LEGISLATORS' MEET

Himalayan Glaciers and Water Security of the Indo-Gangetic Plains

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INTEGRATED MOUNTAIN INITIATIVE

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IHCAP Indian Himalayas Climate Adaptation Programme

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Executive Summary: Status of the Himalayan Cryosphere and Future Implications

The Himalaya are the most dominant geographical feature of India and have been key in shaping the culture, economy, climate and the ecosystem of the country. The Himalaya give rise to some of the world's major rivers and almost 800 million people live in the catchments of the Indus, Ganges, and Brahmaputra rivers and rely to varying extents (in particular during dry seasons and in mountain valleys) on the water released from glaciers that constitute the most extensive glacier cover outside Alaska and the Arctic. The Great Northern Plains of India rely on the perennial melt of snow and glaciers to meet the water requirements of agriculture, industries and domestic sector.

Climate change, environmental degradation and other anthropogenic activities are contributing to the rapid melting of the glaciers, which are the lifelines of the Himalayan states as well as the Indo-Gangetic plains. Therefore, it has become imperative to study and conserve this sensitive ecosystem.

The Integrated Mountain Initiative (IMI) conducted the fifth **Sustainable Mountain Development Meet** in Ladakh in 2016 to discuss issues like "water security in the mountains" and "receding glaciers and snow cover areas". One of the key objectives of the summit was to understand the issue of growing water scarcity both at global and national levels. The summit sought to inform and influence public policy and generate awareness on best practices and comprehensive adaptation and mitigation strategies to strengthen resilience of mountain communities in the context of water security. One of the key sessions under 'Water Security' looked at understanding snow and glacial melt water which sustain both lives and livelihoods of the population residing in the mountain states. The sessions also aimed at scientifically understanding the relation between the decline in mountain glaciers, snow covered areas and the reduction in spring water sources in mountain regions. Presentations and discussions highlighted the need to raise awareness and consensus amongst policy and decision makers, development experts, donors and grassroots workers and communities on issues of water security, solutions and good practices developed to address the challenges.

A direct outcome of the meet has been the "**Conference on the State of the Cryosphere in the Himalaya: Gaps, Challenges and Opportunities**", held on the 19th and 20th of February 2018, in Gangtok. The conference saw 300 participants and keynote speakers from India as well as the countries of Nepal, Bhutan, Afghanistan, UK, USA, Switzerland, Finland and Germany.

The major objectives of the conference were:

- To initiate a dialogue about the future of water and energy security in Sikkim and other Himalayan states.
- To take stock of the state of cryosphere research in the country and identify knowledge gaps and improve data collection, mapping and monitoring of the eastern Himalayan glaciers.

- To assess the capacity building needs so as to elevate research in the Himalayan states and to establish a Centre for Excellence in Glacier Studies in Sikkim with national and international collaboration.
- To advocate the findings to the central and state governments to enable appropriate Public Policy formulations and to re-establish the Glacier Commission in Sikkim.

The key takeaways from the conference were:

- To introduce Glaciology in school curriculum and as a course in the University, with a comprehensive plan and mentoring programme for young researchers in Sikkim, with national and international support.
- To study the sensitive Himalayan Cryosphere further, with a focus on the factors affecting it and predicting the future impacts.

The future of our country depends on the health of the Himalayan glaciers and rivers. They are crucial from the perspective of water security and hydel power generation. The state of the Himalaya can have a significant impact on future public policy in the domains of food security, forests, water, energy, climate change and education. On the other hand, existing and upcoming policies in these domains can also have a momentous impact on the well-being of the Himalayan ecosystem. The aim of this Legislators' Meet was to enable public policy formulations which will help conserve the sensitive Himalayan Cryosphere and ensure sustainable growth in the region.

Chaired by Hon'ble Member of Parliament and Chairperson, Parliamentary Standing Committee on Water Resources, Shri Rajiv Pratap Rudy and co-chaired by Member of Parliament from Sikkim, Shri PD Rai, the Meet saw the active participation of 13 Members of Parliament - Shri Sanjay Jaiswal, Shri Ninong Ering, Shri Vincent Pala, Shri Sidhant Mohapatra, Shri George Baker, Shri Ram Prasad Sarmah, Shri Kamakhya Tasa, Shri Jitendra Choudhury, Shri Mohammed Salim, Shri Rajendra Agrawal and Shri Narendra Swaikar. The State of Sikkim was represented by Shri DG Shrestha, Additional Director, Department of Science and Technology and Climate Change, Government of Sikkim and Dr Smriti Basnett, Research Associate, Sikkim University.

Report of the Meet

Welcoming the gathering, Shri Sushil Ramola, President, Integrated Mountain Initiative described briefly the relevance of the theme and need for a discussion on the same, among Members of Parliament. He explained how the recent conference in Sikkim on 'State of Cryosphere in the Eastern Himalaya' saw the participation of 300 people from Indian and experts from 8 countries of the globe with about 50 papers presented. The discussion on State of Cryosphere and water security for states in the Indian Himalayan Region began there and this Legislators' Meet intended to carry forward deliberations at the National level. He extended a special welcome to experts from various distinguished Institutions - Dr. Akhilesh Gupta, Head, Climate Change Programme, Department of Science and Technology, Government of India; Madam Marylaure Crettaz, Head, Swiss Agency for Development and Cooperation - India; Shri Shyam Khadka, Representative, United Nations Food and Agriculture Organization; and Dr. SK Satheesh, Chairperson Divecha Centre for Climate Change, IISc Bangaluru, Prof. J Srinivasan and Dr. Anil Kulkarni, Indian Institute of Science, Bengaluru. He concluded his remarks by stating the key purpose of the interaction - To strengthen policy research and decision making in order to convert expert suggestions and recommendations into outcomes at the grassroots level.

Presentation on 'Status of Glaciers and Outcomes of the Cryosphere Conference' by Dr. Anil Kulkarni, Distinguished Scientist, Divecha Centre for Climate Change, Indian Institute of Science (IISc) Bengaluru

Discussion and Findings from the Conference

- Contribution of Himalayan glaciers to water flow in the Himalayan Rivers -72% of Indus water as it enters Pakistan is from glacier melt; 40-60% of Barkha Nangal water is from glaciers and along the Ganga basin composition varies between 20-30% depending upon the origin of the river.
- Two fundamental effects today on mountains are - rise in temperature and change in precipitation pattern in the Himalaya. A substantially higher temperature rise is observed in the Himalaya than in plains. In the Himalaya in the recent years, snowfall has been declining and this is being compensated by an increase in rainfall. Hence, the total precipitation is maintained at the same level. These two effects have had adverse impacts on the Himalayan glaciers.
- Many glaciers have vanished over the years, 13% loss has been accounted for, from 1960s to 2000s. Remote sensing technology can study only areal extent but not the depth of glaciers. Hence, the Divecha Centre for Climate Change (DCCC) has developed a model to understand depth. Through this model the Gangotri glacier's depth has been recorded to be maximum 500 meters at some places and hence is seen as a major source of water to our perennial rivers that flow through the Ganga basin.
- Himachal Pradesh has 3274 square km of glaciers with 174 gigatonnes of water stored in them. How has loss taken place in Himachal Pradesh? Every year the state loses approx. 1.65 gigatonnes

of ice of the total mass of 174 gigatonnes. This accounts for substantial loss. Especially, lower the altitude of the glacier, higher is the loss. By 2050, almost 1612 glaciers from Himachal will completely disappear and this will have huge adverse impacts on livelihood of people.

- A new hazard of glacier melt at this rate is the formation of new lakes.
- Disappearance of glaciers will also significantly affect hydropower generation and horticulture.
- The present availability of water can be maintained if rise in temperature over the century is capped at 2°C. If it climbs to 5°C, it will result in an additional loss of 25% of glacier area by the end of the century. If the Paris Agreement is followed in letter and spirit, it has the potential of saving a large number of glaciers.

Recommendations made at the Conference held in Sikkim

- We need a better estimate of contribution of rain, snow and glacier into river water discharge
- Schemes like Dhara Vikas/ Spring Rejuvenation in Sikkim can be made more scientific and extended to the rest of IHR states.
- An Integrated network of Agriculture Meteorological stations at the village level is needed to forecast hailstorms and dry-spells.
- A better technique to monitor Himalayan Cryosphere has to be developed.
- There is a need for significant amount of capacity building and scientific knowledge has to be sufficiently gathered.
- Revival of the Snow and Ice Commission in Sikkim to create a database for the state.

Presentation on 'Monsoon and Climate trends in India' by Prof. J Srinivasan, Distinguished Scientist, Honorary Professor, IISc Bengaluru

- Climate variability is natural. However, the rate of change is way higher than it used to be, due to human influence. In recent times, a 1°C change is observed over 100 years which earlier used to occur over 1000 years.
- Our main concern is that carbon dioxide is increasing rapidly, well beyond the danger level. While carbon dioxide is the main reason for global climate change, in India air pollution, deforestation and urbanisation also contribute to climate change. Local factors like aerosol content in the Gangetic Plains are more complex.
- The area covered by heat waves in India has gone up by 44 times in the last 50 years. This is a fundamental problem for people of the plains.
- The maximum temperature for the month of May along the Indo-Gangetic plains in recent years has decreased, which is rather surprising. The reason for this has been found to be the increase in rainfall for the month of May. This is an example for the change in climate we are witnessing.
- Rain gauge distribution from IMD suggests that the number of rain gauges in Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and the North East isn't very high. This is a major issue as data to understand climate phenomena is inadequate.

- A fifty-year trend in rainfall shows that the states of Uttar Pradesh and Bihar are experiencing a decrease in rainfall, while Gujarat and interior parts of Karnataka have higher rainfall than usual. Even within states, there are variation in rainfall pattern data between districts.
- Extreme rains have increased in the summer months by about 50% and this is the main cause for increase in floods.

Thus, climate change is not a phenomenon that happens in isolation. It is linked to all other issues such as poor air, soil and water quality and presence of ground level ozone. One has to hence take a holistic approach in the study of climate change.

Issues Raised by Members of Parliament

- The effect of changes in glaciers in Nepal is felt in the state of Bihar. Since catchment areas have decreased and glacier meltwater or rainfall inundation doesn't take place Nepal, the plains of Bihar are flooded every year.
- Ten years ago, in the months of September, October, November and December huge snow-clad mountains would be visible from Bihar. However now, obvious black patches are seen on these mountains till the month of November, suggestive of black carbon.
- Lack of adequate experts to study the glaciers, especially in the state of Arunachal Pradesh. Frequent occurrence of earthquakes and landslides has been recorded. Events like the Siang (Brahmaputra) River being found completely black (fully contaminated) throughout this winter are evidences of looming ill-effects of climate change.
- In the name of development, we are ruining forests. Today, we project 'development of cities' through high-rise structures. However, we fail to build resilient structures that are most needed to protect communities against landslides and earthquakes.
- Earlier, in Tripura, despite continuous heavy rains there used to be hardly any inundation of land. But now, even half an hour of heavy rains cause inundation and result in crops and livelihood of local communities being affected.
- It needs to be well thought through on what policy interventions can we make as Members of Parliament, especially in terms of adaptation and mitigation to enhance sustainability under the present scenario of rapid climatic changes.

Actions Suggested by Members of Parliament

- Comprehensive presentation by scientists from IISc Bengaluru, with the Parliamentary Standing Committee on Water Resources as Public Consultations
- Since our country is in the lower basin of Himalayas, the main countries that should be concerned are China, Nepal and Tibet. There should be serious dialogue among Governments on how to take mutual responsibility.
- Local communities should be made more aware of the present challenges and must be educated on adaptation strategies.

Responses by Experts

- Science for policy and society is the need of the hour. The Department of Science and Technology, Government of India is trying to create a dialogue in regions across the country. According to the UNFCCC climate action tracker, India's actions are in line with the commitment under Paris Accord to cap temperature under 2°C.
- Sustainable lifestyle has to be instilled and maintained across communities of India. Traditionally, India has fared quite well in sustainable lifestyle.
- The Swiss Cooperation Office has been working on glaciers over the years. Also, so have many Universities in Switzerland. The IHCAP Glaciology website has a comprehensive glaciology coursework for further dissemination.
- The UN FAO Representative to India suggested that water today is being under-priced. In order to make the people of the world understand the importance water, a scarce resource, it is the responsibility of Governments to fix a high price for water resources. This would deter wastage and help conserve water.
- Future Earth Program by the Divecha Centre for Climate Change has region specific issues as the focus of the Program. This is a solution-oriented research supported by the UN. Divecha Centre for Climate Change also issues policy briefs for Legislators on specific topics. This way, research can be more focused towards policy interventions and decisions.

The co-chair Shri PD Rai concluded the session by emphasising on the need to integrate the scientific community in providing research and recommendation in the fashion that can entail policy dialogue. He also pointed out that the keenness of Legislators' to work together on Sustainable Development Goals has been expressed through the session. Shri Ramesh Negi, Vice President, IMI then thanked the Members of Parliament and experts for sharing their knowledge and experience through the integrating platform created by IMI.

Annexure 1: Agenda

LEGISLATORS' MEET

on

Himalayan Glaciers and Water Security of the Indo-Gangetic Plains

Date: 27 March 2018, Tuesday
Time: 6:00 - 9:00 pm
Venue: Deputy Speaker Hall, Constitution Club of India

Chair: Shri Rajiv Pratap Rudy
Hon'ble Member of Parliament (Lok Sabha)
Chairperson, Standing Committee on Water Resources

Co-Chair: Shri P.D. Rai
Hon'ble Member of Parliament (Lok Sabha)
Member, Standing Committee on Finance

TIME	AGENDA
06:00 – 06:05	Welcome Address and Context Setting: Sushil Ramola, President, IMI
06:05 – 06:15	*Status of Glaciers and Outcomes of the Cryosphere Conference held in Sikkim*: Dr Anil Kulkarni, Distinguished Scientist, IISc Bengaluru
06:15 – 06:25	*Monsoon and Climate Trends in India*: Prof. J. Srinivasan, Distinguished Scientist, Honorary Professor, IISc, Bengaluru
06:25 – 07:30	Introduction and Discussion with Members of Parliament
07:30 – 08:00	Responses by Panelists and Experts (Representatives: DST, SDC, FAO, IISc)
08:00 – 08:10	Chair and Co-Chair's Remarks
08:10 – 08:15	Launch of IHCAP Glaciology Website
08:15 – 08:20	Vote of Thanks: Ramesh Negi, Vice President, IMI
08:20	Dinner

Annexure 2: List of Participants

Name	Designation	Email
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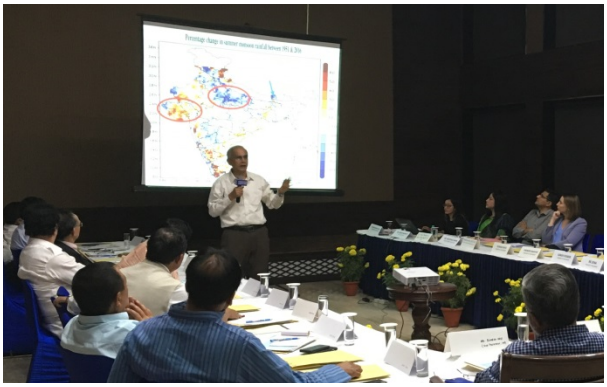
Annexure 3: Snapshots of the Meet

1. L-R: Dr Akhilesh Gupta, PD Rai, Rajiv Pratap Rudy, Sushil Ramola & Ramesh Negi

2. Dr Kulkarni talking on Status of Glaciers in the Indian Himalaya



3. Dr Srinivasan speaking on Monsoon and Climate Trends in India

4. Ninong Ering highlighting issues faced in the state of Arunachal Pradesh

5. Discussion on Issues of water among Members of Parliament, Panelists and Experts

6. Launch of IHCAP glaciology website by Rajiv Pratap Rudy

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