Interstate Cooperation for Climate Change Adaptation in Indian Himalayan Region

NISHIKANT GUPTA, ARABINDA MISHRA, NAND KISHOR AGRAWAL, SACHIDANANDA SATAPATHY

Mainstreaming climate concerns in cross-sectoral planning and teamwork among neighbouring states in the Indian Himalayan Region are persistent hurdles in addressing climate adaptation at the state and regional levels. The authors propose interstate cooperation facilitation through a specific knowledge network, decentralised and coordinated approach for capacity building, joint adaptation project formulation and implementation, high-level coordination mechanism, and the creation of an adaptation portal as a novel way forward.

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Nishikant Gupta (*nishikant.gupta@icimod.org*), Arabinda Mishra (*Arabinda.Mishra@icimod.org*), and Nand Kishor Agrawal (*Nandkishor.Agrawal@icimod.org*) are with the International Centre for Integrated Mountain Development, Kathmandu, Nepal. Sachidananda Satapathy (*drssatapathy@gmail.com*) is a scientist at the Ministry of Environment, Forest and Climate Change, New Delhi and a policy champion at International Centre for Integrated Mountain Development, Nepal.

The Indian Himalayan Region (IHR) continues to support the needs of over 1.3 billion people. However, by 2050, temperatures across the IHR are projected to increase by about 1°C–2°C, the monsoon is expected to become longer and more erratic, precipitation is projected to change by 5% on average, and the intensity of extreme rainfall occurrences are likely to increase (Shrestha et al 2015a: 1–96). The resulting demand on water resources, increase in flash floods and droughts, formation of additional glacial lakes/increased risk of Glacier Lake Outburst Floods (GLOFs), and increased risk of diseases (Shrestha et al 2015b) would increase the vulnerability of mountain communities, especially women due to their constrained adaptive abilities (Mishra et al 2017). Between 2010 and 2014, there have been seven major disasters in the IHR contributing to the loss of over 4,500 human lives (NDMA nd). While it may not be appropriate to attribute these disasters to climate change, the scale of damage caused by them highlights the need to enhance resilience among mountain communities of the region.

Common Challenges

Most climate-related challenges are common across the 12 states in the IHR. To some extent, Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand, and the hill regions of West Bengal, face evaporation of seasonal and perennial waterbodies, emergence of new crop pests, and vector-borne diseases (for example, malaria) (INCCA 2010: 1–164), changes in forests species' composition (Ravindranath and Bala 2017: 1–36), increase in heat stress (Ebi et al 2007: 264–70), droughts (National Water Mission 2011), frequent floods (Mukherji et al 2015: 151–60). This warrants action to improve socio-economic well-being in the IHR. The Indian Himalayan States (IHS) share a common vulnerability profile due to the extent of socio-geographical resemblance, exposing them to similar risks and challenges. The IHR suffers from low adaptive capacity due to geographical location, the remoteness of mountain communities, connectivity challenges (for example, roads and transport), and limited reach of government extension services at the community level. Some key indicators of economic development in most of the states in the IHR have low scores, although there are exceptions. For instance, the literacy rate in the IHS lies in the range of 67%–80%, with the exception of Tripura and Mizoram. Similarly, except Sikkim, the state per capita gross domestic product in other IHS are in the range of $1,000–$2,500. For all states in the IHR, the overall Human Development Index is between 0.56 and 0.67.

Policy Driver: National Government

India has formulated its National Action Plan on Climate Change (NAPCC) for addressing adaptation mitigation and other climate-related issues through core national missions: Solar, Enhanced Energy Efficiency, Sustainable Habitat, Water, Sustaining the Himalayan Ecosystem, Green India, Sustainable Agriculture, Strategic Knowledge for Climate Change, and Himalayan Studies. The Prime Minister's Council on Climate Change has suggested preparing for three new missions—Wind Energy, Health, and Coastal System—which are being finalised by the respective ministries. Two of the national missions, inter alia (that is, Sustaining the Himalayan Ecosystem and Himalayan Studies) are specifically focused on the IHR.

As an extension of the NAPCC, the IHS have prepared their State Action Plans on Climate Change (SAPCC) by identifying sectors, key climate change-related issues impacting these sectors, and strategies/programmes required to address the adaptation needs emerging from these issues. The following sectors have been identified

as vulnerable across the IHS (highest to lowest, number in brackets show the number of IHS that have explicitly identified the sector as vulnerable in their SAPCC): agriculture, forests and biodiversity (12), energy, water resources, and disaster management (11), health (10), strategic knowledge and information (9), sustainable habitat (7), urban planning and development (6), livestock and transport (5), horticulture, infrastructure, and tourism (4).

The sensitivity and exposure of the above sectors' (except strategic knowledge and information, which may not necessarily be termed as a sector) risks to climate is established in literature on the subject (INCCA 2010; Shrestha et al 2015a). The agriculture sector in the IHR is projected to be affected by a delay or early onset of monsoons, changes in its duration, higher precipitation (rainfall) variability, and an increase in floods and droughts (Shrestha et al 2015a). Projections by the Indian Network for Climate Change Assessment (INCCA) (2010) show that by the 2030s there is a possibility of irrigated and rain-fed rice yields to reduce by up to 5%, wheat yield by up to 20%, potato yield by 4%, and maize yield by 40% in the North-eastern IHS (that is, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura). In the remaining IHS, with an increase in temperature, it is projected that there will be an upward shift in agriculture, and this is likely to result in the loss of permanent pastures and grassland, significantly impacting the livestock sector. This is likely to adversely influence the region's grain production and food security (Johnson and Hutton 2014).

Table 1: Analysis of the Four Most Common Identified Sectors, and Select Adaptation Strategies according to the Available SAPCCs (in the Public Domain) of the 11 Indian Himalayan States (excluding West Bengal)

Sector	Identified Issues (in More Than One State)
Agriculture	Erratic precipitation (AS, HP, JK, ML, MZ, NL, SK)
	Climate variability (AS, HP, JK, ML, MZ, SK)
	Reduced soil fertility (AS, ML, NL, SK)
	New pests (AS, HP, ML, SK)
	Reduced water availability (AS, JK)
	Jhum cultivation (ML, MZ)
	Lack of water storage (NL, SK)
	Weak extension services (NL, SK)
Energy	Access to electricity (AS, HP, JK, NL, TR)
	Poor infrastructure and management (AS, NL, TR)
	Lack of renewable energy policy (AR, JK, NL)
	Lack of solar use in building laws (AR, HP, JK)
	Dependence on biomass (HP, JK, NL)
Forests and biodiversity	Forest fires (HP, MN, MZ, NL, SK, TR)
	Encroachment (HP, JK, MN, MZ, NL, TR)
	Jhum cultivation (MN, ML, MZ, NL, TR)
	Extreme rainfall (AS, HP, ML, MZ, SK)
	Forest cover loss (HP, JK, MN, ML, MZ)
	Long dry periods (AS, HP, ML, SK)
	Soil erosion (JK, MZ, TR)
	Weak enforcement of laws (JK, MZ, TR)
	Over-exploitation (HP, JK, MZ)
	Changes in geographic distribution (HP, JK, SK)
	Human–wildlife conflicts (HP, JK, SK)
	Lack of alternative livelihood (HP, JK, TR)
	Increasing landslides (MZ, SK)
Water	Flooding and landslides (AS, HP, JK, MN, ML, NL, UK)
	Groundwater management (HP, JK, MN, NL, SK, TR, UK)
	Drying of springs and streams (JK, NL, SK, UK)
	Varying monsoon (HP, JK, ML, MZ)
	Quality reduction (ML, NL, UK)
	Increasing demand (HP, JK, NL)
	Recharge of springs and lakes (HP, JK, SK)
	Maintaining forest cover (HP, JK, SK)
	Lack of high resolution rainfall data (SK, UK)
	Change in evapotranspiration (JK, MZ)
	Appropriate pricing and regulation (HP, SK)
	Poor supply systems (JK, UK)

AR–Arunachal Pradesh; AS–Assam; HP–Himachal Pradesh; JK–Jammu and Kashmir; MN–Manipur; ML–Meghalaya; M–Mizoram; NL–Nagaland; SK–Sikkim; TR–Tripura; UK–Uttarakhand.

The projected declining precipitation pattern will not only be harmful for river runoff, but also for dependent hydropower plants–increased sedimentation in rivers can negatively impact electricity production (Shrestha et al 2015a). Additionally, droughts, GLOFs, and the increasing temperatures (increased evapotranspiration from reservoirs) are all projected to influence the energy sector here (Zhang et al 2015).

Vegetation shifts due to changes in temperature and precipitation is likely to affect the region's forests and biodiversity (Ravindranath and Bala 2017), endangering some species in the wild due to a loss of their habitat and temperature-dependent migratory ranges/routes. For example, over half of the forests in Jammu and Kashmir, Himachal Pradesh, and Uttarakhand are projected to be adversely affected, and the net primary productivity (that is, total new organic matter produced in a stipulated time) is projected to increase by up to 57% by the 2030s (INCCA 2010).

Flash floods, landslides, GLOFs, droughts, and glacial melting are all projected to upset the water sector in the IHR (Bajracharya et al 2015). This will affect the availability of water, impact food security, energy production, and the health of dependent communities and ecosystems (Shrestha et al 2015b). The Temperature Humidity Index (THI) (representing thermal stress due to the combined effects of air temperature and humidity) reveal that by the 2030s, the region is likely to remain under high temperature stress. Additionally, it is projected that by 2030s, there will likely be an increase in morbidity due to extreme cold and increase in temperature, and a likely increase in incidence of malaria due to increased transmission windows at higher altitudes (INCCA 2010).

In Table 1, the most common issue in each of the four identified sectors are as follows: agriculture—erratic precipitation; energy—access to electricity; forests and biodiversity—forest fires and encroachments; and water—flooding and landslides and groundwater management. These issues indicate an implicit acknowledgement of the significance of the water–food–energy nexus in the IHS. The three sectors are intricately linked and reliant on each other (Rasul 2016). There are similarities, yet there are issues very specific to/uniquely identified by some SAPCCs such as reduction in crop by-products, landownership, and need for institutional strengthening by Nagaland, an absence of an electricity regulatory commission by Arunachal Pradesh, and dissemination of traditional knowledge by Sikkim.

The adaptation strategies contained in the SAPCC documents can be grouped under four broad categories—data generation and monitoring; training, capacity building, and institutional development; infrastructure strengthening and creation of new centres; and research and technology advancement (Table 1). To help with data generation and monitoring, risk and

Table 2: Select Adaptation Strategy according to the Sectors (in more than one state)

Type of Adaptation Strategy	Agriculture	Energy	Forests and Biodiversity	Water
Data generation and monitoring	Vulnerability assessments (AS, JK, ML) Record crops and pest–host relationship (AS, MN, ML, NL, SK, UK) Set up weather recording and synthesising centre (AS, SK) Modelling technology for early warning (JK, ML, MZ, NL, SK, UK) Revitalise rain-fed agriculture (JK, UK) Integrated farming system (HP, UK) Assess indigenous knowledge (AS, SK) Assess state agriculture policy (MN, UK)	Framework for energy efficient economic development (HP, JK, MZ, NL, TR, UK) Development of state energy policy (AS, HP, JK, MN, MZ, NL, TR, UK) Detailed study on water availability and hydrology data (HP, JK, MZ, NL) Mandate of siltation and pollution control for hydropower projects (HP, MZ, UK)	Build data on forest quality (HP, JK, NL, TR, UK) Develop biodiversity register (AS, MN, NL, TR, UK) Vulnerability study of forests (AS, HP, JK, NL, UK) Create a database on landslides (SK, TR) Map springs, watersheds and lakes (HP, SK, TR, UK) Collate information on problem species (SK, UK) Phonological study of wild edibles (JK, SK, TR, UK)	Study to understand river flow (AS, HP, JK, TR, UK) Assess floods and landslides (AS, HP, JK, NL, TR, UK) Document indigenous adaptation strategies (AS, SK, UK) High resolution mapping and dissemination of information (HP, JK, SK) Develop GIS-supported data-base (HP, JK, TR, UK) Develop groundwater models for different agroclimatic zones (HP, JK, MN, SK, TR, UK) Assess change in demand of water (HP, JK, NL) Identify recharge zone for spring water (JK, SK, TR, UK) Set up State Water Resource Council (AS, HP, SK, UK)
Training, capacity building, and institutional development	Develop and propagate crop insurance (AS, HP, JK, ML, NL, SK, UK) Train farmers on DRR and resilient agriculture (AS, HP, JK, ML, NL, SK) Crop diversification and rejuvenation (AR, HP, JK, ML, MZ, NL, SK, UK) Sustainable crop management and horticulture (AS, HP, JK, ML, MN, MZ, UK) Identify commodities and market accessibility (AS, SK, NL, UK) Rainwater harvesting (AR, HP, ML, MN, MZ, NL, SK)	Training on green building and supporting entrepreneurs (AS, HP, JK, MN, MZ, NL) Enforce energy conservation building code (AS, HP, JK, MN, MZ, NL) Maximise decentralised renewable energy option (HP, JK, NL, UK) Promote energy-efficient household appliances (AS, HP, JK, MN, MZ, NL, TR, UK)	Afforestation of native species (AR, AS, HP, JK, MN, MZ, NL, SK, TR, UK) Skill development of forest communities and forest officials (AS, HP, JK, MN, MZ, SK, TR, UK) Improve protected area management (AS, JK) Strengthen biodiversity conservation (AS, HP, MZ, NL) Conserve contiguous forest patches (SK, UK) Plantation on jhum lands and char areas (AS, MZ) Promote non-timber forest product utilisation (AR, AS, HP, JK, MN, MZ, UK) Secure wildlife corridors (AS, ML, NL) Community-based ecotourism (HP, SK, UK)	Protect catchment area (AR, HP, JK, MN, ML, MZ, SK, UK) Strengthen community-based flood early warning system (AS,MZ) Develop capacity for modelling/ forecasting (JK, SK, UK) Enable spring shed development (AS, HP, JK, MN, ML, SK, TR, UK) Diversify cultivars (ML, MZ) Prevent forest cover loss (AR, HP, NL, TR) Empower panchayati raj institutions (HP, JK, UK) Reutilise domestic waste water (AR, AS, HP, NL, SK, TR, UK)
Infrastructure strengthening and creation of new centres	Expand area under low water requirement/value crops (AS, HP, ML) Strengthen irrigation (AS, HP, JK, ML, MN, MZ, NL, SK, UK) Establish high resolution weather stations (AS, SK, UK) Strengthen existing biocontrol laboratories (AS, HP, MN, SK)	Adopt high voltage distribution system and provide benefits under Bachat Yojana Lamp (AR, AS, HP, JK, MN, MZ, NL, TR, UK) Develop hydroelectric projects and solar plants (AS, HP, JK, MN, NL, UK) Promote and facilitate hydropower project implementation (HP, JK, MZ, NL) Energy Efficiency Financing Platform (MZ, NL, TR, UK) Promote biogas plants and manure management (HP, JK, NL, UK)	Fire protection measures (AR, AS, MZ, SK, UK) Safeguard against encroachment (AS, ML, TR, UK) Man–animal conflict resolution (HP, SK, UK) Connect fragmented forests with corridors (AS, SK) Develop nurseries for quality planting material (AS, JK, SK) Micro ecosystem improvement (AS, MZ) Set up repositories of germ plasm (AS, JK, MZ, NL, UK)	Set up Hydrology Data Management Centre (AS, JK) Construction of multipurpose flood shelters (AS, HP) Set up automatic weather stations (JK, NL, SK) Embankment raising (HP, JK, TR) Build water harvesting tanks and reservoirs (HP, JK, NG, SK, TR, UK) Install shallow/deep tube well (HP, JK, TR) Install technologies to clean waste water (HP, JK, SK, UK)
Research and technology advancement	Redefine cropping pattern for agro-climatic zone (AS, HP) Develop water, temperature and pest/stress tolerant crop varieties (AR, AS, HP, JK, ML, MZ, NL, SK)	Strategies for reduction of T&D losses (AS, HP, JK, MN, MZ, NL, TR, UK)	Develop a manual for disaster risk reduction (AS, TR, UK) Identify tree species adapted to various altitudes (HP, JK, SK, TR, UK)	Understand geohydrology of springs and streams (JK, SK, TR, UK) Develop drought/water-resistant crops (AS, JK, ML, MZ)

Sources: (i) Arunachal Pradesh State Action Plan on Climate Change, (2011), Consortium: Integrated Natural Resource Management, Indian Institute of Management Ahmedabad, Indian Institute of Science, Bengaluru.
(ii) Assam State Action Plan on Climate Change, 2015, Department of Environment, Government of Assam, India.
(iii) Himachal Pradesh State Action Plan on Climate Change, 2012, Department of Environment, Science and Technology, Government of Himachal Pradesh.
(iv) Jammu and Kashmir State Action Plan on Climate Change, 2013, Department of Ecology Environment and Remote Sensing, Government of Jammu and Kashmir.
(v) Manipur State Action Plan on Climate Change, 2013, Government of Manipur, Directorate of Environment.
(vi) Meghalaya State Action Plan on Climate Change, Government of Meghalaya, viewed on 11 November 2017, http://www.moef.nic.in/sites/default/files/sapcc/Meghalaya.pdf.
(vii) Mizoram State Action Plan on Climate Change, 2012–17, Directorate of Science & Technology, Government of Mizoram.
(viii) Nagaland State Action Plan on Climate Change, 2012, Government of Nagaland.
(ix) Sikkim State Action Plan on Climate Change, 2011, Government of Sikkim.
(x) Tripura State Action Plan on Climate Change, 2011, Government of Tripura, Department of Science, Technology and Environment.
(xi) Uttarakhand State Action Plan on Climate Change, 2014, Government of Uttarakhand.

vulnerability assessment, development and use of models and modelling techniques; documentation; and application of geographic information system (GIS) for mapping and database generation can prove to be beneficial. Under training, capacity building, and institutional development, training farmers on Disaster Risk Reduction (DRR), resilient agriculture and crop diversification; skill development and empowerment of local stakeholders; and developing capacity for modelling and forecasting are the common strategies. For infrastructure strengthening and creation of new centres, establishing high resolution weather stations; setting up of an energy efficiency financing platform and mechanisms to resolve human–wildlife conflicts; and setting up data management centres can be some of the methods used. Research and technology advancement can be achieved through research on climate-tolerant crop varieties; identifying species adapted to various altitudes (shifting species); and understanding the geohydrology of springs and streams stand out (see Table 2, p 37).

The adaptation strategies, which have been presented by the IHS in their respective SAPCCs, have the potential to effectively address and reduce the impacts of climate change in not just the IHS, but in the IHR too, while contributing to the national action on climate change as well. There are many examples of these strategies. Local level trainings on DRR, which have the potential to provide an opportunity for timely adaptive actions by communities under climatic risks such as flash floods, would need to be complemented by data generation and sharing between the upstream and downstream agencies for timely preparedness and coordinated response. Understanding the geohydrology of springs and streams would certainly contribute to better comprehending the issue of drying springs across the IHR, and again require sharing of best practices and appropriate technologies across the agencies mandated to address water shortage issues. Examining the floral and faunal species shift due to the warming climate will not only assist in strengthening the current approaches to address human–wildlife conflicts, but also investigate the adverse impacts on the current livelihoods and food security of dependent communities. This will require the intervention of concerned agencies to strengthen the local technical capabilities and provide alternative sources of livelihood.

As the above examples illustrate, the adaptation strategies need to be considered in combinations of complementing interventions, so that they act as solution packages, rather than independent actions. Further, given the commonality of challenges, inter-sectoral and inter-state constructive cooperation and coordination will be of utmost importance to achieve climate change adaptation and sustainable environmental management in the IHR.

It is important to mention that the IHS have begun processes to strengthen their proposed adaptation strategies. Some noteworthy examples across the IHS include social forestry programmes, riverbank stabilisation, integrated watershed management programme, constitution of

biodiversity management committees and preparation of people's biodiversity registers, crop insurance schemes, mainstreaming disaster management in development programmes, and involving stakeholder communities in the adaptation discussion. Further, some of the IHS have begun to implement adaptation strategies such as the pilot project on climate resilient agriculture by Himachal Pradesh; assessing the perception and traditional knowledge of rural population by Meghalaya; practices adopted to replace shifting cultivation by Mizoram; and the Model Carbon positive eco village project by Manipur.

Additionally, the National Bank for Agriculture and Rural Development (NABARD), the National Implementing Entity of the Adaptation Fund, the National Adaptation Fund for Climate Change (NAFCC), and Direct Access Entity of Green Climate Fund (GCF) has been providing grant support for adaptation to IHS. Under the NAFCC, 38% of the projects sanctioned worth ₹442.88 crore have gone to the IHS for projects such as climate resilient sustainable agriculture in rain-fed farming areas in Jammu and Kashmir, climate smart agricultural solutions in Himachal Pradesh, ecosystem management in Assam, sustainable agricultural development in Mizoram, and rejuvenation and climate proofing of spring shed in Meghalaya. Under the Adaptation Fund, over ₹6.2 crore has been sanctioned for climate-smart agriculture for sustainable livelihoods in Uttarakhand.

In addition to these initiatives, there are efforts by non-governmental development agencies for building adaptive capacities in the IHS. However, these are few and mostly implemented at small scales. There is a need for these to be inventoried and evaluated for their effectiveness.

Bridging the Divide

The SAPCCs have identified lacunae in the areas of resource, knowledge, and capacity. There are limited location/site-specific vulnerability assessment studies that would help in the design of targeted adaptation interventions for knowledge generation. State agencies attempt to fill this knowledge gap, for instance, vulnerability assessment in Himachal Pradesh. Additionally, the Himalayan and Knowledge Missions have also contributed in filling the existing knowledge gaps. The most important of these is the lack of institutional capacity for collating of public services, synthesising and delivering climate services for building communication between knowledge-generating and user-communities, public awareness on the need for people's participation in climate action, and unsatisfactory management of domestic waste, urban spaces, and water storage and usage.

Interstate Cooperation

The IHS needs to enhance the experience-sharing and adopt good practices collectively to deal with natural resource management challenges, which cut across the region.

Sharing climate information and good practices: There is a requirement for a knowledge network specifically for the IHR to collate the multiple government/non-government adaptation initiatives in the region, and assist with the visualisation (scenario building) and adaptation pathway (Bosomworth et al 2015) for a particular risk (for example, droughts or forest fires). The National Mission on Sustaining the Himalayan Ecosystem (NMSHE) initiative along with the National Mission on Himalayan Studies (NMHS) can promote the establishment of such a network. It would be necessary for this network to link up with knowledge organisations beyond the IHR, at both the regional and global levels. This network will need to be complemented by a strong engagement process, which the State Climate Change Cells can facilitate. While updating the SAPCCs, neighbouring IHS may share their experiences related to policy, fiscal and interventions adopted and planned for operating their SAPCCs.

Interstate capacity building and sensitisation: There is a necessity for a decentralised approach to capacity building by linking the IHS institutions (universities) with international/regional think tanks. The Ministry of Environment, Forest and Climate Change (MoEF&CC), India's nodal agency for climate change is providing assistance to all IHS for capacity building in order to operationalise the SAPCCs under existing schemes (for example, Climate Change Action Plan, NAFCC, and National Mission on Himalayan Studies). The Department of Science and Technology (DST), a nodal department for implementation of National Mission on Sustainable Himalayan Ecosystem, which organises, coordinates, and promotes climate-related activities in the IHS, can play a crucial role. The kind of capacity building required is rarely discussed. Training should be provided on model projections, uncertainty and risks, different methods to assess community vulnerability to climate change, training on development of adaptation project proposals, and the related monitoring and evaluation mechanisms—financing (awareness of source and mechanism of adaptation finance available at national/global level). They should be able to distinguish between development and adaptation projects, identify co-benefits, and assess resource requirements. Approaches to losses and damage due to adverse impact of climate change and slow onset events also need to be developed in a coordinated manner.

Joint project proposals: It would be relevant to explore the possibility of joint adaptation projects/programmes with a few IHS coming together to address issues of mutual interest. This would make it possible to experiment with solutions to achieve "adaptation at scale" and enable the design of projects and programmes to address transboundary issues involving more than one IHS. Possible opportunities could be explored from the Green Climate Fund (GCF), Adaptation Fund (UNFCCC), National Adaptation Fund on Climate Change, and bilateral/regional/multilateral institutions.

High-level political leadership: It is important to set up a high-level coordination mechanism with political leadership or endorsement. The Chief Minister's Council on Climate Change for each of the IHS need to be linked as a common body to provide this leadership. The National Mission for Clean Ganga—which has adopted a river basin approach[1] to promote inter-sectoral coordination—and the Himalayan States Conclave can be models to emulate.

IHR-specific vulnerability and adaptation portal: It would be useful to initiate a process that can prepare an inventory of the completed and ongoing adaptation projects at various locations in the IHR. This can be an IHR adaptation portal that would be accessible to the key stakeholders in the region. There is technology available to cloud-source information for such a portal, and this can deepen the public–private interface, and assist in providing a common framework on vulnerability assessment and adaptation.

Conclusions

With the large pool of climate change knowledge/adaptation experiences across the IHS, it is critical to collaborate on and generate opportunities for a climatically secure, and economically and environmentally sound IHR. At the regional level, a think tank like the International Centre for Integrated Mountain Development—a regional intergovernmental learning and knowledge-sharing centre based in Kathmandu, Nepal—in partnership with DST can provide the IHS with vital scientific knowledge and adaptation solutions on climate vulnerability and risk assessment, river basin management, livelihood alternatives, and enhancement of ecosystem services. It can support the IHS in operationalising their SAPCC, strengthening their capacities for monitoring the implementation of their SAPCC, and assisting in the implementation of their sectoral action plans. The time is right for the IHS to come together, share, discuss, and devise adaptation strategies not only best suited to themselves, but also to the IHR. It is important to view the IHR as a single entity, where collaborative and cooperative actions within the IHS will benefit the IHR to deal with the adverse impact of climate change, make the region climate resilient, and move ahead towards sustainable development.

NOTE

1 The process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin to maximise the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems is termed as the river basin approach (Integrated Water Resources Management, Global Water Partnership Technical Advisory Committee Background Papers, No 4, 2000).

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