable/implementable solutions to the problems in the priority thematic areas

This mission aims at increasing the interaction between science policy and practice and build knowledge. Under NMHS a total of Rs 79.85 crores was released to 42 R&D Projects during 2015-17 (27 in 2015-16 & 15 in 2017-18) and 119 Himalayan Research Fellowship granted in 2015-16. It covers water conservation through spring revivals, water conservation & management, river bed filtration; conservation of orchid, pine needles, medicinal plants and other issues- Climate Change, Livelihood Support, Human Wildlife Conflict, Alternate Sources of Energy, Solid Waste Management

The NMHS is being revised with a total cost of Rs. 165.50 Crores. The revised NMHS has proposed to support 5 complementary components that are aimed at Conservation and Management of the IHR.



Need for the National Policy for Mountains and Hill Regions in India

The policy has been drafted keeping in mind the following objectives:

- For Protection of Mountains and Hill Regions in the country
- For Sustainable Development and inclusive growth for the population of the Mountains and Hill Regions
- For suggesting mechanism of planning in Mountains and Hill States for judicious use of natural resources as integral component of development
- For identification of past scenarios, gaps in efforts, constraints and actions for development processes for the region
- For inventory and sector wise priority actions including research, development and management aspects of planning

Specific Areas of Action

- Development and application of technologies for water & soil conservation specific to mountainous/hilly region
- Access to Simple cost effective technologies on water & soil conservation in terms of water & food security.
- Low cost housing using materials resilient to natural disasters.
- Catchment area protection – identify critical patches across the IHR which require urgent remediation & and conservation
- Development of infrastructure and civic amenities such as roads, schools, Hospitals & health care centres, etc
- Identify and promote sectors leading to minimum environmental impacts and maximum economic returns
- Manufacturing sector (not using/using less water)
- Medicinal Plants, Aromatic Oils
- Non-Timber Forest Produce (NTFP) and Cottage industries
- Social forestry, community/village forestry, Agroforestry
- Raw materials for pharmaceutical industry
- Organic farming
- Horticulture, Export of Flowers & Fruits grown in farms
- Heritage Conservation

Policy Benefits

- Comprehensive database with all vital information which will facilitate informed decision making
- Environmental Sustainability- Sustainable mountain development can only take place when we realise that the resource are not infinite.
- Conservation of Forest and Biodiversity along with Climate Resilience
- Better infrastructure for Skill development and employment
- Promotion of innovative technologies
- Support to reduce Man-Animal conflict
- Disaster Resilience area development
- Opportunities to private Sectors for Large, Medium & Small scale investment- we can also look at small and limited sector focussed investments like Switzerland has done.

- The policy doesn't include Corporate Social Responsibility because the Ministry is not sure so far as to how to engage CSRs but is open to innovative ideas on how to do so.

Discussion: Feedback on Policy Draft

Much of the discussion focussed on how there is need to build integrated efforts for addressing the multitude of issues and challenges that mountain ecosystems and communities face. A national policy covering the mountain and hill regions of India is a welcome effort. However, the policymaking process has some inherent limitations. The scope of policy cannot be too broad even if the issues of the mountains are spread across a number of domains and sectors. The policy is being drafted by the Ministry of Environment, Forest and Climate Change which is mandated to focus on biodiversity, climate change, and sustainable development and hence cannot go beyond a certain scope or impinge on domains covered by other ministries and department. While there are limitations in the extent to which state action and policymaking effort can encompass the vastly spread issues, there is no limit to opportunities for other stakeholders to work together on innovative partnerships for the benefit of mountain region.

A summary of feedback on the draft of National Policy on Indian Himalayan and Hill Regions of India is as follows:

Ecosystem Services

Valuation of Mountain Ecosystem Services which has been a long standing demand has not been done. Biodiversity targets are talking about ecosystem services, their enumeration and measures to safeguard them. Data on these services is not available.

Enumeration of Ecosystem services can be the first step. Each state is trying to see how they can understand this element. We need to find a common theme, the issues are interconnected, they are not geographically divided. We need to first understand the basic logic- which covers not just economic services but also social, environment and anthropological logic and then based on that enumerate and identify what it means and then think about what those services are and how to quantify them, how to convert them into financial gains. There is a fundamental inherent disadvantage that mountain states face- a point which has been highlighted by Planning Commission committee headed by BK Chaturvedi. On the other hand, there is a surplus of natural resources which is available free of cost. So there is an inherent need to build a coherent approach to evaluate ecosystem services.

Ministry has been thinking about it. Idea of National Green Capital was discussed but it never took off. MoEFCC undertook study for two three ecosystems in the country as pilot with GiZ. The concepts were not very clear. We put an economic value to these. Environment Assessment looks at degradation that has happened because of industry and then attach an economic value to it. However, we do not have systems for fixing value to ecosystem services. MoEFCC is trying to do this.

Policy Coverage

Different sectors have not been well differentiated in the policy document. Wetlands are of critical importance to mountain states and must be included in the policy. Livestock Development, river conservation and their carrying capacity, horticulture are some of the sectors that can be covered.

People Centric Approach, Participation and Communication

Much of the policy is not focussed on the people in the mountain areas. Development of the people in the Himalayan Mountain region should also be included in the policy. Secondly, communication with people in the mountain regions needs to be strengthened. People living in the region remain uninformed about much of the decisions and actions that would ultimately affect them the most.

People participation needs to be encouraged to ensure the success of schemes and initiatives launched by different ministries. Similarly, traditional practices that communities have been practicing should be adopted in state planning also.

Natural Resource Management

Relaxation of norms for industrial activity, as enlisted in the policy draft, might not be the best idea. Keeping in mind the fragility and sensitivity of the Himalayan ecosystem, the role of Himalayan Region on downstream climate change impact, it would be suggested to strengthen the norms for industrial activity and diversion of forest cover.

There are challenges pertaining to depletion of forest covers especially in the north east Indian region from where the unprocessed timber is exported to other parts of the country. The policy could look at encouraging and sustaining processed material industries in the region to bring down the depletion of forests and other natural resources as exporting unprocessed raw material leads to more exploitation of natural resources than necessary without much benefits accruing to the region. Similarly, concrete initiatives for developing the region in terms of production forestry can be looked into.

The policy must also focus on community based forest reserves which is already being done by communities on their own but state and central government are not able to support such initiatives because land holding patterns in North East Indian region are different from those of other regions of India and there are trans boundary land disputes.

There are issues related to definition and classification of forest also which makes availing of certain schemes difficult because there are multiple ways of classifying forests. Also, there should be compensation to people when classifying their forests as protected forests. (Note- The issue of classification of forests is going to be addressed in the Forest Policy.)

There must be concentrated efforts for research on and conservation of Bio-resource and Medicinal plants

Proper guidelines must be enlisted for accessing natural resource

Research on carrying capacity of rivers, river management required

Data

Lack of data relating to Himalayan mountain regions and Lack of information on the ground reality which leads to difficulty in drafting policies relating to development of the mountain regions. All state government and concerned departments/ organization should take necessary steps to get appropriate information proactively.

Lack of data on biodiversity- Biodiversity management committee should be formed in each state as it is already a mandate since 2004. MIS system should be put in place to access the available data.

Funding

Funding for Himalayan Mountain Development for NGO's and other organizations- Lack of awareness of funders and programs available. (Note- Green Climate Fund through NABARD and SIDBI can be sought.)

In practice, there are problems related to diversion of CAMPA funds which should be addressed through any effort at mountain policy making

Better Integration

Lack of connectivity and cooperation between various agencies and people working in the mountains. Simultaneously, national targets and ground level implementation need to be aligned. Often we are

discussing issues of the diverse mountain states but the practice remains distant from the ground reality. How do we organise the closely tied sectors- forestry, biodiversity, climate change, SDGs? There is unavailability of support for alignment. In this respect we must utilise a platform like IMI for connecting and integrating the efforts and imbibing this practice in the way we work.

Eco-Tourism

Some suggestions for effective tourism management in the mountains are:
Integration of ecotourism policy with Forest Departments and with other policies
Incentivisation of vernacular architecture for promotion of eco tourism
More stringent tourism regulations for protected areas
Trans-boundary notion should be reflected upon as it has implications for communities living in such areas. Address land demarcation and borders between states.
Waste management as effect of tourism should be dealt with as priority for action
Carrying capacity assessment should be central to the tourism planning

Waste Management

Waste is not only an urban phenomenon but also in the protected areas and bio-reserves as well. Waste management in protected areas and forests should be dealt with, in the policy. Effluent Treatment Plant for Industries should be considered.

BUILDING PARTNERSHIPS
FOR
SUSTAINABLE MOUNTAIN DEVELOPMENT

Chairperson: Mr. Gopal S Rawat
Co-Chairperson: Dr Tej Pratap, Councillor, IMI

The session started with Mr.Krishna Rautela of SDFU contextualizing the subject of Mountain Partnerships. In his address, he highlighted the platform provided by IMI through the SMDS for individuals with a shared goal to meet and network with other individuals working towards the shared goal. Krishna also touched upon the Sustainable Development Goal 17- which is build on the premise of partnership and so are other international accords such as Copenhagen, Kyoto and Paris which have codified these partnerships.

The keynote speech was delivered by Mr.Vincent Darlong. He began by contextualizing SMDS as a platform to re-look at what have we achieved thus far, evaluate problems and challenges of the mountain communities and then move towards new ideas to find solutions by way of building partnerships across the mountain states of India.

In any role whether government or multilateral agencies like the UN, partnerships and relationships are critical. The importance of partnerships can be seen from SDG Goal 17 which has been accepted and adopted by 193 countries. A multi-stakeholder approach to partnerships keeping in mind communities, people, research, governments, civil society organization will play a key role in defining sustainable development for the mountains.

As a veteran in government and multilateral systems such as the UN, forging partnerships should be based on what the organization would like to implement or achieve, Mr. Darlong stressed. Each partner has particular interest areas and objectives which need to be addressed for a mutually beneficial partnership. In the mountain context, partnership principles should go beyond sectors to focus on SDGs in all aspects- poverty, biodiversity, culture, market access, trade, commerce, HRD etc. Mountain development is a particularly broad term. It is critical to define and narrow the subject of work to for instance: water, forests, livelihoods etc. to attract relevant partners: individuals, organisations or groups.

IFAD defined Partnerships as ‘Collaborative relationships between institutional actors that combine their complementary strengths and resources and work together in a transparent, equitable and mutually beneficial way to achieve a common goal or undertake specific tasks. Partners share the risks, responsibilities, resources and benefits of that collaboration and learn from it through regular monitoring and review.’

Further, he dwelled on the subject of need to form partnerships and how to access partners. A systematic method of developing indicators to find the most suitable partner is key to a successful partnership. Foremost, the interest of the partners should be aligned with your own goals and one must have the same level of thinking and purpose for the outcomes. For instance, to find financing for programs and projects in Manipur, often partners in New Delhi will not be able to speak the same language or understand the need of the communities.

Partners should be committed and have ownership. Trust, confidence, transparency and accountability in the relationship is critical to developing a long term relation. Therefore, partnership modalities, conflict resolution mechanisms must be clearly defined and regular communication should be followed.
Systems to monitor, measure, and evaluate results and then learn from each other to strengthen the partnership will ultimately benefit the mountain people. Partners should be willing to look beyond the MoU or MoA for the larger benefit of the people.

Traditionally, multilateral, bilateral and trilateral partnerships have existed. Now it is time to build partnerships among scientists or academics and communities to implement development programs. Intra community partnerships such as women groups and youth groups is also developing. In the mountain context, there is a need to partner with corporates and their CSR wings such as NHPC which work in the NER. International agencies such as JICA, ADB etc are also present in NER. It is important to map the ecosystem for sustainable development. For instance, an NGO or civil society working on waste management cannot achieves its goal without a partnership with Municipality. Partnership in the context of Northeast Autonomous District Councils (as seen in Tripura, Meghalaya) and Village Development Boards (as seen in Nagaland) are a way to strengthen sustainable mountain development.

LEGISLATORS' MEET
on
Climate change and its impact on Indian mountain states

Chairperson:	Shri Hiphei, Hon'ble Speaker, Mizoram
Co-Chairperson:	Shri PD Rai, Hon'ble MP (LS) Sikkim & Councillor, IMI

Background
The Legislators' Meet is an important event in the Sustainable Mountain Development Summit (SMDS) which brings together legislators from mountain states to deliberate and examine key policy measures of the Centre and highlight issues from the vantage point of mountain states. The platform enables knowledge sharing and replication of leading practices across the mountain states. Delegates discuss the development challenges and opportunities, and collectively explore ways for collaborative functioning. The Meet is held keeping in mind the need to take relevant outcomes of the summit to key political participants.

The 5th Legislators' Meet held at the 6th SMDS in Aizawl saw participation from 7 Members of Parliament, 23 Members of Legislative Assembly including 2 Ministers and Chairman of Ladakh Autonomous Hill Development Council. This Meet saw participation from the highest number of elected officials this year giving a huge boost to the cause of IMI.

The subject of the Meet this year was *Climate Change and its impact on Indian Mountain States*.

Opening Remarks
The session was opened by a Welcome Address by the Speaker of the Mizoram State Legislative Assembly, Shri Hiphei. He set the tone of the Meet by acknowledging the imminent threat facing mountain states and the primary responsibility of legislators to guide public policy suitable to the needs of the mountain states. Recent events of incessant rains triggering landslides and flash floods in the North East Region, flooding of rivers in Assam and Bihar, heavy rains causing floods in Mumbai, the devastating Hurricane Harvey in Houston, are all instances of growing magnitude of calamities.

The loss of life and property, inconvenience caused due to disruption of rail and road connectivity and hindrance to the drivers of economy such as agriculture and tourism are manifestations of challenges posed by climate change. Shri Hiphei pointed out to the existence of disaster relief funds for foods and earthquakes but lack of a similar resources for landslides, which are a common feature in the Indian Himalayas and expressed hope that this forum provided by IMI will help take some of these recommendations forward.

Member of Parliament (LS-Sikkim), Shri P.D.Rai then facilitated a round of introductions which was followed by the key note address by Dr. Mandira Kala, Head of Research- PRS Legislative.

Key Note Address

The address was delivered by Dr. Mandira Kala, Head of Research- PRS Legislative.

The issue of climate change cannot be divorced from sustainable development. She emphasized that the global phenomenon is real and affecting our country, states, districts and constituencies. Mountain states are ecologically vulnerable which can be a political challenge in constituencies from the standpoint of Legislators. The understanding of interlinked nature of the climate change issue will help us holistically understand the emerging issues in constituencies.

Climate change is a global phenomenon. Excessive amount of GHG in the atmosphere leading to rapid change in temperature and change in weather patterns is broadly climate change.

To contextualize, If there were no GHG on the planet, the temperature of Earth would be minus 18 degree Celsius. Since 1850 till 2012- change in temperature was less than 1 degree Celsius but because of rapid industrialization and development by end of the 21st Century, the temperature of earth would increase by 2 degree Celsius as revealed by an IPCC Study.

While the contribution to greenhouse gas emissions is lower than other countries However, as result of population and development our contribution to carbon emissions will be significant. As we develop, more GHG will be released in to the atmosphere. As legislators, we need to ensure needs of the current generation are met without compromising on the needs of the future generation and therefore, need to ensure sustainable development. As a large country, India's role therefore is very significant in the climate dialogue.

Extreme weather phenomenon, flooding, change in rainfall patterns, melting of glacier, rise in sea level, salination of water, decrease in crop yields, erosion of land, increase in imports, higher energy consumption, loss of livelihoods, increase in DRR costs are all indicators of the changing climate. And therefore the question is how to balance climate and development especially in the mountain regions given the constrains of geography, connectivity and climatic conditions.

Mountain states can specifically focus on solar and hydro power generation as a step to mitigate climate change. An assessment on sectors contributing to climate change, to review and identify areas of improvement was a recommendation.

Problems cannot be solved at the same level of awareness that created them.
– Albert Einstein

Discussion Points

Shri Ninong Ering, MP- Arunachal Pradesh: Mountains are a rich source of water, biodiversity and forests. However, climate change is changing rainfall patterns, causing a number of landslides especially in the North-Eastern Region. This disaster which causes loss of life and property, is not under any relief packages.

Assam is often flooded by the overflowing Brahmaputra waters, Arunachal Pradesh's forest cover has reduced from 82% to 68% over the last 2 decades and the Himachal Apples are lacking taste. These are signs of changing environments and ecosystem and we must adapt to mitigate these risks.

Shri B. Kalita, MP-Assam: As an observer at the Legislators' Meet and Chairman of NEMPF, the subject of climate change is critical for NER and particular importance. Urbanisation leading to migration and infrastructure development will create challenges for the environment. For instance, road building in NER requires forests to be cleared. Development has a role to play in climate change. However, since hilly and mountainous regions are vulnerable, action plan to resolve and balance the environmental damage due to haphazard development should be created.

Shri H.S Rawat, Minister-Environment /Forests, Uttarakhand- : Hill states should come together to voice our challenges at all platforms- national and international to ensure a policy for the mountains is created/ policies are developed keeping the mountains in mind. INR 2000 crores under the CAMPA Act is available to Uttarakhand however, has not been released by Central Government due to restrictions on use of the funds. Unfortunately, we are unable to access these funds for use due to these constraints.

Many legislations such as Indian Forest Act, Wildlife Protection Act are acting against the environment. Citizens view the trees as enemies and often are destroyed before reaching a sizable stage.

Landslides have been identified as a common problem in mountains. In case of Japan, a country in high seismic activity zone- Japan has ensured earthquake resistant building and similar building codes and policies should be pursued in India.

Shri Madan Kaushik, Minister-Urban Development, Uttarakhand: As citizens of a common geographic region with common challenges, we need to cooperate and encourage dialogue to find solutions and cross implement. We also need to invest in technological solutions and develop a strategic plan to tackle these challenges. Nationally, the Central Government is now focusing on digital and technological solutions which is a step in the right direction. However, this needs to be directed towards solutions specifically for the mountain areas.

Shri Nazir Gurezi, Dy. Speaker, J&K: In the valley of Kashmir, villages are far and remote- citizens need to travel over 20 kms on foot to reach a hospital. Often basic amenities are not available and accessible in these locations. Given the remoteness of the region, the Government of the day makes decisions of building schools, health centres etc. from New Delhi. Budgets allocated are not suitable for building of this infrastructure as costs of logistics and raw material is more than 10 times that of the plains. For instance, in SBM after much deliberation budget for a toilet construction in the hilly region was increased to INR 10800 from INR 4000. This leads to non-utilisation of funds. It is therefore critical to include representatives from mountain states while framing policies for our states. As representatives of the people, we should find and share solutions that can be implemented in other states.

Dr. Sonam Dawa, Chairman-LAHDC, J&K: He emphasized on the differences in physical conditions – geography, climate, terrain etc even within a single mountain state such as Jammu & Kashmir. Ladakh, which is a vast dry and cold desert region is significantly different from rest of Kashmir. Therefore, it is critical to include regional representatives from all regions. Similar to the platform given to 8 NER States, 3 States of the Northern Himalayas could come together with NER to make a Ministry/ Department for the Mountain Regions of India.

Shri Alfred Arthur, MLA-Manipur: No natural resources are now available in Manipur as trees have been felled for development in the cities of the mainland. He also suggested earmarking 25% of MPLADs and MLA Funds to climate adaptation and mitigation measures. Bold steps such as these will then make our country carbon negative. Therefore, existing legislations for environmental conservation must be implemented stringently.

Shri Timothy Basnet, MLA-Sikkim: Urbanisation is leading to greater generation of waste and we need to have smart disposal mechanisms to curb the generation of waste and therefore, emission of GHG. Due to urbanization, waste from construction is dumped on river beds, to meet water requirements- rivers are dammed changing the course of rivers and contributing to disaster risk. As legislators, we need to bring in legislation and policy particularly in this regard. Building norms need to be reviewed and strengthened.

Shri James Sangma, MLA-Meghalaya: Coming from Meghalaya and a constituency which has huge biosphere reserves. In his constituency, the amount of expenditure for DRR induced from climate change has been increasing. It is important to live in harmony with nature. Traditional knowledge followed by ancestors and forefathers should be preserved and followed. Consultations with locals and tribal who follow traditional methods in agriculture, building, conservation etc should be encouraged and implemented.

Dr. Thokchom Meinya, MP-Manipur: We need to integrate traditional and modern ways of conservation.

Shri Pradeep Tamta, MP-Uttrakhand: Under BK Chaturvedi Committee instituted under the leadership of Prime Minister Manmohan Singh had recommended a green bonus of 2% for the Himalayan States for development of the region as a compensation to the eco-system service offered to the entire country. He also suggested a non-lapsable pool of resources for the Himalayan States under the government of India.

Shri CL Ruala, MP-Mizoram: Jhum or shifting cultivation which degraded the environment and contributes to climate change will require more financial resources.

Summarization

Shri Conrad Sangma in his summarization on behalf of all legislators commended the efforts of the Integrated Mountain Initiative and Shri PD Rai, who is a forbearer of the mountain cause, in bringing together legislators of mountain states at a platform like the legislators meet. He also added the efforts of the Government of India to encourage and promote the use of solar energy. Government is also working on the electric vehicle models and policy to reduce emissions. Building designs to ensure better lighting will automatically reduce electricity consumption. Simple household measures will reduce carbon emissions and contain climate change he stressed. Shri Sangma also brought out the aspect of human migration that needs to be looked into closely in the near future.

The Aizawl Declaration was unanimously adopted by the participants.

Knowledge Sharing by Partners:

Dr. Mustafa Khan from Swiss Agency for Development and Cooperation (SDC) apprised the legislators of the Indian Himalayan Climate Adaptation Program (IHCAP) of SDC.

The objective of the program is to integrate climate risk management in the planning process of the State through climate adaptation programs and capacity building of all stakeholders to tackle the challenge that climate change poses on us. R&D for climate resilience mapped to policy and practice interventions is also being undertaken.

The program supports several climate adaptation programs, conducts trainings for policy makers, researchers and academics, and media persons. The program has also developed simplified reports for dissemination to a wider audience.

Dr Murali Kallur, IDRC, representing TERI-HIAWARE, and CARIAA, spoke about the people-centric work the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) is carrying out in various climate change hotspots in India. He further enlightened the legislators about the Himalayan Adaptation, Water and Resilience Research project (HI-AWARE). The goal of the project is to enhance the adaptive capacities and climate resilience of the vulnerable in the mountains and plains of the river basins of the Hindu Kush Himalaya (HKH) region through the development of robust evidence to inform people-centered and gender sensitive climate change adaptation policies and practices.

AIZAWL DECLARATION 2017

We, the people's representatives in Parliament, in State Assemblies and in other local bodies would like to embrace the "Aizawl Declaration 2017" on this 22nd Day of September 2017, and will do our utmost to disseminate it and implement the same in our constituencies and in India - for the greater good of our people, and of mankind in general.

We accept Climate Change is rapidly endangering the weather patterns around us. We have noted with all seriousness the climatic changes and the havoc it has unleashed in the Himalayas, the North-East India plains and other parts of India and the world.

We RESOLVE:

- **To first rethink and reengineer our State Action Plans on Climate Change. We believe that it is a very good starting point.**
- **To further engage more fully in our constituencies to see the changes being brought about and help our farmers, our lay people and our societies in general to adapt.**
- **That we will closely work with our Universities and other Institutions of academic excellence to help build a more resilient future utilising their research and policy guidance.**
- **That we will be ever more vigilant on the changes that are upon us and find ways to mitigate disasters that are brought about by more flooding, landslides and other natural calamities. We will help our Governments build capacity and adopt International best practices with regard to climate induced disasters.**
- **That we will ensure adequate oversight through legislative mechanisms and instruments such as debates, discussions and questions in Parliament and Legislative Assemblies and monitor implementation at the ground level through platforms such as the District Development Coordination and Monitoring (DISHA) *Committee meetings*.**
- **That it is now a call for duty like never before.**

We therefore attach our signatures to give effect to this Declaration.

(Signed by all the Legislators present in the meeting)

VALEDICTORY SESSION

Chief Guest: ***Lt. Gen. Nirbhay Sharma, PVSM, UYSM, AVSM, VSM (Retd), HE Governor of Mizoram***

Guest of Honour: ***Shri Jitendra Chaudhury, Hon'ble MP, Tripura East***

The valedictory session began with the arrival of the Chief Guest Lt General (Retd) Nirbhay Sharma and playing of the National Anthem. Shri Alemtemshi Jamir, President of IMI in his welcome address fondly remembered Dr.RS Tolia as the anchor of IMI whose vision for the mountains and its communities was one based on sustainable development.

Dr RS Tolia Award 2017

The Dr RS Tolia Award was instituted to keep Dr RS Tolia's memory and vision alive. The purpose of the award is to recognize and reward the exemplary work of individuals whose work has created an impact / has the potential to impact sustainable prosperity and well-being of the people of the Mountain Areas. The Award presents a modest sum of INR 1 Lakh to the winner. This year an independent jury comprising of Dr.Roshmi Goswami, Dr.David Molden, Mr Mihir Bhatt and Mr Phrang Roy selected Avani Society, Pithoragarh, Uttrakhand to be the first recipient of the award for Avani's commitment to developing alternate livelihoods for over 25,000 in 106 villages in the Kumaon region. The Award was presented to Ms. Rashmi Bharti for Avani

Avani places great emphasis on rural and local resources. Avani utilises waste pine needles, often are a cause of forest fires in Uttrakhand, to generate electricity and 10Kw of electricity is now sold to the Uttrakhand Power Corporation. The char generated is then used for cooking ensuring a closed loop. In the livelihoods space, Avani has revived hand spinning and hand weaving to create beautiful garments using natural dyes such as indigo which is also locally produced on waste lands. Avani focuses on bringing in sustainability in everything it does and works with earth to bring harmony of existence with nature. Ms.Rashmi Bharti in her acceptance speech thanked IMI and the eminent jury for recognizing the efforts of Avani and its supporters. She credited the Avani team for their dedication and commitment to Avani's cause.

SMDS VI also conducted the 6th Himalayan Photography Competition and the 1st Himalayan Young Filmmakers' Competition. The prizes were presented by the Chief Guest to the following winners:

The 6th Himalayan Photography Competition:

1st Prize Winner: Ms. Liansangpuii Khiangte, Mizoram.
2nd Prize Winner: Mr. Lalmalsawma Fanai, Mizoram.

The 1st Himalayan Young Filmmakers' Competition

1st Prize Winner: Witness of the Changing Climate by Mr. Peter Thopi
Directed by Tshenyilou Chirhah & Kewekhrozo Thopi of Nagaland
2nd Prize Winner: Preserving our Treasure
Directed by Zothansanga of Mizoram

Shri Krishna Rautela, Returning Officer for the Governing Council Election 2017 formally inducted the new office bearers of IMI. They are:

President:	**Shri. Sushil Ramola**
Vice Presidents:	**i) Shri. Ramesh Negi IAS (Rtd.)**
	ii) Dr. Lalbiakmawia Ngente
Secretary:	**Ms. Fanry Mein Jaswal**
Joint Secretary:	**Ms. Priyadarshinee Shrestha**
Treasurer:	**Mr. Gopal S Rawat**

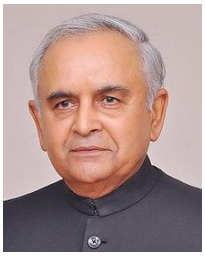
Shri Sushil Ramola, the newly-appointed President for the term 2017-2020, acknowledged the hard work put-in by the Council and Secretariat and expressed his gratitude to the outgoing Council members in ensuring that the flag of IMI is held high. He recognised the enormity of the task and urged partners and delegates to work together with the institution to achieve the shared vision of making people of India proud of our mountains.

Dr. Amita Prasad, Additional Secretary, MoEF&CC, emphasised on the importance of institutions such as IMI which can bring together multiple stakeholders for the cause of the mountains, often a region of low priority for the government. Mountains are crucial for water security, energy needs, recreational purposes, flora & fauna, food security and safeguarding traditional and tribal communities. She highlighted the lack of a mountain policy till date which is now being developed in consultation with various stakeholders including IMI.

With the seventh edition of SMDS scheduled to be held in Himachal Pradesh, Dr. Lalbiak Mawia Ngente handed over the baton of SMDS to Dr. Tej Partap who gracefully accepted the responsibility for organisation of SMDS VII in 2018. Dr. Tej Partap emphasised the unique development model of Himachal where highland communities have more vibrant economic models. He also remarked that the next summit might challenge the participants not only through intellectual deliberations but also physical labour through a landscape walk or field visits.

Guest of Honour, Shri Jitendra Chaudhury, Hon'ble MP (Tripura East) in his address highlighted the need to maintain sustainability of the mountains to ensure well-being in the plains and downhill. He also emphasised on the need to focus on population growth both in situ and ex situ such that the ecosystem can be managed. He applauded IMI's efforts to conduct an exercise to bring together stakeholders and provide a platform to exchange ideas and educate people about the challenges and solutions in the mountains.

Chief Guests' Address



Lt. Gen. Nirbhay Sharma,
PVSM, UYSM, AVSM, VSM (Retd),
HE Governor of Mizoram

"Shri Jitendra Chaudhury, Hon'ble MP, Tripura East, Shri Lalmalsawma IAS, Chief Secretary, Government of Mizoram, Shri Alemtemshi Jamir IAS (Retd), President, Integrated Mountain Initiative (IMI), Dr. Lalbiak Mawia Ngente, President, Mizoram Sustainable Development Foundation, Dignitaries and officials, Ladies and Gentlemen!

I am extremely delighted to be invited as the Chief Guest for this Valedictory Session of the 6th Sustainable Mountain Development Summit (SMDS VI). The themes for this year's Summit, viz. Climate Change and Sustainable Mountain Cities, are extremely relevant in today's context.

This subject impacts the entire Himalayan and sub Himalayan belt starting with J&K to Mizoram, Nepal and Bhutan included. So, compliments to the organizers from all of us i.e the "Highlanders" living in this region. In exchange for your valuable contribution made during the Summit, you must appreciate that we have provided pure oxygen of Mizoram to enable you to recharge your lungs!

I understand that in the last three days, there have been a number of sessions, participated and graced by eminent dignitaries, legislators and policy-makers from across the Himalayan states. Alongside, parallel programs such as Photography Exhibition and Youth Summit have also been successfully held. This Summit has certainly created a purposeful dialogue, which should be translated into meaningful policies to meet the climate change challenge, so vital for our basic existence.

In my address, I consider it unnecessary to repeat what has already been discussed and summarized during the Summit. Instead, I will flag a few major concerns affecting us, as also suggest certain actions to deal with climate change and create sustainable habitat in the Himalayan belt.

Let me start with global warming, which is a live issue and affects the entire humanity and responsible for climate change world over. It is one of the most important global challenges affecting our ecosystems. There is an ongoing shrinking of glaciers, rising of water level in the seas, as also erratic and reduced rainfall. It also causes excessive rains causing widespread flooding, but over time, as the snow disappears, leads to drought. It also causes ozone layer depletion in the stratosphere and has adverse impact on all living beings.

The Himalayas are the largest body of snow on our planet after the Arctic and Antarctic and are sometimes called the "third pole". The melting of snow in the Arctic and Antarctic due to global warming and climate change is reported frequently. However, melting of the Himalayan glaciers goes largely unreported, even though more people are impacted. Glacial runoff in the Himalayas is the largest source of fresh water in this part of the world. It is the source of the Indus, the Ganga, the Brahmaputra, The Irrawady and the Yellow and Yangtze rivers. Overall, the water from Himalayan glaciers feeds nearly 30% of the world's population, in some way or the other.

According to the Intergovernmental Panel on Climate Change (IPCC), "glaciers in the Himalaya are receding faster than in any other part of the world and if the present rate continues, the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the earth keeps getting warmer at the current rate". The Gangotri glacier, the source of the Ganga, is receding at 20-23 miles per year. According to the IPCC report, the total area of glaciers in the Himalaya will shrink from 19,30,051 square miles to 38,000 square miles by 2035. These figures are alarming and more or less paint a doomsday scenario!

Rise in Global temperature results in more evaporation from the seabed and causes higher precipitation. Due to this phenomenon, it is believed that Indian Ocean may become an ecological desert affecting livelihood and food security of Indian Ocean Rim countries. Some scientists believe that two- thirds of Bangladesh, which is above 5 metres of sea level is under imminent danger of being submerged in not too distant a future. In fact, a 3 feet rise in sea level will totally submerge Maldives.
In this region, the fury of flood is increasingly being witnessed every year. A recent report on climate change impact highlights that "extreme precipitation events may increase by 5-10 days in all the regions in the Northeast. The number of rainy days is likely to increase by 1-10 days with intensity of rainfall in the region to increase by 1- 6 mm/day." This may aggravate existing problems of landslides and flash floods in the state.

Being in the Northeast, as every year, we are yet to recover from this monsoons fury of flood of Brahmaputra. Even urban centres like Chennai, Bangalore and Srinagar have witnessed a major flood due to shrinking of water table/water bodies, encroachment, filling of ponds etc. Let me illustrate with two examples, one is of Srinagar and the other of NCR. You are well aware that we now witness extreme weather event, with floods in some areas and droughts in another area at the same time.

Let me relate it all to my State to draw some lessons. Temperature rise has been observed in Mizoram as well. Available data shows a warming trend with increase in mean and maximum temperature over the last 10 years. The state also experiences frequent occurrence of storms during March and April.
In Mizoram, according to recent survey, erratic nature in weather patterns have been increasing during the past few years, distribution of rainfall pattern becomes unpredictable, peak monsoon season has shifted forth and back, etc. Frequent flash floods have also been observed. Agriculture remains the source of livelihood for a large majority of the population in Mizoram. Changes in rainfall patterns have already started affecting agriculture practices; physiology of crop plants has been disturbed which adversely affects the quantity and quality of productivity, and incidence of pests and diseases are also increasing in agriculture and allied sectors.

Rise in temperature causes decline in food production and breeding efficiencies in domestic animals, with adverse effect on their health and prevalence of diseases. Climate change has also increased in the spatial and temporal distribution of vectors of human diseases. Availability of domestic water supply becomes limited and scarcity of water becomes imminent.

We, therefore, need to urgently shift towards renewable sources of energy, such as wind, solar power and reap Mother Nature's bounty! This clean energy revolution is our only salvation. Complicating the issue of greenhouse gas emission, the problem of the ozone layer has come back into focus again. New evidence has emerged that potential ozone-eating compounds can reach the ozone layer much faster than previously thought. The depletion of ozone layer in the Stratosphere has adverse impact on all living beings. This is another serious problem, which should grab our urgent attention.

Alongside, there is a need to focus on disaster prevention. We invariably wait for a disaster to occur and then react to it rather than take measures to mitigate/prevent it in advance. It will be good to remember that unlike in India, the recent flood fury "Hurricane Harvey" has resulted in only three deaths. Similarly, Japan, which is affected by earthquake almost on a daily basis with buildings swaying like a pendulum withstands the impact with minimal damage and almost no loss of life.

We must remember that the Himalayan States are under the Seismic Zone V. The recent devastation in Mexico due to earthquakes should serve as stark reminders. More than a million people have been affected, with casualties running into hundreds. In Aizawl, the National Disaster Management Authority (NDMA) has estimated that at least 17,000 people would die if an earthquake with a magnitude of 8 on the Richter scale hit the state capital. According to GeoHazards International, the figure is even higher at 25,000. Therefore, we need to be thorough with our Disaster Plans and conduct Disaster Audits.
My address on sustainable mountain development will be incomplete without highlighting the issues affecting the habitat. In particular, a fine balance has to be struck between preserving the ecological balance and creating a self sustaining socio economic structure or else environmental degradation and poverty driven thinning out of border belt will follow. The specific needs such as water, biodiversity, waste management, transport and infrastructure must be taken into account. Ways and means to make cities and human settlements in the mountains inclusive and safe modes are a must. All this needs sustained effort on the ground by all concerned. Only then we will not only save ourselves from the fury of mountains, but harvest the rich potential of the Himalayas.

Realizing the importance of sustaining the Himalayan Ecosystem, it is rightly being made one of the missions under the National Plan on Climate Change. While scientists have been working on different aspects of climate change, State Governments are preparing plans for adaptation and action groups on the ground are engaged in implementing projects. There is, however, a greater need for generating awareness and motivating communities at the local level.

All of us can play a vital role. Legislators, policy- makers and think-tank groups need to focus more on impact of climate change on remote and vulnerable communities. We need to highlight case studies of success at local level, which are not adequately covered. In this regard, I must make a mention of a people's movement in Aizawl to save 'River Chite', which is laudable!
To the immense frustration of environmentalists, the issue of climate change often goes unmentioned in the wake of environment-related crisis, such as droughts and hurricanes. There is hesitation among some to make it an issue for fear that it comes off as politically opportunistic. This can be seen from the silence on the issue of climate change in the US at a time when the country has been ravaged by ever more powerful hurricanes. Ongoing happenings in Mexico, Indonesia and other parts of the world are indeed alarming.

Environmental issues have also been dragged into international politics, with China recently not sharing hydrological data with India due to the Doklam face-off. This co-incided with the torrential downpour in the eastern part of the country, including the North East, Bihar and UP.

Climate change skeptics still have a loud and influential voice. The clearest depiction is the Trump administration's decision to withdraw the U.S. from the Paris agreement this June. I am told there is a rethink on it. In this regard, it will be interesting to note that when US President Trump called on the Pope and showered him with gifts, the Pope responded by presenting him an essay on "Climate Change"!

To conclude, as the former US Vice President Al Gore has rightly put it, climate change has become an "inconvenient truth"; inconvenient for an aspiring global power like India as well. The challenge is to achieve high economic growth rates to raise living standards and to provide basic facilities such as food, water and shelter to people, while addressing climate change effectively.

For a long time, we have found it convenient to shut our eyes to the fast emerging reality of havoc due to climate change. In particular, thoughtless urbanization has converted some of our beautiful sites into concrete jungles! I think this Summit will definitely create greater awareness amongst all stakeholders and help us in evolving strategies to arrest the adverse impact of climate change and creation of sustainable mountain cities.

We need to study the adverse impact of climate change in all its dimensions and more importantly, discuss the strategies/action plan to mitigate such disaster and work towards capacity building. All relevant ideas, experiences and contributions that have emerged in this Summit will require a meaningful follow up by all stakeholder groups including government officials, scientists, experts, local communities, private sector, NGOs and most importantly our youth. Himalayan region, as we know, apart from feeding a large population of this planet in many ways has tremendous scope for bringing in prosperity in the region.

Specifically, may I suggest that:
The conclusions drawn during the Summit are communicated to all stakeholders, both at strategic and tactical levels, using all forms of media. In particular, development of sustainable mountain cities requires a major effort and holds the key. The ongoing brazen urbanization must give way to smart and safe habitat as a part of overall eco-system.

Combination of top down and bottoms up multipronged and multidimensional approach be adopted to formulate specific action plans.

In that, also remember what our Prime Minister has recently said i.e need to practise what we profess. In fact, it is a challenge to all of us to translate these issues into doable actions. I am certain we will succeed and prove the doomsday prediction wrong!

In the end, let me congratulate the Integrated Mountain Initiative (IMI) and the Mizoram Sustainable Development Foundation (MSDF) for hosting a highly valuable Summit.
'JAI HIND'"

The vote of thanks was proposed by Prof. Lalnuntluanga, Vice President, MSDF who expressed gratitude to all dignitaries, government functionaries, stakeholders, participants and partners for making the summit successful. The event concluded with playing of the national anthem.

2. SELECTED PAPERS

a) Views from Below: The Economics and Politics of Water in the Darjeeling Himalayas

b) Soil nutrient conservation for Sustainable Upland Farming:
Introduction of Nitrogen Fixing Trees in Horticulture Orchard

c) Use of Herbs in Local Health Care by traditional healers of Kanchanpur

d) Promotion of Niche Value Chains and Appropriate Technologies for Sustainable Livelihoods of Marginal Communities in Uttarakhand: An Initiative under Kailash Sacred Landscape Transboundary Project

e) Low-Cost Vermicomposting: An Innovative Technique for Climate Resilient Organic Farming and Livelihood Development

f) "Community Livelihood Nursery":
An Effective Tool to Restore Bamboo Diversity in Tripura

g) The Hindu Kush Himalayan Monitoring and Assessment Programme:
Assessments and Science-Policy Dialogues to sustain a global asset

h) Fallow Management in Shifting Cultivation: A Review of Opportunities and Challenges and the way forward in North East India by taking the Institutional Economics Approach
Responses of sensitive fauna in the face of climate change in Sikkim Himalaya, India

i) Tackling Climate Change and Making Mountain Town/Cities Smarter Through Climate Resilient Infrastructure

j) Urbanization in the Indian Mountain States: Issues and Challenges

k) Water in Himalayan Towns - Lessons for Adaptive Water Governance

l) Application of geo-spatial technology for sustainable land use planning and management based on water resources in Kawnpui town, Mizoram, India

A. Views from Below: The Economics and Politics of Water in the Darjeeling Himalayas

Deepa Joshi

Several years ago, when Nepal was reeling under a politically induced fuel crisis, the local taxi driver in Kathmandu city questioned and rightly so, my need to travel across the breadth of the city for a thirty-minute meeting at the office of the International Centre for Integrated Mountain Development (ICIMOD). Visibly struck by the elegant landscape of the office and convinced that matters of utmost importance must happen here, he pressed me – on our return journey, to explain the functions of the office / institution. On hearing my Nepali translation of ICIMOD's vision to 'enhancing livelihoods, equity, and social and environmental security for all mountain people[s]' - he was deeply perplexed, as to why he and many others like him in the very city of Kathmandu were unaware of the institution and/or its worthy intentions. I am afraid, I failed, despite best efforts to assure him or explain how he gains from ICIMODs objectives. In a similar vein, Gyawali and Thompson (2016) write, 'Ask any Nepali villager about the Millennium [now Sustainable] Development Goals (M/SDGs) and you will be met with a confused shrug'. Translated to Nepali – the term makes for a 'confusing mouthful' and as Gyawali and Thompson (ibid) note, global concerns (sic) on the urgency to meeting these goals are poorly aligned with the everyday life challenges of ordinary Nepali citizens. It would thus, not be entirely untrue to say that what happens by way of research, environmental policies, strategies and interventions are significantly disassociated from the everyday lives and challenges of the dispersed and widely heterogenous Himalayan community. This note speaks to these issues – to the politics and practice of environmental research and how these relate or do not to *"views from below".* In this case, I focus on the economics and politics of water development and discourse in the Darjeeling Himalaya region.

Even though, Eckholm's "Theory of Himalayan Environmental Degradation" which spoke of the inevitable and alarming ecological crisis in the Himalayan region - is long considered debunked (Guthman, 1997); the politics of environmental crises, or what Agarwal (2005) notes as the political production[s] of the "environment" persist in the Himalayan region. In other words, "environment" here continues to be isolated from local realities as it is aggregated, positioned and presented as resources and/or challenges that have significant downstream and/or global consequences. This conflates the issue and concerns to an entirely abstract level, in the process disassociating it from the ordinary, everyday lives of local communities - what they make of the "environment" and how they deal with it, which incidentally is no more special in the Himalayas, as it in every other uniquely local [socio-political and geographic] context.

This is not to say, that the Himalayas are not a specific geophysical landscape - or for that matter, that they are not, as popularly described - the crucial "Himalayan Water Towers" and/or a "climate hot-spot". Indeed, as Pomeranz (2009; 5) notes, 'For almost half the world's population, water-related dreams and fears intersect in the Himalayas and on the Tibetan plateau'. What is intriguing, is the selective imagery around the Himalayas, or for example, that, 'glaciers, which almost never used to make the news, are now generating plenty of worrisome headlines' (ibid). The fact that most of the Himalayan population rely not on its perineal rivers, but on groundwater available through natural springs – which are for multiple reasons, being increasingly unreliable receive relatively scant attention (Tambe et. al. 2011). Environmental imageries of the Himalayas - present a partial, aggregated and almost always, technocentric, managerial overview. Writing about the scalar politics that constructs and then reproduces "local" manifestations in relation to climate change in rural Nepal, Yates (2012; 537) points to how 'normative frameworks of development [prescribing to] "desirable states" of socio-ecological systems' are contingent on 'unstated assumptions and belief systems'. Climate change

literature is particularly symptomatic of such aggregate assumptions of "mountain people", including of mountain women. First, a bureaucratic theorization of "mountain women" identifies them as 'as an already constituted and coherent group stripped of all class, caste, ethnic and religious differences' (Tamang 2002: 317). These generalities then, present a paradoxical image of "mountain women" - identified simultaneously as extremely vulnerable as well as perpetually capable climate stewards (Joshi, 2014). Such rhetoric completely disregards the complex and evolving weave of social relations that determine how diverse groups of "mountain people/women" in spatially unique contexts deal with what constitutes their "environment". This is the unfortunate divide between *"*eagle's eye science and toad's eye science" (Gyawali and Thompson, 2016). A fundamental re-thinking of development aligned with the everyday realities of local communities, as argued by the authors (ibid) is easier said than done, given that scientific scholarship claimed to be highly objective, is hardly „neutral, [rather it] is unavoidably partial, unavoidably political, and has tunavoidably ethical consequences" (Smith, 2003).
The 'consensual presentation and mainstreaming of the global problem of climate change' (Swyngedouw, 2012; 213) thrown in with the disproportionate power that statistics and numbers generate in environmental science, has helped make an overwhelming cause of a climate alarm in the Himalayan context, even though, data on climate-induced changes in the Himalayas is acknowledged to be sparse, uneven and mostly unknown. There is thus, an avalanche of disparate climate interventions, which speak of the age-old practice of a politico-environmental re-visioning and -structuring of local Himalayan landscapes which, as we discuss below, often overstep "tolerable bounds" for local communities (see Agarwal, 2005).

In relation to climate-induced interventions in the Eastern Himalayas, I raise attention here, to two issues. First, to the paradox in global policy prescriptions and local impacts of climate change. The Eastern Himalaya region is considered highly vulnerable to climate change and is the focus of numerous climate mitigation and adaptation plans. It is paradoxically, also the target of ambitious hydropower development plans, the latter positioned globally as a climate mitigation (clean-energy) strategy. It is worth noting here, that in national plans and policies, hydropower development is not pursued essentially to mitigate climate change, but rather, to meet objectives of sustained economic growth and energy demand. To that extent, there has been little consideration of how a globally acclaimed climate mitigating strategy intersects with the local effects of climate change. This anomaly is evident in the deregulation of India's environment and energy policies and interventions to speed up hydropower development and the conscious, careful delinking of climate, water and energy policies, strategies and interventions in national and state plans in India, even though, fundamentally, climate change, and climate mitigation, especially in the Himalayan region, would have required making visible and deliberate, rather than ignoring these intersections. While hydropower might be comparatively green (although this is a contested discourse), the environmental and social implications of large dams in the high altitude, high seismic-activity regions of the Eastern Himalayas – leave much to worry about (Ahlers et. al. 2015).

The current development of hydropower in the region is thus, far from consensual and in the process, has sparked conflicts and contestations. These developments have drawn attention of a diverse group of civil society actors, including researchers, who question dam construction activities in the climate-vulnerable Eastern Himalaya waterscape; skewed human-environment implications of the same; procedural and distributional injustices in the dam development process, etc. (Joshi, 2015). This speaks to the second issue of focus – whether and how these metaphors (languages) and ontologies (discourses) of environmental injustices represent local realities. Here, I relate to Forsyth's (2014; 230) analysis that, "environmental politics does not consider deeply enough how or with whose concerns, justice is... [framed and] applied".

In the Darjeeling region, well-intentioned discourse relating to large dams is nonetheless significantly distanced from complex ground realities of latent old water injustice. The uneven economics of investments in large dams compared to under-investments in meeting domestic and irrigation water supply is completely overlooked in the contemporary discourse against large dams (Joshi, 2015). This even, though locals (Rai, 2016; 48) note, and, as is poignantly pictured in the image below, 'the water crisis is synonymous with the image of [the region's] town[s]'.

Although data is unreliable and anecdotal, it is likely that less than 50% of urban households are connected to the municipal water supply in towns like Darjeeling (Chettri and Tamang, 2013). Consequently, a lucrative private water trade operates here – thoroughly intertwining - community, state and market-based approaches to managing water. These hybrid arrangements of water delivery are nested in entrenched political, social, economic injustices and symptomatic of a democracy deficit evident in the wider political, social and economic setting (Joshi, 2015). Local politicians point to the enduring urban water supply crisis as a key marker of the politico-spatial injustice: '...in terms of infrastructure, ...nothing has been added to... the water supply...[to] whatever the British had planned [then] for 3,000 people in Darjeeling town, [even though the population] is over 3 lakhs [300,000]' (Wenner, 2013; 209). However, it is another reality that the everyday water supply injustice is obscured by other competing political priorities, which in no small way, impacts alternatives to, or the questioning of these everyday injustices.

In sum, water problems in the Darjeeling region necessitate the need to, 'critically interrogate the universalizing and globalizing tendencies in asserting and invocating' environment and related injustices (Sikor and Newell, 2014; 155). At a workshop organised locally in 2012, a participant expressed, „*The problem is not water – water is only one manifest of everything else that is wrong here. Solutions need to emerge here locally and they need to go beyond water*". This speaks of the need to review narrow development conceptualizations of the "environment", which currently lured and spurred by "climate change" funding and policy instruments, first construct "local problems" of climate change – so that they can be apolitically slotted into pre-determined categories of environmental interventions.

B. Soil nutrient conservation for Sustainable Upland Farming: Introduction of Nitrogen Fixing Trees in Horticulture Orchard

Vanlalruata. JH. Lalrinfeli R. and Lalrinkima. B.

The North East Initiative Development Agency (NEIDA) has been promoted by the Tata Trusts, Mumbai as the nodal agency for the Trusts' North East Initiative (NEI). Launched in 2008, NEIDA addresses livelihoods issues of rural communities in the region. Through direct field engagement, NEIDA works towards enhancing livelihoods opportunities and improving the quality of lives of households it works with through improved agriculture and horticulture practices, promotion of livestock activities, providing access to safe drinking water and sanitation facilities and sustainable use of natural resources.

A project intervention was carried out on intercropping of nitrogen-fixing tree species (NFTs) onHorticultural orchard's demonstration plot (1 acre) at Mualthuam North, Lunglei District during agricultural season 2015-2017. Two species of nitrogen fixing trees, namely *Flemingiamacrophylla* Willd. Merr. (familyFabaceae) and *Tephrosia candida* Roxb. DC. (family-Fabaceae) were planted as hedgerows. A total of 100 orange (Khasi Mandarin) saplings and60 suckers of banana (Tall Cavendish variety) were planted the main horticulture crops. The key activities at the field level during the 24 months pilot project are: (a) setting up of demonstration plot to showcase improved management practices; (b) setting up rain water harvesting systems; (c) developing a suitable agricultural extension service model at the village. Seasonal vegetables were also planted to act as cash crop to add additional income.

The different nitrogen-fixing tree species introduced as hedgerows were found to supplement soil nutrients and improve efficiency of the system (better root growth) without the use of chemical fertilizers. The pilot project reveals zero incidence of nitrogen deficiency (yellowing of leaves) on all the horticulture crops. An additional income of Rs. 15,000/- in the first cycle of harvest from banana.

C. Use of Herbs in Local Health Care by traditional healers of Kanchanpur

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Herbs play an important role in human life as they are beneficial for maintaining healthy body. At present varied types of herbal medicinal plants are used as different purpose with qualities like flavour, scent, and preparation of herbal foods and for spiritual activities in social life. Traditional herbal practise is very common among the tribal societies for treating different ailments with medicinal herbs to promote sustainable land use management to protect the sloppy mountain region with their conservation. Some of the motivated hill tribe practitioners of Kanchanpur area from North Tripura district have established herbal gardens for an easy accessibility of medicinal plants required for their traditional formulations. The traditional healers develop various formulations for treating some of the most common diseases, like Anaemia and Skin problems Stomach disorder, Bone fracture, Jaundice, Fistula and Piles, Heart disease, Arthritis, General weakness, Gynaecological disorder etc. Some of the popular herbal plants used by the these tribal healers in the hills are viz: Ginger, Golmorich, Loung/Cloves Hetranga, Kulekhara, Khejur, Kaju, Alkoshi, Ashwagandha, Thankuni, Jaba, Jangle Ullo, Tunkadana, Apamargo, Daultpata, Karalapata, Halud, Neem, Guggul, Basak, Anantamul, TilManjshla, Chalmugra, Guruchi, Tulsi, Aloe vera, Dhutura, Gandaki, Sohaga, Hatisur, Biskadalirpata, etc. Different Parts of the plants are used for different traditional medicine purpose and all of them have different process of preparation for a particular traditional medicine. Centre for Forest-based Livelihoods and Extension, Agartala extended support to these tribal healers and developed a participatory mechanism for ex-situ conservation and documentation of traditional knowledge. The aim is to promote traditional medicines and preserve traditional knowledge as well as generate forest-based livelihood to growers and practitioners in view of a large proportion of the population that relies on traditional practitioners.

D. Promotion of Niche Value Chains and Appropriate Technologies for Sustainable Livelihoods of Marginal Communities in Uttarakhand: An Initiative under Kailash Sacred Landscape Transboundary Project

P. Tewari, G. Pande and P.S. Nagarkoti
Central Himalayan Environment Association (CHEA), Nainital

The role of communities in executing the programmes is critical for achieving the objectives and ultimate results. Active participation of communities can lead to ingenious Sustainable Livelihood Approach (SLA) specifically in mountains as majority of population is marginal. The holistic approach has been attempted for demonstrating models in Pithoragarh district of Uttarakhand under flagship transboundary landscape project i.e. Kailash Sacred Landscape Conservation and Development Initiative since 2013-14. This project aims to include research as well as development all together for sustainability of interventions in context of climate change. Under livelihood interventions various niche value chains were selected and executed. Chyura based value chain has been demonstrated in 6 villages among 400 households through Joint Liability Groups (JLGs) and further federated into a registered cooperative to ensure collective approach and also to create impact in terms of production of surplus Chyura honey and Chyura hand made soap under transboundary brand Kailash. In addition, efforts being made to bring forest dweller Van Rajis into main stream by promoting successfully the Kidney Bean Value Chain among 169 households in 9 villages followed by Wadi concept to ensure sustainability and nutritional security. Off Season Vegetables (OSVs) has remarkably done well in 2 villages located close to Pithoragarh townships and of 200 households involved in VC, 85% are led by women. These VCs are

now established and efforts are being continued to replicate the learnings by convergence and leveraging resources through line agencies and development programmes in the landscape. The increase of 12-18% in annual income has been recorded by these VCs.

Considering the Climate Change issues and its affect attempts has been also made in selected villages by promoting water and energy initiatives towards sustainability of ecosystem as well as livelihoods. The establishment of Roof Water Harvesting Tanks in 17 villages among 270 households is providing water security during long dry stress and able to save time of around 300-350 hours in a year that was spent in water collection. It is also benefiting communities to fulfill their irrigation and domestic needs. For reducing the drudgery, pressure over forests and to promote clean energy concept, 37 biogas units are operational and are producing energy for 2-3 hours resulting in time saving of 400 hours in a year and fuel wood extraction also came down from average of 6 ton to around 3-4 ton in a year. The 4 years of experience reveals that to sustain and ensure replication of niche VCs and technologies, support from governments departments, scientist and policy makers is vital to outreach in landscape and in entire Indian Himalayan Region.

E. Low-Cost Vermicomposting: An Innovative Technique for Climate Resilient Organic Farming and Livelihood Development

Pritam Choudhury, Pawan K Kaushik and Sariel T Reang
Centre for Forest-based Livelihoods and Extension (CFLE), Agartala

Climate change impacts on agriculture are well known all over the world, but countries like India are facing vulnerability in view of the huge population and their dependency mainly on agriculture, uncontrolled use of natural resources and poor coping mechanisms. Strategic adaptation is essential to increase the resilience of agricultural production to climate change particularly in mountain regions. Several improved agricultural practices developed over time for diverse agro-ecological regions in India to enhance climate change adaptation. One of the best techniques *i.e.* Low Cost Vermi composting (LCVC) can be practiced to encourage organic farming particularly at vulnerable sites in mountain regions. The raw materials used to install a LCVC unit are bamboo, wood, black polythene sheet, wire, nail, pipe, net, drum, chips, sand, soil and gunny bag. To operationalize these units, many ingredients can be used to produce vermin compost like cow dung, banana plant, water hyacinth, fern, weed, straw, neem leaves, cassia leaves, kachu leaves(arum), ipomea leaves, sajna leaves and other agricultural waste materials. To produce compost from different ingredients the best suitable earthworms to use is red worms (*Eiseniafoetida*) also known as "red wigglers" and "manure worms". There are many advantages of using LCVC technique like huge quantities of organic waste can be converted into a valuable product. Some of the significant benefits of this technique are that low investment and minimum maintenance. It can be installed close to the farm or farmhouse even in hilly terrains. Besides the field applications, the compost can also be sold in the market along with the worms and fetch income to the farmers. Its residues have no negative impact on the soil and environment. Field application of the vermin compost produced by using judicial proportion of tree leaves and other locally available materials increases yield of the crops and improves crop quality with essential nutrients. Also, it controls pest and pathogen and as a result vermin compost is considered to be essential substitute to chemical pesticides. In fact, the process also is an eco-friendly and produces a product which improves the soil fertility and food nutrition. The technique has possible opportunity to become the ideal tool for climate resilient farming and sustainable mountain agriculture besides livelihood development through income generation from sale.

F. "Community Livelihood Nursery": An Effective Tool to Restore Bamboo Diversity in Tripura

Sariel T Reang, Poulami Saha and Pawan K Kaushik*
Centre for Forest-based Livelihoods and Extension (CFLE), Agartala

Bamboo, the "green gold" is one of the most important plant, provides the basic needs to one's life. Its utilities are widely known, from cradle to grave, schools to offices, home to industries, food to medicine; around fifteen hundred uses have been recorded in the world while in some part of Northeastern India, bamboo flowering is considered "a bad omen" for the people particularly in the mountainous regions. Flowering habit of bamboo differs from species to species. Similarly some species have a gregarious flowering habit which may be wiped out soon after flowering as the mother culm dies off. There will be a long years of scarcity of bamboo based food and construction materials for the hill communities. Therefore, conservation and management of bamboo resources in view of this phenomenon are the need of the hour. In Tripura, the natural bamboo patches are vanishing day by day and the declining trend of bamboo stock has become a threat to the dependent communities and industries. The biological diversity in the State is also under threat. In order to restore the stock of bamboo in the State, community participation is being encouraged by CFLE, Agartala by establishing Community Livelihood Nurseries (CLNs) and Bamboo Growers Societies in different parts of the State. These societies are engaged to develop quality planting material of 14 commercial bamboo species under the technical guidance of CFLE. This participatory approach for raising bamboo plants has been proved to be an effective mechanism in motivation, capacity building and sustainable income generation. So far these small nurseries on homesteads at 80 locations have been initiated by CFLE in different parts of Tripura by providing mother plants and field demonstration. There has been a tremendous success in the establishment of CLNs in the State. The bamboo species, newly introduced to them through nurseries, have also find place on their homesteads which is a necessity in view of realizing the bamboo diversity and diverse uses in the State. This nursery will help in conserving the bamboo genetic resources in the state. Availability of bamboo planting stock materials at any point of time even after gregarious flowering would facilitate the restoration of bamboo resources in the hill regions of Northeastern States of India.

G. The Hindu Kush Himalayan Monitoring and Assessment Programme: Assessments and Science-Policy Dialogues to sustain a global asset

BMS Rathore, ICIMOD

The Hindu Kush Himalayan Monitoring and Assessment Programme (HIMAP) is a collaborative effort of over 300 scientists and policy experts to provide information on the status of, and threats to, the people and environments of the Hindu Kush Himalaya (HKH), through assessments and science-policy dialogues.

HIMAP compiles and analyses current science on the HKH in order to produce robust evidence to reduce scientific uncertainty and to identify actions that governments, civil society, and development professionals can take to address the challenges in the HKH.

The programme's first comprehensive assessment, set to be published at the end of 2017, goes beyond climate change and is expected to greatly assist efforts to address threats, act on opportunities, and scale cutting-edge approaches. The HKH Assessment Report contains a wide-ranging, innovative evaluation of the current state of knowledge of the region and of various drivers of change and their impacts, and a set of practical policy recommendations.

The future of the Hindu Kush Himalaya matters to over one billion people

The Hindu Kush Himalaya is one of the greatest mountain systems in the world. Home to the world's highest peaks, unique cultures, diverse flora and fauna, and a vast reserve of natural resources, the HKH supports the lives and livelihoods of over 210 million people living in the hills and mountains of the region. This region also provides numerous benefits to people living beyond its borders. As the source of 10 major Asian rivers, the HKH provides essential resources, especially water, to over a billion people and feeds the grain baskets of Asia.

The HKH is undergoing rapid change, driven by forces such as climate change, disasters, economic growth, globalization, infrastructure development, migration, and urbanization. Changes at the rooftop of the world will have major consequences, not only for people living in the region but globally. Both regional and international action is required to sustain this global asset.

- 4.3 million km^2
- Third pole, largest storage of ice outside the polar regions
- Source of 10 major Asian river systems
- 4 global biodiversity hotspots
- 330 important bird areas
- Hundreds of peaks +6000 m
- Directly sustains the lives and livelihoods of 210 million people
- 1.3 billion people benefit indirectly from resources and services
- 3 billion people rely on food produced in HKH river basins
- Home to diverse cultures, languages, religions, and traditional knowledge systems

Vision for the HKH

A future in which the region's people and societies are:

- Prosperous, healthy, peaceful, and poverty-free
- Food, energy, and water secure
- Climate and disaster resilient

Achieving the vision

- The Hindu Kush Himalayan Monitoring and Assessment Programme (HIMAP)is a long-term, integrated science-policy initiative that aims to support policy change and sustainable solutions to some of the region's most immediate challenges by:
- Comprehensively assessing the current state of knowledge of the HKH region, including thematic assessments and annual outlooks
- Increasing understanding of various drivers of change and their impacts
- Developing evidence-based policy solutions and recommendations
- Engaging decision makers across sectors and institutes through a series of HKH Science-Policy Dialogues

Bringing together diverse stakeholders to develop lasting solutions

HIMAP is a platform for long-term collaboration and coordination among a broad and diverse group of more than 300 leading researchers, practitioners, and policy specialists working in the HKH. Under HIMAP, experts from the region have come together to develop the first Comprehensive Assessment of the HKH, which is set for publication in late 2017 as the first in a series of monitoring and assessment reports. The assessment addresses the social, economic, and environmental pillars of sustainable mountain development and will serve as a basis for evidence-based decision-making to safeguard the environment and advance people's wellbeing.

Taking HIMAP findings into action through HKH Science-Policy Dialogues

Strong scientific evidence is needed to support effective decision making and planning in response to emerging challenges. Through policy-relevant assessments, HIMAP generates sound scientific evidence to support governments in the HKH in their efforts to address challenges related to climate change and other environmental and development stressors.

HIMAP also promotes country and regional deliberations and HKH Science-Policy Dialogues to discuss and define possibilities for enhanced cooperation based on HIMAP results.

Through targeted policy outreach, HIMAP ensures that its findings will contribute to both international dialogue on climate change, adaptation, and resilience as well as action in the eight countries of the HKH by the people who make decisions on investment in, and management of, mountain development—natural resource managers, private sector investors, policy makers, and civil society members.

Priorities for action

- Cooperate at all levels across the HKH on sustainable mountain development. The cost of non-cooperation will be unacceptably high, with the heaviest burdens borne by the poor and marginalized.
- Recognize the uniqueness of the HKH in national, regional, and global decision-making institutions and processes.
- Take concerted action to keep global level climate change to 1.5 degrees by 2100.

Promoting and monitoring HKH priorities in the UN Sustainable Development Goals

The United Nations Sustainable Development Goals set targets for countries to end poverty, protect the planet, and ensure prosperity for all. To support countries in the HKH in achieving these goals for mountain communities, HIMAP has developed SDG consistent HKH Mountain Priorities. The programme will work with countries to periodically monitor their performance and progress toward achieving SDGs at the HKH regional level. It will also promote the use of HIMAP findings and HKH Mountain Priorities in national plans for adaptation and development.

Sooner or later, we will have to recognise that the Earth has rights, too,
to live without pollution.
What mankind must know is that human beings cannot live without Mother Earth,
But the planet can live without humans - Evo Morales

H. Fallow Management in Shifting Cultivation: A Review of Opportunities and Challenges and the way forward in North East India by taking the Institutional Economics Approach

Meziwang Zeliang, Ditho Kathiry, Atoho Jakhalu, Mhabemo N Patton, Kenilo Kessen, Thsope Medo,Vekho Tunyi and Dimusie Pojar
NASTEC, Kohima

Discourse on shifting cultivation and its intervention in the North East region of India has generalised economic and ecological outcomes, without the sound understanding of the cultural attribute of the community and the land tenure system. Therefore, this research study will embrace a multidisciplinary approach to identify key 'determinants' for appropriate intervention. Taking the Institutional Economics approach, this study will employ the Institutional Analysis and Development (IAD) framework which is equipped to analyze such interplay of society and environment through investigation of causes, consequences and policy responses.

Globally, deforestation and degradation is the second largest source of global greenhouse gas emissions contributing between 12-20 %(IPCC,2007), and shifting cultivation accounted for 70% of total deforestation in Africa,50% in Asia, and 35% in Tropical America(Cleuren, 2001).Addressing this concern, the Green India Mission (GIM-2010) under the National Action Plan on Climate Change pledged to increase and improve 10 Mha of forest, which was further reiterated in India's Intended Nationally Determined Contribution (INDC-2015).The Mission committed to rehabilitating shifting cultivation by essentially supporting agroforestry- based fallow land management to increase the forest cover.

The North-East region of India covers about 83.3% of the total shifting cultivation area (Mandal, 2011). Recognising the indigenous traditions and customs that are deeply rooted, there has been a paradigm shift from 'control' to 'improvement' of shifting cultivation at both the national and regional policy level. The Inter-Ministerial National Task Force on Rehabilitation of Shifting Cultivation Areas attributed the problem to unsustainable fallow management practice and has prescribed the integration of agro-forestry principles as a potential intervention towards its improvement. However, the Task Force also reiterated "the uniqueness of shifting cultivation systems because of acombination of socio-cultural-legal and bio-physical characteristics". While anarray of scientific literature and reports on shifting cultivation in NER India exists; they have however been largely descriptive with a normative approach for the way forward.

Nagaland state is a representative of the above problem in North-East India. The total geographical area of the state is 16,579 km2, out of which nearly 28 percent is under cultivation and over 80 percent of the cultivable area is under shifting cultivation. The problem of land tenure issue in shifting cultivation has been greatly emphasized in the Nagaland State Action Plan for Climate Change. This research study proposes that shifting cultivation can be economically and ecologically viable by adopting agro-forestry-based fallow management practices, as long as the three key factors are taken into consideration: land tenure and security, the cultural attribute of the community, and the policies and rules(both formal and informal rules).The IAD framework provides the platform for the interaction of these three key interdependent factors to give a scientific explanation of the interaction process and distinctly distinguishes and identifies the 'determinants' that influences the 'cause' and 'effect'. Diagnosing such influencing 'determinants' would enable any project interventions to clearly lay out the framework and its objectives, rather than prescribing the remedial measures by understanding the problem objectively.

The research study will employ qualitative empirical enquiry relying on multiple sources of data (policy document analysis and field-based interview).The anticipated outcomes would be to strengthen capacity building of all stakeholder groups to have a better understanding of agro-forestry intervention in shifting cultivation. The key outputs of the research study will be briefing papers, discussion papers, journal publications and policy briefs to promote the crafting of institutions, governance mechanism, policies and practices that essentially improve linkages between research and policy communities in shifting cultivation within the climate discourse.

H. Responses of sensitive fauna in the face of climate change in Sikkim Himalaya, India

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Climate change and its impact on biotic and abiotic components of ecosystem is a global concern. Currently it is one of the greatest challenges faced by the scientists and policy planners around the globe. It is reported that the earth's surface has warmed up by 0.6 °C for the past 100 years, and with the current rate of emission of green house gases the global air temperature is likely to increase by 1.5 to 4.5 °C by the end of 21st century (Walther et al., 2002; IPCC, 2007; Hannah, 2015). Effect of such changes in global temperature has been reflected on physical and biological components of the earth (Hickling et al., 2006; Lawler et al., 2009; Xu et al., 2009).

The most prominent impact of climate change on biodiversity is the alteration of the natural distribution limits of floral and faunal communities. There are clear evidences of northward shift of distribution of species pushing their ranges towards poles or higher elevation, and species with southern and montane distribution are rapidly disappearing from lower elevation and colonizing sites at higher elevations (Parmesan et al., 1999; Walther et al., 2002; Hickling et al., 2006; Sekercioğlu et al., 2012; Hannah, 2005).

Himalayas are more sensitive to such effect as warming rates as well as consequences are far above average in the Himalayas compared to rest of the world (Nogues-Bravo et al., 2007; Xu et al., 2009). Over the years, the impacts of climate change have been experienced in Sikkim Himalayas (Arawatia and Tambe, 2012) with evidences of various climate induced effects and the responses of different sensitive faunal groups (Acharya and Chettri, 2012).

Upward migration of species

With the emerging warming and climate change pattern, many species of animals are migrating towards higher elevation. Compared with historical records (Ali, 1962), elevational range shifts in the lower as well as upper limits of around 25 bird species have been recorded in Sikkim in recent years. The upward migration trend was also observed in four species of snakes, two species of amphibians and 22 species of butterflies in Sikkim. Birds such as Blood Pheasant *Ithaginis cruentus*, Snow Pigeon *Columba leconota*, Ibisbill *Ibidorhyncha struthersii*, Rusty-bellied Shortwing *Brachypteryx hyperythra* and White-throated Redstart *Phoenicurus schisticeps* have responded to climate change by shifting their lower as well as upper elevational range limits. Among snakes, Monocled Cobra *Naja kaouthia*, King Cobra *Ophiophagus hannah*, Himalayan Mountain Keelback *Amphiesma platyceps* and Worm Snake *Trachischium guentheri* have shifted their range upwards along the elevation gradient. Similarly, Snow

Toad *Scutiger sikkimensis* and Common Toad *Duttaphrynus himalayana* among amphibians have shown upward elevational range shift in Sikkim Himalayas.

Upward migration has reduced the range sizes and distribution limits of species. While some species might not get affected, the rate of effect differs among others so that all species in a community do not synchronize their shifting behavior. Asynchronous shift results in changed species assembly and community structure resulting in competition among species leading to extinctions (Jankowski et al., 2010). In montane species, range size can be best used to predict the threat of extinction as most of the species has very small range size (Harris and Pimm, 2008).

Altered breeding seasonality, breeding failure and population decline

Warmer temperature, alteration in habitats and changed climatic pattern may alter animal's reproductive strategies (Hovel et al., 2017). Due to unexpected weather events such as longer dry spells, altered plant phenology and insect emergence or may be heavy rainfall at the onset of breeding season, the breeding seasonality of around eight species of birds were affected in Sikkim. Similarly, breeding failure occurred in some water birds such as Ruddy Shelduck *Tadorna ferruginea*, Ibisbill *Ibidorhyncha struthersiii*, Common Redshank *Tringa totanus* and Black-necked Crane *Grus nigricolis*. Due to unusual rainfall event or early summer rain, some amphibians in Sikkim started breeding earlier than their actual breeding time. Bush frog *Philautus* sp., *Duttaphrynus* spp., *Amolops* spp. and *Paa liebigii* have advanced their breeding activities. Longer dry spells has caused breeding failure and population decline in three species of frogs. Such irregular rainfall pattern poses serious threat to both eggs and tadpoles; either they face the risk of being washed away by heavy rains or face desiccation before the completion of metamorphosis leading to mass mortality and population decline.

Skewed sex ratio

Sexes are determined by temperature in most species of reptiles (Bull, 2008) and increased temperature results in biased sex ratio. *Trachischium guentheri*, a high altitude snake in Sikkim, showed skewed sex ratio indicating that the habitats are becoming warmer leading to the production of more females (Chettri et al., 2009). Such deviation of sex ratio from the normal can disrupt population dynamics of snake community.

Influx of exotic species and disappearance of some species

The hilly terrain of Sikkim forms natural continuum with the plains of North Bengal. Due to favorable temperature in the hills, movement of species from lowland to highland occurs thereby threatening the local diversity and endemicity. Such influx has been noticed in some snake and lizards. Influx of exotics might lead to disproportion in prey-predator relationship thereby disturbing the entire food chain. Similarly, some reptiles (such as turtles and tortoises) and amphibians have probably been disappeared from Sikkim due to drying of springs and streams in the lower elevation caused by climate change. Climate driven extinction of amphibians due to chytrid fungus have been reported from tropical mountains (Pounds et al., 2006) but such studies are not available in the Himalayas.

I. Tackling Climate Change and Making Mountain Town/Cities Smarter Through Climate Resilient Infrastructure

Pradeep Mehta, Ph D.
Managing Trustee & Chairman CHINAR

Mountain ecosystems are one of the most fragile ecosystems. The occurrence and the magnitude of extreme climatic events are traditionally higher in mountain than in lowlands, a situation that is increasing due to climate change. Incidents in the Indian Himalayas like Laddakh floods in 2010, Himalayan Tsunami in 2013 and Srinagar floods in 2014 are example of such extreme climatic events. Mountain cities are getting warmer. In Kullu valley in Himachal Pradesh that was once known for its apple cultivation, farmers can't grow apple anymore in the lower valleys. Air-conditioners are becoming popular in town like Kullu. Wetlands and lakes are in the verge of declining. Nainital lake witnessed a drop of almost 14 feet this summer. According to the latest Intergovernmental Panel on Climate Change (IPCC) report, temperatures are predicted to increase further in most mountain areas, making it very likely that in the near future, disasters and extreme events will impact mountains even more. At this rate, climate change could increase the vulnerability of mountain peoples in the long run and may push them to continue to out-migrate or to deplete mountain natural resources to survive.

Mountain towns/cities urgently need attention, investments and interventions to support sustainable development and make them smarter. To achieve this, we need more climate resilient infrastructure like housing, promotion of renewable energy (solar), promotion of terrace farming to control the temperature of our building, minimize our energy uses and increase carbon sequestration. We need to have less impervious structure to maintain the ground water table and keep our wetlands functional and protect our towns/cities from climate risks. Capacity development of the citizens and government officials is important to achieve this before it's too late.

Mountain ecosystems are found throughout the world, from the equator almost to the poles, occupying approximately one-fifth of its land surface. Beyond their common characteristics of having high relative relief (or very marked topographic variation) and steep slopes, mountains are remarkably diverse (Ives. Messerli and Spiess, 1997).Mountain peoples, many with thousands of years of experience living and working in their rugged environments, are overlooked stewards of fragile landscapes that support over ten percent of the Earth's population, and protect the watersheds that ensure freshwater for more than half of humanity. An estimated one-tenth of the human population derive their life-support directly from mountains. Yet, mountains are important not only for their inhabitants, but for millions of people living in lowlands. At the global scale, mountains' greatest value may be as sources of all the world's major rivers, and many smaller ones (Mountain Agenda, 1998).

Despite being ecologically rich, more than 1/3 of the rural population in the mountain areas suffer from hunger and malnutrition. As a result of this, migration from the rural areas to the towns and city has been increasing. Today, people want better education, employment, and health facilities. The mountain towns and cities are increasing in size and population. Mountain ecosystems are one of the most fragile ecosystems. The occurrence and the magnitude of extreme climatic events are traditionally higher in mountain than in lowlands, a situation that is increasing due to climate change. Incidents in the Indian Himalayas like Laddakh floods in 2010, Himalayan Tsunami in 2013 and Srinagar floods in 2014 are example of such extreme climatic events.

Wetlands and lakes are in the verge of declining. Nainital lake in Uttarakhand witnessed a drop of almost 14 feet this summer (2017). According to the latest Intergovernmental Panel on Climate Change

(IPCC) report, temperatures are predicted to increase further in most mountain areas, making it very likely that in the near future, disasters and extreme events will impact mountains even more. At this rate, climate change could increase the vulnerability of mountain peoples in the long run and may push them to continue to out-migrate to bigger cities in Indian or to deplete mountain natural resources to survive.

Mountain cities are getting warmer. Meteorological data of Srinagar recorded during the last century suggest a rising trend in the mean maximum temperatures during the summers (Singh, G.C. et al, 2000). The highest temperature ever recorded in Srinagar was on July 7, 2006, it was recorded as 39.5 ^{0}C (Annon, 2006). In Kullu valley in Himachal Pradesh that was once known for its apple cultivation, farmers can't grow apple anymore in the lower valleys. The local temperature has increased to such extent that people have started using air-conditioners which are now becoming popular in town like Kullu. The apple belt has shifted further north because of this rise in temperature.

The growing city-based or dependent production and consumption of crucial resources and also the sheer numbers of poor people dwelling in urban centres in developing countries highlight how important it is for cities to prepare for climatic impacts and lower their anthropogenic contribution towards greenhouse gas emissions (Satterthwaite 2008, 2011; Bicknell et al. 2009). Climate change poses serious threats to urban infrastructure, quality of life, and entire urban systems. Not only poor countries, but also rich ones will increasingly be affected by anomalous climate events and trends (World Bank 2010).

Climate Resilient Infrastructure: A solution to tackle climate change in the mountains

Mountain towns/cities urgently need attention, investments and interventions to support sustainable development and make them smarter. To achieve this, we need more climate resilient infrastructure like housing, promotion of renewable energy (solar), promotion of terrace farming to control the temperature of our building, minimize our energy uses and increase carbon sequestration. We need to have less impervious structure to maintain the ground water table and keep our wetlands functional and protect our towns/cities from climate risks. Capacity development of the citizens and government officials is important to achieve this before it's too late.

Climate Resilient Housing

Housing in the mountain towns/cities needs utmost attention. We need to plan our housing that are climate resilient. For example, in areas like Laddakh, where the walls of the houses are made up of bricks made from local mud and grass and roof made from wooden poles, mud and grasses. These kinds of housing have been prevalent in the area for centuries and were best suited for cold desert. But asthe climatic condition of the region is changing and the region has stated receiving more rains, it has been observed that these housing structures are unable to withstand heavy rains. It has been seen that during heavy rains and cloud burst, the destruction and loss of human lives is more due to these poor housing structures which were more suitable previously to withstand cold. To tackle the situation, we have to redesign housing structures for cold desert region which are warmer in winters and can also resist heavy rains. There is a need to research on different housing material and structures which are climate resilient. We need material which doesn't get dissolve or washed away easily during rains and at the same time is not too cold during winters i.e., cement coated local mud and grass bricks which will be water resistant and will bind the bricks better can be an option but needs to be researched. We need structure and design which will make housing stronger and climate resistant.

On the other hand, we are seeing a shift in the housing structure in towns and cities. For example, in Himachal Pradesh where traditional houses were made from locally available material like stones interlocked with wooden piles which made them earthquake and climate resistant. The stone walls of

these traditional houses range from 2 – 2.5 feet which retains the heat for long during winters and the same time they keep the houses cool during summers. Thus, these structures were less energy consuming and eco-friendly. The inner roof of these houses is made from wood while the outer side is made of slate stones. The use of wood is helpful in retaining carbon stock which is important from carbon emission point of view. Today, people in the towns/cities and even in villages are adopting modern housing structures with just 9-10 inches of wall made of bricks and cemented roofs. These structures are more energy consuming as these houses are very cold in the winters and need more heating. At the same time, they are very warmer during winters, therefore, they need cooling. As a result of this, ceiling/table fans and air conditioners are becoming common even in the mountain towns and cities. These structures are also less earthquake and climate resistant.

Therefore, we need to revive our old traditional architecture in such cases and the town/city development authority should standardize the design and make it part of urban planning so that it is a compulsion for upcoming housing.

Use of Renewable Energy

The use of energy in the towns and cities is comparatively higher than the rural areas. To meet the demands of the urban communities more dams and micro hydropower's are constructed thus impacting the mountain ecosystem and the livelihoods of the rural mountain communities who have been guarding those ecosystems and have been living in harmony with nature. Melting of glaciers and adverse climate events due to climate change in future may impact the hydropower's. Even the carbon emissions from the urban areas are quite high. Thus, to minimize the pressure on hydropower's and minimize carbon emissions, promotion and adoption of renewable energy like solar technologies (solar lights, solar street lights, solar panels, solar geysers, etc) should be the priority for towns and cities in the mountain areas. Government should come forward to promote such technologies. All Government buildings should be equipped with solar panels. Towns and cities should be prepared to generate their own energy needs.

Roof Top or Terrace Garden

India's urban centres are already confronted by environmental concerns, such as increasing energy consumption, large scale pollution, a scaled up built environment at the cost of green spaces, unmanaged waste generation, unsustainable use of natural resources like water, pressure of increased population density (Mukhopadhyay and Revi 2009).Increasing urbanisation is leading to large-scale deforestation. One might think it better to check urbanisation than invest in setting up green roofs/terrace. But checking urbanisation is a massive step. One can focus on doing little bit to make cities healthier. Cities are already devoid of vegetation. Increasing vegetation in these urban spaces is a good idea which is not in conflict with stopping deforestation or other pro-environment activities in the larger sense. Roof Top Garden's (RTG's) or terrace gardening can regulate the micro as well as macro climate if encouraged on larger scale.Rooftop agriculture is one way in which urban areas could attempt to be more balanced and sustainable in their resource consumption. It is possible to produce a variety of fruit, grain, and vegetable crops on rooftops, either in containers or as field crops (TFPC 1999).

Research at Trent University has found on a typical day with a temperature of 18.4 °C a normal roof surface temperature was 32 °C while that of a green roof was 15 °C. Roof gardens keep roofs cool in summer and help insulate in winter. They require little maintenance and reduce energy bills significantly. RTG's reduces the Intensity of solar flux. The Tokyo government estimates that if half their roofs were green it would save a million dollars every day in air conditioning energy use. The majority of the roofs in the world are dark-coloured and as a result have a low albedo and absorb excessive amounts of heat. Earlier there used to be infrastructure that used to maintain the temperature

inside the house. But today our architecture is not sustainable. Green roofs can aid reducing urban heat islands effect and help in climate change adaptation. RTG's provide added insulation in the colder months and prevent excessive heat absorption in the summer. By regulating temperature variability; green roofs also reduce energy consumption. The aim is to keep buildings cool and curb carbon footprint.With the presence of more green area the carbon cycle can function more appropriately. One of the primary benefits is reduction of carbon footprint. More green space means less air pollution. A city with green roofs will have a clean and healthy environment. This will help the city in terms of sustainability and climate change adaptation. Green roofs are, in fact, the best technology to improve sustainability.
These kind of RTG's and terrace gardens can be promoted in the mountain towns which will not only increase the aesthetic value but will help in improving the air quality, more carbon sequestration, minimize energy needs and will also meet some food requirement of the people.

Watershed Approach in development
Today, majority of the towns and cities not only in the mountain areas but all over India are suffering from the crisis of water. All these towns and cities are dependent on borrowed water either from different place/state or are dependent on underground water which we are actually borrowing water from the next generation. Ground water in town and cities is depleting day by day due to excess use and increase in impervious structures. Wetlands are in the verge of depletion in many places and have gone extinct in few cases.

The famous Nainital lake in Uttarakhand, is facing similar problem where water level of the lake in the past two years have gone down at an alarming rate. This downfall is mainly seen in the summer season (May-June). This year there was a drop of almost 14 feet in the water level. Scientist believe that its mainly because of the depletion of another wetland Sukhatal that feeds the main Naini lake. While there is still a debate to find the real cause of the problem but the main reason is the recharge of underground water whether mainly from Sukhatal lake or from the entire catchment. Today, almost all roads including the walking pathways in Nainital have been concretized thus increasing surface runoff and decreasing ground recharge. This change happened in the past 15 years. Earlier (1980's) there was no sewage system in the town and people had their own soak pits. The water after getting filtered use to recharge the aquifers. Today, the entire town has been connected with sewage line which discharges all the waste water almost 5 km away at a place called Rusi village. The number of houses constructed in the past two decades have also minimized the area of water percolation. Addition to this, the increase in population and number of tourist has also put pressure on the lake as the drinking water boring wells are located next to the lake. Climate change is another factor due to which there are seasons when there is less rain and less snow. As a result of all these factors, the health of Naini lake is depleting year by year. If it continues to deplete the same way, many of the tourism dependent enterprise should suffer a lot in near future.

Another example was 2014 Srinagar floods when the region received about 150 mm of rainfall in just 24 hours while the monthly rainfall for the city is, on an average, 56.4 mm. Some regions received almost 400 percent more rainfall. More than 300 deaths were recorded. Scientists say that since the drainage channels of the city has been blocked and the link between the lakes has been cut off due to unplanned urbanization and encroachment, the lakes have lost their power absorb water the way they used to a century ago and save the city from floods. The wetlands and lakes act as sponges during floods. Comparative studies of the map of 1911 and 2000 reveal that wetlands like Batmalun nambal, Rekh-i-Gandhakshah, Rakh-i-Arat and Rakh-i-KhanKhan besides stream of Doodhganga and Nalla Mar have been completely lost while other lakes and wetlands have experienced considerable shrinkage during the last century (Rashid & Naseem, 2008).

According to a Comptroller and Auditor General of India (CAG) report, the catchment area of the Dal lake is 314 sq km, of which 148 sq km was identified as prone to soil erosion. The open area of the lake had been reduced to 12 sq km from 24 sq km and its average depth also reduced to three metre because of siltation. For this reason, the lake's ability to naturally drain out flood waters has greatly suffered (DownToEarth). There are hardly any wetlands to hold the excess water and act as sponges during the floods.Based on climate models, scientists predict that such events of high rainfall and cloud bursts will be common in the Himalaya in future. We are witnessing incidence of cloud burst or unprecedented climate events every year in the mountains.

One of the solutions to such problems in all such landscapes is to adopt a watershed or landscape approach and manage it accordingly. We should minimize concrete structures especially the roads and should have structures that are less impervious and allow water to infiltrate to recharge the ground waters and maintain the water table. Wetlands should be protected and a green buffer zone of grasses, shrubs and trees of at least 15 metres should be maintained on either sides of the streams which can act as sponge and save the towns and cities from floods during extreme climatic conditions.

Capacity development

Capacity development is another area where the mountain states needs to focus to tackle climate change. In order to achieve the above tasks, we need to prepare a task force for which capacity development of departments and citizens is important. Related Government departments, Non-Government Organizations (NGO's), citizens need to be trained to take actions before it's too late. We need skilled people to develop infrastructure that is climate resilient for which we need to develop the capacity of local architects, urban planners as well as local masons. Climate preparedness is a must to minimize the damage at the time of climate disasters.

Mountain town and cities are more vulnerable to climate change, therefore, there is an urgent need for climate preparedness. Analysing the climate events in the past one decade, it seems we are far behind in our preparedness not only at the time of climate disasters but also in climate mitigation and adaptation. Mountain urban communities residing in the towns and cities are more literate and well off than urban communities living elsewhere, therefore, it is easy to aware them and make the desirable change. We sensibly must design our town and city infrastructure and make them climate resilient. We need immediate policy interventions for urban planning in the mountains so that we are prepared to tackle the problem of climate change in the mountains and make our fragile mountain ecosystems sustainable and climate smart.

Climate change has been felt worldwide and its impact is clear on different organisms and ecosystems. While some species have adapted to this global phenomenon (Mawdsley et al., 2009), population decline have been reported in many species threatening their existence. More extensive studies are necessary to understand the precise effect of global warming on fauna. Understanding responses and adaptation exhibited by species in order to survive and reproduce in such altered environmental conditions in the Himalayas aids in their conservation.

What is the use of a house if you don't have a decent planet to put it on?
– Henry David Thoreau

J. Urbanization in the Indian Mountain States: Issues and Challenges

Dr. Lalbiak Mawia Ngente
Architect & Councillor, IMI

'Urban areas are engines of economic growth...Urbanization will be central to India's strategy of achieving faster and more inclusive growth because agglomeration and densification of economic activities (and habitations) in urban conglomerations stimulates economic efficiencies and provides more opportunities for earning livelihoods...urbanization increases avenues for entrepreneurship and employment compared to what is possible in dispersed rural areas. It thereby, enables faster inclusion of more people in the process of economic growth.'
India's Twelfth Plan: Urban Development

Urbanization

Urbanization refers to the population shift from rural to urban areas, "the gradual increase in the proportion of people living in urban areas", and the ways in which each society adapts to the change. It is predominantly the process by which towns and cities are formed and become larger as more people begin living and working in central areas. The United Nations projected that half of the world's population would live in urban areas at the end of 2008. It is predicted that by 2050 about 64% of the developing world and 86% of the developed world will be urbanized. That is equivalent to approximately 3 billion urbanites by 2050, much of which will occur in Africa and Asia. Notably, the United Nations has also recently projected that nearly all global population growth from 2017 to 2030 will be absorbed by cities, about 1.1 billion new urbanites over the next 13 years.

Urbanization is relevant to a range of disciplines, including geography, sociology, economics, urban planning, and public health. The phenomenon has been closely linked to modernization, industrialization, and the sociological process of rationalization. Urbanization can be seen as a specific condition at a set time (e.g. the proportion of total population or area in cities or towns) or as an increase in that condition over time. So urbanization can be quantified either in terms of, say, the level of urban development relative to the overall population, or as the rate at which the urban proportion of the population is increasing. Urbanization creates enormous social, economic and environmental changes, which provide an opportunity for sustainability with the "potential to use resources more efficiently, to create more sustainable land use and to protect the biodiversity of natural ecosystems."

Urbanization is not merely a modern phenomenon, but a rapid and historic transformation of human social roots on a global scale, whereby predominantly rural culture is being rapidly replaced by predominantly urban culture. The first major change in settlement patterns was the accumulation of hunter-gatherers into villages many thousand years ago. Village culture is characterized by common bloodlines, intimate relationships, and communal behaviour whereas urban culture is characterized by distant bloodlines, unfamiliar relations, and competitive behaviour. This unprecedented movement of people is forecast to continue and intensify during the next few decades, mushrooming cities to sizes unthinkable only a century ago.

Urbanization in India

Urbanization in India began to accelerate after independence, due to the country's adoption of a mixed economy, which gave rise to the development of the private sector. Urbanisation is taking place at a faster rate in India. Population residing in urban areas in India, according to 1901 census, was 11.4%. This count increased to 28.53% according to 2001 census, and crossing 30% as per 2011 census, standing at 31.16%. According to a survey by UN State of the World Population report in 2007, by

2030, 40.76% of country's population is expected to reside in urban areas. As per World Bank, India, along with China, Indonesia, Nigeria, and the United States, will lead the world's urban population surge by 2050.

The vision of India's urban growth has to be aligned with the objectives of inclusion and sustainability. Urbanisation is to be guided towards inclusive, equitable and sustained growth of towns and cities with proper civic amenities. Good urbanisation would ensure that towns and cities are free from slums and provides adequate opportunities for productive employment and decent quality of life to all their inhabitants, including the poor.

Causes of Urbanization

- The main causes of urbanization in India are:
- Expansion in government services, as a result of the Second World War
- Migration of people during the partition of India
- The Industrial Revolution
- Eleventh five-year plan that aimed at *urbanization* for the economic development of India
- Economic opportunities are just one reason people move into cities
- Infrastructure facilities in the urban areas
- Growth of private sector after 1990
- Growth of employment in cities is attracting people from rural areas as well as smaller cities to large towns
- Driven by economic compulsions where people move out for economic advancements to areas offering better job opportunities.
- Also driven by land fragmentations, villages being erased due to roads and highway constructions, dam constructions and other activities.

Consequences of Urbanization

Rapid rise in urban population, in India, is leading to many problems like increasing slums, decrease in standard of living in urban areas, also causing environmental damage. The Industrial Revolution in the 18th century caused countries like United States and England to become superpower nations but the present condition is worsening. India's urban growth rate is 2.07% which seems to be significant compared to Rwanda with 7.6%. India has around 300 million people living in metropolitan areas. This has greatly caused slum problems, with so many people over crowding cities and forcing people to live in unsafe conditions which also includes illegal buildings. Water lines, roads and electricity are lacking which is causing fall of living standards. It is also adding to the problem of all types of pollution.

Urbanization also results in a disparity in the market, owing to the large demands of the growing population and the primary sector struggling to cope with them. It can be argued that urbanization impacts the migrant himself at multiple levels. His network of friends and family become his support system during the initial transformation phase and the struggle to find a job. His struggle could take months to years in order to find a stable job. He is responsible to support himself in the city and family back home.

Some of positive shifts that have been back home from where migrants come, easing out of financial pressures as well as lifestyle up gradation of family through better homes and products that the migrant sends back. On the other hand, it poses a big challenge for the cities that are growing due to migrant population shifting in. How will cities support in terms of resources, land and space

Urbanization in Indian Mountain States

Urbanization in Mountain States has historically developed as Hill Stations or pilgrimage locations. Most of these hill stations have a legacy of colonial planning and still are dependent on infrastructure created during those days. Second wave of urban growth was driven by migration of villagers to nearby towns in search of education and employment which led to growth of few towns as education centres as well. Majority of the mountains states in Indian were carved out of the bigger states as the development of these areas was a subject of neglect under the bigger entities. Formation of new states also led to growth of urbanization in the capital cities & district headquarters of these states.

Despite the growth in urbanization, there are only 20 one lakh plus population cities in these states and most of which are in the plains/terai part of the states. By classification of urbanization most of these urban settlements would qualify as towns only. As this urbanization has been a result of growth of small towns which have grown into nearby rural habitations, it has been plagued by :

Lack of Master Planning

- *Unplanned development of housing*
- *No plan for Urban Transport*
- *No plans for basic necessities like drinking water, sewerage, drainage & solid waste management*

- *Population growth out pacing development of physical infrastructure*
- *Disaster prone development near hazardous areas*
- *Lack of resources and capacity in urban local bodies & delays due to centralized planning/implementation*

As we, the citizens of these mountain states face the consequences of these problems and compare ourselves with the developments in neighbouring metropolitan cities or mountain cities around the world; it is natural to have aspirations for better liveable mountain cities/towns. It is imperative for the governments of these cities and states also to improve state of urban amenities in order to ensure a better experience for the tourists who provide one of the biggest sources of income to these states. These urban agglomerations are also important link in the value chain of inclusive development and act as growth drivers for surrounding rural economies. In the context of mountain development rural and urban need to be treated as complementary to each other for either to be effective. History has also taught us that these urban habitats have always been prone to natural calamities and in the absence of long term planning for such events there have been historic disasters.

The national urban planning landscape also is dominated by the topography of plains which has led to super imposing ill fitted solutions on these cities. When these small states seek solutions on their own, the market has never perceived them as sizeable opportunity to design unique and economical solutions. There are pockets of improvements but impact of these is either limited to a small area or soon outstripped by the demand due to lack future proofing at the planning stage. The trend of development around the world is today urban centric and mountain states have to develop sustainable city development framework instead of patch work arrangements.

The urbanization agenda has been given prime space in Eleventh Plan but the impact of efforts from central & state programmes have not been visible in the mountain cities. This is mainly due to the following reasons:
Lack of specific solutions for the mountain cities
Lack of special norms for mountain cities leaves many cities out of the national programmes (eg. JNNURM)
State initiated urban development programs have lacked resources and capacity to make the difference.

Some of the mountain cities like Shimla, Gangtok etc. have been able to address a few of the problems but these have not been enough. The key steps required to change this status quo are:
Explore and Understand the underlying issues
Sensitize the planning and implementation machinery at the local, state and central level
Bring together the stakeholders of all mountain cities from all the mountain states to ensure that solutions would find necessary economies of scale
Find resources under the current planning mechanism to fund the above
Catalyze creation of new policies and schemes which address the specificity of the mountain cities

Apart from the flagship program of JNNURM by the Central Government, there have been multilateral agency funded state urban development programs which have so far worked on the same old solutions. It is important to find resources to fund exploration of new solutions so that the central and state level programs could be made more effective. This could also be addressed under the central government initiated missions under National Action Plan for Climate Change. These mission are :

- *National Solar Mission*
- *National Mission for Enhanced Energy Efficiency*

- *National Mission on Sustainable Habitat*
- *National Water Mission*
- *National Mission for Sustaining the Himalayan Eco-system*
- *National Mission for a Green India*
- *National Mission for Sustainable Agriculture*
- *National Mission on Strategic Knowledge for Climate Change*

National Mission for Sustaining the Himalayan Eco-system is most directly related to the concerns related to urban development in this region but currently it has become restricted towards the science and environment concerns. It is important that stakeholders in the mountain states sensitize the mission agencies and influence them to ensure that the resources can fund exploration of new solutions which in turn would ensure success of the mission. Each of the above missions have direct impact on creating a sustainable urbanization the mountain states and thereby setting sustainable development in motion for these states.

Stakeholders and their roles

The stakeholders and central actors in the process of urban development are mainly :

- *Urban Local Body*
- *Central Government*
- *International Partner Cities*
- *Civil Society*
- *State Government*
- *Multilateral Agencies*
- *Private Sector*
- *Science & Technology*

Urban local body is at the nucleus of all this through which the implementation of the planned urban development has to take place but unfortunately it lacks the capacity and resources to do so.

The State governments have been the main actors in urban development space and have acted through the departments of housing, town and country planning etc. These departments however have confined themselves to state capitals mostly and have done very little to change the landscape. As the rural livelihood opportunities in the mountains have been dwindling over the years there has been outward migration into towns and cities. This has been accelerated in the post liberalization decades and urbanization really went out of control for economic reasons. The development of cities like Gurgaon is one the most relevant examples for the pace and manner in which urbanization has grown in last two decades. This growth not only resulted in people moving from villages to cities in search of livelihoods but also cities moving into villages to fulfil the rapid increase in housing demand. In the mountain states such pressures have been faced by cities in foothills or terai areas but at slightly smaller scale the existing mountain cities also have faced smaller but proportionate growth. The lack of capacity and planning from the state government has resulted in lack of action from its end and also unwillingness to transfer powers to urban local bodies has not helped the matters. State governments need to work towards decentralizing the functions and provide resources to urban local bodies. This could be done in regional/cluster approach to ensure that solutions could find right scale for viability and would not result in fragmented response from the smaller urban local bodies. State government would have to act as aggregator & facilitator for these urban local bodies for an integrated response to the problems.

Central government has created many instruments like HADP etc. in the past but the emphasis has not been on the sustainable urban development. The mountain areas have always been viewed with prism of environmental conservation and rural development and the urban development was seen mostly in negative light to put it mildly. Even now when at national level urban development has been given

prominent place in planning and implementation, mountain states remain at the margins as the planners and implementers are not sensitized to the special needs of these terrains. Central government needs to ensure that more consultations are done with stakeholders and planning should have a bottom up approach. Central government should also consider looking outside the country for solutions and involve the states in such an exercise.

Multilateral agencies have wealth of experience from multiple geographies around the world, which ideally should have helped in bringing right technologies for the mountain cities. So far there have not been any such examples in the mountain states for path breaking solutions either from developed or developing nations. There are examples in European alpine countries our Andean Countries in South America which could be used as base for developing local solutions in the area of public transport, waste management etc. Science & Technology, especially from the domain of environmentalists, has had a sway over most policy matters of the mountain states. So far the emphasis has been on conservation and very little has been done on adaptation by the science & technology community. In recent times the work done in the area of valuing ecosystem services etc. has been one of the few constructive works of scientific community which would help in augmenting resources of the mountain states. The real challenge for the scientific community would be to balance the conservation and adaptation for the development of the mountain states. In the area of urban development a lot of new technologies are needed to find geography specific solutions and the scientists would be needed to step up to the plate.

Private sector has been shackled by the lack of public sector initiative mostly. The local private sector has its limitations in terms of resources and capacity. Private sector could play a big role provided the issue of scale can be addressed by the central and state governments to make private sector participation worthwhile. In recent times 3 JNNURM supported SWM projects in Uttarakhand were successfully contracted out to private sector but lack of adequate capacity in public sector and delays on environmental clearances have resulted in setbacks. Success of these projects would have worked as catalyst and also as platform for encouraging the private sector to take smaller projects in the state. In case of public transport also if one were to look for a new alternative like PRTS solution to address one city project the cost would be huge but if we are able to study and commission solution for 10 similar cities it would bring the cost down by bringing economies of scale. This has already been successfully tried in case of JNNURM urban bus standardization. Cost of Metro Rail implementation in India would also soon provide similar benefits as more cities opt for it and encourage manufacturers to localize their content. Civil Society has been active at various levels and it has resulted in change of policy making and implementation at all levels of government. However urbanization has once again not been the primary agenda for the civil society in most cities. Even the vocal sections of the civil society have been limited to an urban area or a particular sector only and thereby not having right impact. Integrated Mountain Initiative has been in existence since 2011 and has tried to tackle such limitations of civil society action. The mountain cities agenda is one more such step which began with first mountain cities discussion in 2012 Gangtok SMDS-2. Some of the recommendations from this discussion were:

Better definition of road hierarchy, focusing on transport issues, forming region- based tourism circuits, by curtailing rural-urban and urban-urban migration, and through egalitarian distribution of resources. The focus of urban intervention should also be on such soft aspects as urban governance and capacity building. In the area of urban governance there is a need for revising bye laws, developing e-governance, creating municipal act to form a 3-tier urban mechanism, and developing public-private partnership mechanisms.
Approaches such as city branding also allows for a strategic vision to be implemented.

As funding is seen as a fundamental bottleneck there is a need to find multiple sources of funding based on assets, central resources, subsidies, etc., especially to sustain the development of smaller urban centres.

In order to study the issues in greater details IMI convened the second mountain cities event on January 20, 2014 at Mussoorie. This study has been part of this initiative and author has played active part in conceptualizing, organizing the event. Event was structured to bring out specific suggestions to influence the National and State Urban Development Programs for a visible change in the provision of Urban Amenities in the mountain states with an objective to create discourse on Sustainable Habitats in the mountain states. Through this event, important connection was made with the National Mission for Sustaining the Himalayan Eco-system by engaging the division on climate change in Department of Science &Technology where this important mission has been anchored. This engagement also helped the mountain states to bring the urban development as key agenda for the mission.

Future of Mountain Cities in India

The Conference of Mountain Cities, 2014 held on January 19 & 20 at Mussoorie identified the problems, issues and planning requirements of mountain cities and also suggested Planning Norms for Mountain Cities, as stated below:

Since it is an ecologically fragile area, only carrying capacity based development should be proposed, with not only planning parameters but also aesthetic and cultural parameters taken into consideration.
Delineation of area for development should be made considering land suitability analysis including physical factors such as soil, geology, rock types, geomorphology, topography, slope, etc. Remote sensing & GIS technology should be used for generating maps at appropriate scale.
Micro-zonation of delineated area should be carried out before planning for development.
Proper policy, institutional and legislative framework has to be created for preparation of Comprehensive Development Plan and its implementation keeping in view the natural hazard proneness of the a rea
While formulating Comprehensive Development Plan priority should be given for Environmental Management and Disaster Management.

The following restrictions and conditions may be proposed for future activities.

No construction should be ordinarily undertaken in areas having slope above 30% or areas which fall in landslide hazard zones or areas falling on thespring lines and first order streams identified by the State Government on the basis of available scientific data.
Construction may be permitted in areas with slope between 10% to 30% or spring recharge areas or old landslide zones with such restrictions as the competent authority may evolve.
Prepare detailed contour plan of the area of 1:5000 or larger showing contours at interval of 0.2 to 0.5 metre;
Regulations for disaster mitigation -development control, building regulations/bye-laws for natural hazard prone areas should be followed in the proposed development.

Recommendations

The study and discourse on mountain cities through IMI has brought the issue of urbanization in mountain states into focus. The conference in Mussoorie made a breakthrough with the new beginning

in perspective planning with the help of 3-D modelling as well. Based on these inputs, here is the brief of recommendations:

Planning is the key area which has been addressed only by a few states so far. Most of the small and developing towns in our country today have no master plans. The JNURM program brought in the city development plan documents which had galvanized the process across the country for a rudimentary but welcome framework for planning. The URDPFI guidelines 2014 also as yet do not recognize the specificity of mountain regions. The need for recognizing this is very important as the entire policy paradigm is dependent on it. For example the road planning in the master plans in mountain cities needs to taken into issues of land availability, the setbacks of buildings then need to be revised, alternate public transportations need to be factored in. It is important that following actions be taken at various levels :

Centre :
Immediate recognition for the need of specific requirement of mountain states and supporting development/modification of national guidelines accordingly.
Supporting States in the various levels of planning as the mountain states and cities lack resources to undertake this major overhaul.

State :
Mountain states should immediately redraw the policy landscape by revisiting the existing acts and revising/replacing them refreshed acts/policies.
Develop state perspective plans and regional plans
Provide resources to subsidiaries & ULBs for decentralized Planning.
Ensure that planning process looks at carrying capacity & disaster management as the fundamental components. Carrying capacity tool should be used not stymie the development but also assist in development process by finding sustainable solutions to increase carrying capacity.
As the land availability is limited in urban growth centres and these are interspersed with nature, it would be better to look at cluster approach for developing the local level plans. This would lead to a more sustainable approach for sharing resources and increasing carrying capacity for the cluster while individually these urban centres would saturate at lower levels. This brings the urban transport as a tool for connecting the nodes of the cluster as the centerpiece of the strategy and improve its viability as well.
Better utilization of land for public/semi public purposes needs to be given priority in planning and implementation so as to ensure that land scarcity doesn't lead to exclusion of poor from the process.
Every city in mountains has inherent potential for tourism and it should be made part of urban planning process

Local :
Local Bodies and PRI entities need to find their collective voice for developing the clusters as mentioned above.
Improving the resources of these entities is in their hands and through participatory approach it can be achieved as well.

City Services:
The specific Service level benchmarks should be developed for mountain cities for all city services.

The roll out of many city services would have to be planned as hub and spoke models in a cluster to make the best use of shared resources and provide better scale to private/public implementation of these projects.
Public Transport, Roads, Parking, Water, Sewage & Waste Water, Solid Waste Management need to be made part of essential services for all urban centers.
Public transport planning should look at a mix of mobility solutions which would connect with road and off road networks in the city. There have been encouraging examples in many cities like Medelin, Hongkong etc. for these interconnected mixed models.
Waste & Waste water management are key areas for these cities where both of these problems could be turned into solutions.
City Services planning should also take into account the major economic driver of tourism. Every city in mountains has inherent potential for tourism and it should be made part of urban planning process.

Governance & Finance:
Decentralization and implementation of 74th amendment has been recommended so often that now it is becoming a cliché in its own right. Even if the process is slow but an institutional approach to this goal is important.
The development of certain institutions to support the local bodies under the reformed regime is very important. The city services related agencies could be developed on regional or cluster basis and linked to local bodies in functional/service delivery structure.
Development of PPP mechanism to support the capacity gap for these institutions is needed urgently
Developing new central schemes or converging national missions for mountain areas with the urban planning regime is also important to bring new funding sources. The latest tools like Green Bonus also should be used partly to fund the urban areas so as to make the initial high costs of sustainable development technologies affordable.

Private Sector Engagement:
Hitherto private sector has not developed in the area of city services or other urban development activities in the mountain cities. It is not possible to implement programs/ projects without some degree of private sector involvement in the implementation process.
As suggested above the planning process should enable the mountain cities to collectively create economies of scale to make private sector participation viable and sustainable in these activities.
Better urban planning & implementation regime would also create enabling environment for private sector investments in the other areas of economy of these mountain cities and thereby improving financial resources for the cities.

The Way Forward
The Eleventh Plan, while was able to register a much better economic growth understanding of our Planner, was not very clear when it came to understanding various hues of the term “inclusion”. The limited understanding of the imperatives of the inclusion agenda impressed upon the planners to stress further on ‘more inclusion’ and this was made possible through an unprecedented round of consultations though sharing of the Draft Approach to the Twelfth Plan (2012-17) on web. The effect of the global economic melt-down of 2008 started showing its impact on a hitherto insulated growing economy and growth projections had to be per force harmonized and moderated according to the ground conditions.

Improved understanding of equity issues in development and political implications of ignoring ‘regional imbalance’ makes out a case for special treatment to be meted out to several marginalized geographic regions, with the eleven North Indian mountain States standing out, sharing that space with the Left

Wing Effected Central Indian States, and to some extent the five States of the Western Ghats. The infrastructural inadequacies of the eight North Eastern mountain States and its adverse impact on the over all growth of the country had already been accepted through establishment of a dedicated Ministry, DoNER and a Council, NE Council, for the region. Collectively, the eleven Mountain States also receive some special treatment as Special Category States, to compensate for their specific geo-political position and weak financial base and potential of attracting investments. The overriding security considerations are only too obvious to deserve any mention.

The Sustainability agenda has once again drawn attention of the planners towards our mountain ecosystems. From the Eleventh Plan (2006 -11) the Mountain Ecosystems (Task Force 2006) assumed a recognition which underscored their importance for the present and future generations, not only regional but even Global. The Assessment Report of IPCC (AR 4) triggered constitution of Prime Ministerial Council for Climate Change, which gave birth to a National Action Plan for Climate Change (NAPCC) and its eight National Mission, one specifically dedicated to the Himalayan Eco-systems (NM SHE). The 4 x 4 Vulnerability Assessment further underscored the vulnerability of these mountain ranges to the elements of extreme natural events and the growing warming of the Planet Earth. The Indian Mountain System suddenly emerged not only as a national or regional natural asset but also a Global Asset, in need of all kinds of support and assistance, Local, Regional and even Global. Run-up discourse to the Rio+20 generated a considerable amount of synergy across the mountain States themselves and among other things gave birth to the Integrated Mountain Initiative (IMI).

Central Planning Commission and the various Finance Commissions have taken on board the concerns of the eleven mountain States of India, especially from the Fifth Five Year Plan onwards. Another transformation that has taken place is in the realization that some of these backward regions not only support the most valuable assets of the nation but they have silently contributing to invaluable services to the mainland, namely the various eco-system services e.g. water. fertile soil, forest and other bio-diversity, carbon sequestration etc. The glaciers have suddenly been perceived as invaluable store – house of life-sustaining water (the Third Pole), and so on. Mountain poverty got high-lighted as adversely impacting on this national asset and thus something to be addressed immediately. Sustainable Mountain Development has now acquired a connotation which has become synonym with the very concept of 'Sustainability', a new 'Mantra' to ensure continuity in growth.

Recent disasters of Sikkim and Uttarakhand have added a totally new dimension to the mountain discourse which has triggered discussions on our preparedness to address similar disasters in near future and the impact they leave on such vulnerable regions. Environment and Disaster related issues have now become an integral and unavoidable part of our planning and national accounting system. Improving the exiting National Policies which relate to various components of Urban Development in Mountain States, as also to various programmes and schemes that relate to Drinking Water, Sanitation, City Planning, Solid Waste Management, Disaster Management, socioeconomic infrastructures of urban bodies, Governance of Urban Local Bodies, 74th Perspective Planning of Urban Cities, implementation of the 73rs and amendments in Constitution, Administrative Reforms, principles of awarding Grants-in-Aid by the Finance Commissions, Awards of the State Finance Commissions or their alternate bodies required for Schedule VI areas and Autonomous Regions in the North Eastern States and such allied and related issues. Regional and International cooperation and collaboration among countries to introduce Best Practices and setting up of Dialogue Forums to discuss such issues in future would also be in the priorities that are needed to be streamlined, along with capacity building of Institutions, individuals and various institutions to handle such issues in-house.

K. Water in Himalayan Towns - Lessons for Adaptive Water Governance

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The Hindu-Kush Himalayan(HKH) terrain is characterized by a unique topography and hydrogeology, which is able to support only 3 percent of larger cities and 8 percent of smaller towns. Due to limitation to expand, urbanization is a slow process in HKH. However, off late, there is an increase in urbanisation across HKH region largely due to regional imbalances and failure of planning process that doesn't provide uniform economic means to survive. People are flocking to nearest urban centers for employment and related economic opportunities. In HKH countries, the share of urban population is increasing, while that of rural population is declining. Literature also highlights that by 2050, more than 50% of the population in six HKH countries (Bangladesh, Bhutan, China, India, Myanmar, and Pakistan) will live in cities (UNDESA, 2014).

In HKH, increasing urbanization and climate change are two critical stressors that adversely affect the biophysical environment of urban areas. Degradation of urban environments has not been a matter of concern in the subcontinent. All development plans and policies focus more on rural areas. Across the region, encroachment or degradation of natural water bodies (such as springs, ponds, lakes, canals and rivers) and the disappearance of traditional water systems (such as stone sprouts, wells, and local water tanks) are evident. Depletion of water bodies affects wetland ecosystems and reduces retention capacities that prevent rainfall flooding. As a consequence, urban drainage and flood management systems are impaired. Rapid urbanization and climate change have short and long-term implications for biophysical and socio-economic environments. Urban waste-water discharge and solid-waste disposal are polluting surface water bodies in urban and peri-urban areas. Waste-water re-use for agriculture, a common practice in peri-urban areas, often ignores potential health hazards and other adverse effects of polluted water. Ground water is often contaminated with salinity, iron, and fluoride, and characterized by hardness. The research points to declining ground water reserves due to over-exploitation for domestic, industrial, commercial, and agricultural purposes. Ground water recharge rates are reduced because of low rainfall and interventions in the recharge process such as sand mining.

This uniqueness in groundwater conditions in HKH makes it a specific typology.Aquifers feed into springs which are the main water sources for urban and rural areas in the hills. Springs also contribute to base flows in the streams and rivers. A very conservative estimate suggests that there are more than a million springs in the Himalayan region. However the challenges faced are contamination as some of the aquifers are recharged from greater distances are often disturbed by sinking of wells. As recharge areas of these springs are not well protected because of the absence of such a component in the planning process. Increasing population pressure is also leading to competition for water from common aquifers.

ICIMOD's initiative – Himalayan Adaptation, Water and Resilience Research (HI-AWARE) is presently researching on these issues in 8 towns across HKH regions. These towns are located in India, Pakistan and Nepal covering eastern and western Himalayan regions. The research is assessing the current status of water resources in these towns while understanding the ways in which residents are adapting to the change in water availability and the role of the government in building appropriate adaptive strategies. All these cities are presently fed by various springs which contributes to the water supply in these towns. The research shows that despite high rainfall in these regions where the towns are located, there are gaps in demand and supply due to problems of infrastructure, management and

governance issues. The formal water supply in these towns are unreliable and accessing groundwater is technically not feasible. People adapt to these water insecurities in variety of ways including rainwater harvesting, accessing water through nearby springs and buying water through private tanker market. The research indicates that in the coming years, urbanization and climate change effects are likely to alter the urban and peri-urban micro-climates, and worsen the urban heat 'island effect'. Sectoral development strategies need to factor in climate-resilient development approaches, where sound institutional frameworks and partnerships between planners and communities are required to sustain urban growth and development. The study suggests three broad points. First, a larger feasibility study of present and future trends of demand and supply while undertaking climate change and urbanization stressors which will help the utility in planning for future. Second, the focus should be on protecting watershed of springs which are main source of water supply in urban areas in HKH apart from ponds and lakes. Protection of all urban water bodies and perennial sources are important for present and future water supply. Third, investment is needed in water and sanitation infrastructure where urban planning and environmental planning needs to go hand in hand. Cities need to plan their water and waste water infrastructure. Mismanagement of urban waste leads to pollution of freshwater bodies. Proper infrastructure is needed for sewerage and water supply.

L. Application of geo-spatial technology for sustainable land use planning and management based on water resources in Kawnpui town, Mizoram, India

F. Lalbiakmawia, M. Lalruatfeli & Shiva Kumar

Rapid growth of population necessitates proper planning of natural resources for sustainable socio-economic growth. Land development and its resultant use have a large impact on environment and sustainability. Hence, land use planning forms an important component in development activities of hilly areas. Hilly terrains offer a lot of challenges in land use planning due to their complex geo-environmental factors and socio-economic setup. Hence, the integration of scientific input through advanced techniques is required. North-east India is well known for shifting cultivation which caused considerable destruction to land resources and environment. There is a necessity to develop proper strategies or land use plans which can counteract these detrimental effects on environment, and at the same time improve productivity of land.

Water is essential for sustaining all forms of life, food production, economic development, and for general well being. Moreover, groundwater is a major source for all purposes of water requirements in India both in rural and urban areas as well as in irrigation. Further, the dependency on the ground water is expected to increase in future due to increase in population (NRSC, 2008). Due to fast urbanization and growth in human population, the demand for water supply increases rapidly. Ground water is one of the most important natural resources and the largest accessible source of fresh water . Therefore, managing and conserving this vital resources has become highly crucial.

Advent of geospatial technologies like utilization of geographical information system (GIS) and global positioning system (GPS) allows fast and cost effective survey and management for natural resources.

Hence, this technique has wide-range applications including ground water quality mapping. Therefore, many researchers have utilized these techniques successfully in ground water studies, both for prospecting and quality mapping. The same techniques have been proved to be of immense value in the field of development of water resources. Interpretation of satellite data in combination with adequate ground truth information makes it possible to identify and outline various geo-environmental features.

The decadal growth of the study area is 18.92% in term of population (Census, 2011). This shows the need for proper planning of land use and conservation of resources in the present situation. The main objective of the present study is to utilize several thematic layers for planning sustainable land use model. The result of this study will present maps with constructive options for land and water resource developments in the study area. This information will be very useful for decision makers to plan according to the schemes and resources available at hand.

1.1 Study area

Kawnpui town is located in the central part of Kolasib district, Mizoram, in north-east India. With a total area of 156.50 sq km., the town is located between 92° 36.358'E to 92° 44.210'E longitudes and 23° 57.293′N to 24° 07.543′N latitudes. It falls under Survey of India toposheet No. 83D/12 and 84A/9. The climate of the study area ranges from moist tropical to moist sub-tropical. The entire district is under the direct influence of south west monsoon, with average annual rainfall of 2908.40 mm.
The soils found in the study area were mostly of red and yellow loamy. They were also acidic in nature due to heavy rainfall. They contained high amount of organic carbon and were high in available nitrogen, low in phosphorus and potassium content. (MIRSAC, 2009).

2. MATERIALS AND METHOD

2.1 Material used:

Indian Remote Sensing Satellite (IRS-P6) LISS III data having spatial resolution of 23.5m and Cartosat-I stereo-paired data having spatial resolution of 2.5m were used as the main data. Quickbird satellite data, SOI topographical maps and various ancillary data were also referred in the study.

2.2 Thematic layers:

Thematic layers generated using remote sensing data like land use/land cover, slope, Ground water potential layer and surface water layer are integrated in a Geographic Information System (GIS) environment. These layers are first prepared prior to generating land and water resource plans. They form vital base layer information of existing natural resources which will later assist in preparation of land use and water resources management plans. The different thematic layers are as follows-

2.2.1 Land use / Land cover: Remote sensing and GIS techniques provide basic information for land use mapping and play very significant role in determining land use pattern by visual interpretation (Sharma and Kujur, 2012). The major land use/land cover classes in the study area were broadly classified into built-up land, agricultural land/horticultural land, forests (dense and open), bamboo forest, forest plantation, jhum land (current and abandoned jhum), scrub land and water body.

2.2.2 Slope: Slope map was generated from Digital Elevation Model (DEM) which is prepared utilizing the Cartosat-I stereo-paired data in a GIS environment. The general topography of the central part of the study area is represented by steep slopes. The western, eastern and southern parts of the study area are generally characterized by gently sloping and low-lying units. The northern part is characterized by steeply sloping scarps and cliffs. To assist in the geospatial planning of the study area, the slope facets were generated and classified into 6 classes, represented in slope percent. The slopes of the area are represented in terms of degrees, and are divided into eight slope classes, viz., 0-15, 15-20, 20-25 and >25 degrees. It should also be considered that gentle slope promotes water infiltration and groundwater recharge whereas steep slopes acts as a high runoff zone (Kumar and Kumar, 2013; Siddalingamurthy et. al., 2013).

2.2.3 Ground water: Ground water is the major source of irrigation in India. The availability of this important natural resource has been taken for granted due to fast changing land use pattern. There has been tremendous increase in demand for fresh water due to population growth and intense agriculture activities. (Singh et. al., 2015). Ground water potential map of an area can be generated using GIS and remote sensing data. (Lalbiakmawia.2015b). The same technique has been utilized for delineating ground water prospective locations within the study area.

2.2.4 Surface water: Water is essential for sustaining all forms of life, food production, economic development, and for general well being. (Kumar, et al., 2005). Therefore, the planning of water resources has to be done along with the planning of the land resources. Surface water layer has been prepared for the study area using GIS technique base on topographic map, satellite imagery and field survey.

2.2.5 Base layer: The enclosure of base layers like drainage; contour and road network layers are also important requirement data during this planning.

2.3 Methodology:

Detailed spatial analysis in GIS environment and creating a comprehensive geo-database has enabled the generation of an environmentally and economically sound land-water resource plan in the study area.
The placement of proposed water resource structures in the study area relies on the integration of these layers as well as the proposed land use plan in a GIS environment. To facilitate the identification of these placement points, various criteria were also adopted following physical characteristics of the land. All these criteria were geospatially plotted in the GIS system by executing relevant spatial queries and commands.

Geographic Information System (GIS) technique, which is having a strong capacity in data integration, analysis and visualization, can be utilized for land use and water resources planning. This technique has been adopted in the present study for effective use in sustainable development of land and water resources by integration of the thematic layers. Geospatial modeling technique has also been utilized for sustainable land-use and other natural resources planning and management.
Ground survey is one of the most vital activities of the study. Pre-field interpretations in map forms were subjected to evaluation on-site. Field information necessary for assessing and validating the accuracy of the maps were collected during ground survey. Data from these surveys were then incorporated during the final stages of the study.

Sl. No.	Present Land Use	Slope (in degree)	GW potential classes	Proposed Land Us
1	Single cropped agricultural land, current jhum, abandoned jhum	0-15	Very good	Wet Rice Cultivation (WRC)/
2	Single cropped agricultural land, current jhum, abandoned jhum	15-20	Good	Terrace cultivation
3	Current jhum & abandoned jhum, Existing plantation, Bamboo & scrubland(preferably adjacent to road communication)	20-25	Good	Agro-horticulture cum Agri/horti plantations
4	Current jhum, abandoned jhum, open forest & Scrub lands	>25	Moderate	Afforestation
5	Forest (dense & less dense) and bamboo	…	Very good to limited	To be conserved as forest and bamboo

3. RESULTS AND DISCUSSION

3.1 Land Resources Planning:

The geospatial planning for improvement of land resources in the study area was prepared with the objective of making best use of available land for socio-economic progress and to assist the farmers for stable farming system. Various sustainable land use practices were suggested using the thematic layers generated in GIS environment and considerations were also given to feasibility of water resources by incorporating data from ground surveys which is discussed below.

Wet Rice Cultivation / Pisciculture: The proposed locations for these agricultural activities are confined in the river valleys and other low lying areas. In addition to paddy cultivation, these areas can be utilized for cultivation of other crops along with the practice of pisciculture. Hence, the main components of such land use system are composite fish culture along with paddy or vegetables cultivation.

Terrace farming: Terrace farming occupies an important proposed form of farming in the study area, which not only ensures soil and water conservation but also suits the cropping needs of the farmers on sloping lands. Good irrigation facilities are the basic needs prior to executing a terrace farm. Paddy cultivation along with other crops and vegetables farming can be also carried out in rotation provide adequate supply of water is available. The analyses have shown that terrace farming can be carried out in several places within the study area.

Agro-horticultural system cum Agricultural/Horticultural Plantation*: B*oth fruit bearing trees and field crops can be grown together in many variations in this system. Perennial crops and seasonal crops can be grown in this method whereas crop rotation will be necessary in case of seasonal crops. Several suitable sites are found for agriculture/ horticulture plantations within the study area. However, the existing land use and slope factor determine the selection of suitable places for these plantations.

Afforestation: Deforestation has been the result of the pressure on land for food production which continues to prevail due to shifting cultivation. Therefore, there is need for taking up afforestation programmes in such affected sites. The wastelands can also be reclaimed through reforestation programmes. The existing land consisting of abandoned jhum, scrubland, less dense forest with steep slope can be developed through afforestation. In such areas, the availability of water is limited, hence,

development of springs other sources of water should be considered through rain water harvesting method.

Forest: Forests of the study area comprises dense and less dense (open) forests, as well as other reserve forests and forest plantations (Government owned and private). Since, forest is one of the most important natural resources of Mizoram, it is suggested that the existing forest cover be preserved, and additional conservation techniques may be utilized to prevent encroachment and exploitation of forests for unwanted commercial purposes. Declaration and demarcation of forest areas as Reserve Forests in areas where their conservation is needed can help in protection of the adjoining natural forests. Voluntary organizations/NGOs may be encouraged and entrusted the task of further protection of these forests as well as extension of the forests in the form of parks, etc.

Bamboo Forest: Bamboo forests are more confined to lower altitudes. The bamboo forests needs to be conserved and propagated to continue the existence of these vital resources. Projects initiated by government can assist in ensuring the conservation of the bamboo stocks from the affect of shifting cultivation. Since, bamboo forests are one of the most valuable natural resources of the area, appropriate method for utilization of these resources through rational uses may be adopted.

3.2 Water Resources Planning:

The scope for agriculture production can be enhanced if the water resources are utilized in an effective manner. Surface water harvesting techniques have become important in recent times because of over-exploitation and lack of development in many areas and this imposed a threat to the demand of water supply. One of the most important factors in harvesting surface water is the identification of suitable sites. Selection of proper sites and suggesting appropriate developmental activities can be achieved utilizing Geographical Information System (GIS) technique which can integrate both thematic and non-thematic data. Water harvesting structures are proposed in various locations within the study area and the proposed structures are briefly described below:

Minor Irrigation Tanks: In spite of the natural gift of good rainfall, most of the people in this area are able to grow only rain-fed crop as only a few areas could be facilitated with irrigation facility. Hence surface water harvesting was given priority and therefore 39 Minor irrigation tanks are proposed at various locations in order to meet the demands for irrigation water in the area.

These Minor Irrigation tanks are proposed to be constructed across the perennial streams for creating water reservoirs for providing irrigation water to the crops at critical periods and also to facilitate the groundwater recharge in the downstream regions. The design details of the structures are depending upon the site condition. As far as possible a narrow gorge should be selected for making the dam in order to keep the ratio of earth work to storage as minimum. Besides, geologically and structurally favourable sites have been selected in order to avoid major loss of water.

Water Harvesting Bunds: These are similar to Minor irrigation tanks except that they do not have extensive canal system and their command area is limited to fields downstream. These harvesting bunds are proposed to be constructed in order i) to collect the impound surface run off during monsoon rains and facilitate infiltration to raise groundwater level in the zone of influence of the bunds; ii) to facilitate irrigation in the field lying in close proximity of the structure. iii) It also moderates the peak flow, partly by storing and partly by flood routing. And 64 water harvesting bunds have been proposed and their locations are shown in the action plan map.

Check Dams: Check dams are proposed across the stream to tap the stream water for irrigation and soil conservation purposes. It also provides drinking water for the livestock and human beings. It reduces run off velocity thereby minimizing soil erosion and secondly it allows the retained water to percolate and thus results in increased recharge for the groundwater in the adjoining downstream side of the stream. 35 Check dams have been proposed and are shown in the action plan map.

Farm Ponds: Farm ponds are useful for life saving irrigation in a limited area; it also provides drinking water for livestock and human beings, pisciculture etc. 24 farm ponds are proposed to be constructed as an embankment across a water course or by excavating a pit or the combination of both.

Springs (Tuikhur): These are the most important sources of water supply in Mizoram since time immemorial. The age old method of fetching water from natural springs is still prevalent in many parts of the state. A spring is a location where groundwater naturally emerges from the Earth's subsurface in a defined flow and in an amount large enough to form a pool or stream-like flow. Springs can discharge fresh ground water onto the ground surface. Generally, springs located within or near the periphery of settlement area are utilized for tapping drinking water and for irrigation purposes.

Proposed plan	**Area (Sq km)**	**%**
WRC	13.05	8.34
Terrace	4.16	2.66
Agro-horticulture	12.30	7.86
Afforestation	6.77	4.32
Conserve bamboo	74.77	47.77
Conserve forest	43.28	27.65
Habitation	1.58	1.02
Waterbody	0.60	0.38
Total	**156.50**	**100.00**

Ground water prospective area: Ground water potential map may be applied for for targeting the sites for extraction water at appropriate locations. Solar energy may be applied for environmental friendly method. Dug wells may also be developed in very good ground water potential class for providing water to WRC and other cultivated areas.

Even though the study area receives a good amount of rainfall, most of the rain water gets wasted due to steep slope and lack of water harvesting structures. Hence, surface water resource is often inadequate to meet the demand for drinking water supply for livestock and human beings. The study area, therefore, often faces water scarcity during the lean seasons. Therefore, field studies and mapping of ground water potential zones within the study area become an important task in order to tackle the problems of the inhabitants. Efforts have been made for this important task, to exploit the ground water potential of the region by generating ground water zonation map for the entire study area. This zonation map may be utilized to locate the potential zones and select sites for ground water exploration.

4. CONCLUSION

Land use and water resources management planning in the hilly terrains is not an easy task as it involves a lot of parameters to be taken into account. The study area comprises large percentage of land which comes under shifting cultivation, which is the main system for farming at the present stage. Planning in such system of cultivation is a major task. Therefore, geospatial planning is necessary due to its ability to incorporate both spatial and non-spatial data for generating realistic and successful land and water resource management plans. Identifying the significance of various natural resources in sustaining the livelihood of the locals and considering strategic utilization and management according to their capability is an important input during the planning process. Expansion of habitation and construction of link roads to the cultivable areas are also important factors which need to be approached through consensus of various sectors. The present study has proved that remote sensing and GIS can be utilized effectively for formulating sustainable development plan based on land and water resources.

3. YOUTH SUMMIT 2017

According to one of the reports published in 2012 for the UN-HABITAT Global Urban Youth Research Network, by 2020 India is set to become the world's youngest country with 64% of its population in the working age group. This implies that the role of the youth in the coming years is most pivotal in the country's growth. It is therefore crucial to make the youth realize their responsibilities and help them discover their own potential to shoulder these responsibilities.

Realizing this, the SMDS, that brings together all the stakeholders pivotal to sustainable development in the IHR, hosted the 2nd Youth Summit at the Youth Hostel, Luangmual, Aizawl during the period 18th – 20th September, 2017 to bring together one of the most important stakeholders- the youth, from the 10 states and 2 hill districts of the IHR; wherein LEAD India was the Institutional partner.

The objective of this summit was to sensitize the youth to the current issues related to sustainable development and instill them with a self-belief that they too can become partners-in-change by voicing their concerns and opinions.

The two and half day Youth Summit, which brings together 62 youth, succeeded at enhancing the technical knowledge of the participants as well as honing their leadership skills. The technical sessions focused on various aspects of sustainable development, climate change and the growing urban mountain cities. The skill building was done through making the participants first focus on their mental models and patterns and aligning their inner-self; making them recognize their leadership potential by identifying the roles they can play addressing the challenges faced by their respective cities and states; enhancing their communication skills to collectivize and network to influence action.

Aizawl Declaration - Youth Summit 2017

On the occasion of the youth summit of the SMDS VI, held from 18-20th of September 2017, we the youth from indigenous and local communities of the Indian Himalayan Region (IHR) present the outcome document along with our declaration to promote a sustainable way of life and well-being of our mountain homes

We declare that we:

- Recognise the fragility of our mountain homes therefore promote a sustainable way of living
- Consume, encourage and promote of organically grown local produce
- Spread awareness for the 4'Rs that leads to waste reduction
- Support better waste treatment and share best waste management practices among mountain states
- Prioritise and engage in sustainable urban planning and management with concern authorities
- Promote the conservation of biodiversity of the mountain regions
- Promote the use of technology that supports sustainable mountain development
- Generate awareness about the existing policies and support in implementing them
- Ensure that we continue to engage in critical climate change and sustainable development issues in the Indian Himalayan Region
- Know more about our traditional knowledge systems and find a common grounding with modern science
- Network and connect with the young people of the mountain states towards achieving sustainable development

Choosing the sectors of Agriculture, Health, Water and Cultural Conservation, we suggest the following:

Agriculture

- Establishment of a strong local market in each hill state to promote, facilitate and encourage local farmers. The establishment to also include the following features:
- To design a capacity building program to train the farmers and locals in entrepreneurship skills and responsibility.
- To discourage the use of similar products from outside the state in order to strengthen the agri-horti local economy.
- Encourage the practice of organic farming and organic production in the mountain states and in relation to that:
- Adoption of *Organic Policy* in tune with the related departments like Agriculture, horticulture, Animal husbandry and health department of respective state government for healthier food to combat diseases
- Logical implementation of The National food security Act 2013
- Establishment of food processing and packaging industries;

To outline a method to create linkages and collaborations with the Ministry of Food Processing Industries of the Govt. of India for establishing and building up this industry:

- We stress on the importance of strategies to standardize the quality of food crops, fruits, vegetables and herbs produced in the State/area to bring it at par with the best marketable quality;

- We stress on the necessity to set up a gene bank / seed bank in order to serve the function of storing and preserving genetic diversity of the various grain, fruit and vegetable crops and to retain the exotic and ethnic specialty of the crops;
- Establishment of cold storage facilities across the Himalayan states. The cold storage facilities should also be set up in storage vehicles such as but not limited to vehicles/transport/lorry trucks;
- We stress on the necessity of a suitable hill-designed technology in various agricultural sectors;
- We emphasize of the importance of the promotion of the consumption of local agricultural products in areas such as daily lives, hotels, home-stays in order to sustain our local economy and market the surplus.
- We suggest a transparent and a proper research upon mono cropping to find out the actual reason behind its failure.
- Proper scientific studies and capacity building program on the growth and use of alien invasive species.
- Adoption of agro-forestry practises using multiple purpose trees.

Health

- Identification of strategies to increase community participation in health awareness;
- We stress on the importance of conducting awareness program on the emerging water borne and vector borne diseases from the village/ward level to state level with a focus on the main stakeholders such as the youth and the parent;
- Introduction of innovative health education in the school syllabus;
- We endorse the establishment of proper mechanisms for safe drinking water such as the use of RO based drinking water;
- Formation and the strengthening of village/ward health committee with the active participation of women and youth;
- We suggest the setting up of and the proper functioning of Primary health centre, Community health centre (for immediate treatment) by the states;
- *We endorse the provision of clean water and sanitation, secure essential health care services including vaccination and child health services,*

Water

- We emphasis the role of micro-drainage systems to be made an integral part of urban and remote planning.
- Promotion of watershed management practices, which includes a policy that would require the upcoming infrastructures to have a rain water harvesting facility in individual complex
- Support and promote streamlining of research data in a single portal with open access

Cultural Diversity

- Establishment of cultural museums, art centres and interpretation centres as consistent efforts to exhibit the narratives, history, art and literature coming out of the communities. The structures should encompass the following:
- to be strongly promoted as the primary hubs for state-level cultural activities and festivals;
- to be spread over large campuses in order to accommodate the exposition of artisans, handicrafts, visual art, performance art, literature and festivals;
- to be constructed using vital design elements of indigenous architecture such as natural building materials;
- to be made available online as an open source;

Initiation of archiving and digitisations of the history and stories of the communities:

Establishment of an online resource centre where information about culture can be easily accessible and available;

Use of various mixed-media for the purpose including but not limited to podcasts, footages and films;

Establishment of decentralized public libraries with the following recommended features in brief: accommodation of literary works from all parts of indigenous communities.

Viability of a human library where humans with life experiences and stories to be made as part of public libraries on occasions.

Libraries to be established at the remote level in order to be able to accommodate travelling workshops, festivals, cultural shows, folk dances and tales etc;

Use of eco-tourism and responsible tourism as a vehicle to cultural conservation therefore highlighting lifestyles that are largely defined by culture. It should have the following features:

Formation of a village indigenous committee in order to chalk out eco-tourism packages, homestays and tour operations. The nature of such eco-tourism should not be encouraged by competition but by collaboration. The committee may also take the initiative to establish relations with universities where volunteerism of students of various backgrounds is encouraged in eco-tourism;

Educational and governmental institutions place importance in the conservation of indigenous languages by creating a comfortable space for its use:

Recommend that institutions imposing penalties for the use of local language should be done away with; recommend the establishment of language and research centres as part of university programs;

Policies to exactly outline the rights of forest/ riparian and mountain communities in terms of their traditional use and extraction of resources from such common property resources such as forests, rivers and mountains. Such that:

- indigenous activities may also be encouraged by such policies
- recommend the distinction of the drawing rights of corporations as opposed to indigenous communities.
- Initiate a process of outlining migration policies
- Regulate or monitor the influx of migrants
- recommend that the policy ensure and encourages the harmonious co-existence of settlers and indigenous communities
- recommend the digitisation of accounts of migrants and refugees
- to ensure that there is one policy that overlooks the proper treatment of migrants settling in indigenous land while also preventing cultural loss of the indigenous people.

Programme Of The Youth Summit
Sustainable Mountain Development Summit- VI
(Mizoram – 2017)

Organised by: Institutional Partner:
Mizoram Sustainable Development Foundation (MSDF) **LEAD India**

Venue: Youth Hostel, Luangmual, Aizawl, Mizoram.
Dates : 18th – 20th September, 2017

Day 1 : 18th September, 2017 (Monday)

1400 hrs : Arrival
1400-1600 hrs : Registration, getting to know each other, introduction.
1600-1630 hrs : Tea Break
1630-1830 hrs : **Session I: Ice Breaker - Knowing oneself:**
- Understanding mental models, patterns and frames
- Understanding three brains concept
- Inner certainty, aligning your inner self.

1830-1900 hrs : Tea Break
1900-2030 hrs : **Session II: Inaugural Session**

Chief Guest : **Dr. C Vanlalramsanga,**
Secretary, Planning & Prog. Implementation. Govt of Mizoram

Chairman : **Dr. Lalbiakmawia Ngente,**
Converner SMDS VI & President, MSDF

1.	Opening Remarks	:	Chairman
2.	Welcome & Introduction	:	Dr. C Rinawma, Jt. Secretary, MSDF
3.	Special Number	:	Ms. K Lalthlamuankimi (Mami)
4.	Summit Outline	:	Ms. Bhawana Luthra, LEAD India
5.	Solo	:	Mr. Joseph Lalhmangaihzuala
6.	Expectation from the Summit	:	a) Ms. Raneem Ali b) Mr. Tsering Bhutia
7.	Special Number	:	Ms. Lalvenhimi
8.	Address & Inauguration	:	Chief Guest
9.	Vote of Thanks	:	Dr. John Zothanzama, Secretary, MSDF
Followed by	Cultural Programme	:	Host – Ms. Rempuii

Day 2 : 19th September, 2017 (Tuesday)

0900-1100 hrs : **Session III: Mr. Amba Jamir**
Youth and Mountain Cities
- Issues and Challenges

1100-1130 hrs : Tea Break
1130-1200 hrs : **Session IV: Ms. Radhika Kothari**
Climate Change and impacts in the mountains

1200-1300 hrs :	**Session V: Ms. Bhawana Luthra** Understanding interconnections and Interdependence between multiple sectors
1300-1400 hrs :	Lunch
1400-1600 hrs :	**Session V: The Sustainability Challenge** - Sustainability issues in specific sectors within States - Impacts or manifestations - Priority and recommendations
1600-1630 hrs :	Tea Break
1630-1730 hrs :	**Session VI: Youth Declaration on Sustainability**
1730-1830 hrs :	Leadership Stories
1830-2000 hrs :	Leisure time, followed by Dinner

Day 3 : 20th September, 2017 (Wednesday)

0900-1000 hrs :	**Session VII: Revisiting & Road Map for Youth Declaration**
1000-1100 hrs :	Adoption of Pledges (Group/Individual)
1100-1130 hrs :	Tea Break
1130-1300 hrs :	**Session VIII:** Consolidate key learning & recommendations for the SMDS VI Distribution of Certificates & Closing.
1300-1400 hrs :	Lunch
1400 hrs onwards:	Youth Summit delegates formally joins the SMDS VI Inaugural Session

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We abuse land because we regard it as a commodity belonging to us.
When we see land as a community to which we belong,
We may begin to use it with love and respect
- Aldo Leopold

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