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Review Article

Regional cooperation: Key to climate change adaptation in HKH region

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Abstract
Hind Kush Himalayan (HKH) region is shared by eight countries namely: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan, and extends nearly east-west direction covering about approximately 3500 km. Since the region has both the fastest growing economy and the poorest countries, regional cooperation has become a necessity to sustain current rate of economic growth, continue with the efforts for poverty reduction, and meeting the challenges of achieving the millennium development goals (MDG) against the backdrop of climate change, to which the region is quite vulnerable. The average temperature in the HKH region is rising with changes in precipitation occurring across the region. The impact of climate change has been felt across the region, beyond national boundaries. Droughts, flash floods, and torrential rains in Afghanistan; glacial lakes outburst floods in Nepal; rapid glacier melting in Bhutan; flooding, and cyclones in Bangladesh; temperature rise and declining ground water table in India; and flooding in Pakistan are in increasing trend. This situation calls for a joint collaborative initiatives at the regional level to make and implement effective adaptation measures in order to protect fragile mountain ecosystem and age-old tradition and practices for sustainable development of region. There are two major barriers related to adaptation and governance issues, which under certain circumstance also need regional cooperation to solve. Since China and India are the fastest growing economic powers, it is high time that they take a collective lead role and the rest of the countries share the responsibility in their effort to adapt to climate change in the HKH region. The regional cooperation organization like SAARC (South Asian Association for Regional Cooperation) is expected to help develop integrated approach for addressing all the three pillars of sustainable development.

***Key words*:** Biodiversity hotspots, Climate change, Glacial lake, Greenhouse gases

Background
Hind Kush Himalayan (HKH) Region has all or the part of the eight countries namely, Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan, and extends in nearly east-west direction, approximately 3500 km (Fig. 1). The altitude varies from sea level to the world's highest peak (8848 m), the Mount Everest. Geographically, it extends from 15.95° to 39.31° N latitude and 60.85° to 105.04° E longitude. HKH region is a coalition of the Hind Kush proper, Himalayan range and other hills and mountains.

The economic growth rates of the major countries in the region are enviously high at a time when many developed countries of the world are struggling for revival from recession. Asian Development Bank's publication entitled "Key Indicators of Asia and the Pacific–2010 by ADB" demonstrated that there is a rise of middle class in Asia and Pacific regions and especially in China and India. Furthermore, there has been an impressive reduction in the population below the poverty line poor in many other countries. However, sustaining these positive economic indicators and trends might be challenged by the climate change, if appropriate policies are not implemented at regional, sub-regional, national, and local levels. This is also important for continued progress in meeting Millennium Development Goals (MDGs).

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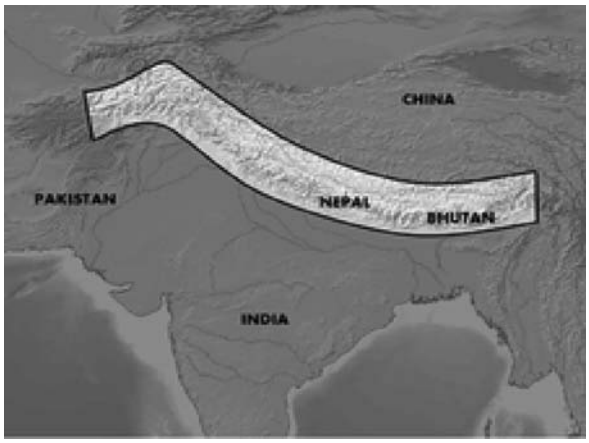

Fig. 1 General location of the Himalayan Mountain range

Mountains in HKH region cover a significant part of the world's surface with half of the world's people depending directly or indirectly on them. As the mountains provide water, energy, minerals, forests, recreational sites and suitable land for agricultural, they are essential for the survival of mankind and global ecosystems. They help in maintaining the climatic cycles and water balances. They create unique microclimates and eco-regions, and also store the biological diversity necessary for the sustainability of human life. Ten of Asia's largest rivers originate and flow across these mountains and more than a billion people's livelihoods depend on them.

The HKH region encompasses at least eight physiographic regions namely: 1. The Himalayan Mountains, 2. Indo-Gangetic Plains, 3. The Deccan Plateau and the Ancient Mountain Ranges, 4. Coastal Region and Islands, 5. The Thar Desert, 6. Baluchistan, 7. Afghanistan's South-Western Plateau, and 8. Afghanistan's Northern Plains (Paudel, 2011). The region is rich in biodiversity. It has either entire or part of four global biodiversity hotspots, 330 important bird's habitats, two mega-diversity countries (India and China), and 60 eco-regions of which 12 are among the global 200 eco-regions.

On an average the global temperature rose by 0.74 ^{o}C over a decade (1906-2005) in which mountain regions have been mostly affected (IPCC, 2007). The rate of warming in the HKH region is also significantly higher than the global average. The rise in temperature has made the mountain ecosystems in HKH region more fragile and susceptible to various types of natural hazards. The people of the Himalaya have maintained a rich cultural identity, and have maintained food security and biogenetic diversity within the parameters of their own tradition. Besides, the Himalayas, which are often called "The Roof of the World", contain the greatest area of glaciers and permafrost outside of the polar regions and, is a gift of nature that nurture the population inhabited in the southern mountain slopes and low lying flat land. But in recent decades, the impact by global warming has been felt significantly in this region threatening age-old settlements and indigenous knowledge. This paper summarizes the impact of climate change in the HKH region, and provides some insights regarding the possibility of adaptation through regional cooperation.

Common climate change issues in HKH regions

The impact of climate change has been noticed in the HKH region, particularly in water resources, agriculture and food security, forest and biodiversity, urban development, infrastructures, natural hazards, and public health. Evidences suggest that droughts, flash floods, and torrential rains in Afghanistan; glacial lakes outburst floods in Nepal; rapid glacier melting in Bhutan; flooding, and cyclones in Bangladesh; temperature rise and declining ground water table in India; and flooding in Pakistan are in increasing trend. Increase in mosquito-transmitted diseases, diarrhoea and drying out of drinking water sources are additional climate change impacts in the region. Desertification and land degradation, intense heat-waves, river bank cuttings, landslides, debris flows, habitat degradation, shifting of tree lines, coastal erosion, changes in hydrological cycle, and decline on water availability are other sets of climate change impacts in this region. Some of the major impacts of climate change in HKH region are briefly discussed.

Table 1 HKH Regional Area (Total estimated area: 3, 441719 km^2)

Estimated	Afghanistan	Bangladesh	Bhutan	China	India	Myanmar	Nepal	Pakistan
HKH part (km^2)*	390,475	13,189	38,394	1,647,725	482,920	317,640	147,181	404,195
Proportion of country	60%	9%	100%	17%	14%	47%	100%	51%

Source: Sharma and Pratap (1994)

** Estimate based on earlier definition of the HKH region, which is smaller than the area used for population estimates*

a. Impact on snow and glacier

Glacier ice covers approximately 33,000 km^2 in the Himalayan range in which thousands of glacial lakes are formed. An inventory compiled by ICIMOD identified 8790 glacial lakes within selected parts of the Hindu Kush-Himalayas. Extent of snow and glaciers in the HKH region are constantly hanging with time, which has influenced the discharge of streams originating from the Himalayas. A recent study suggested that the glacier are retreating and snow deposit reducing by 28% to 16% in different part of the HKH region (Kulkarni et al., 2010; Niederer et al., 2008; Nie et al., 2010). And the changes are mostly attributed to the changing pattern of snowfall and temperature (Shekhar et al., 2010). A recent investigation also suggest that the annual snow cover in the HKH region has declined by 16% per decade between 1990 and 2001 (Menon et al., 2010).

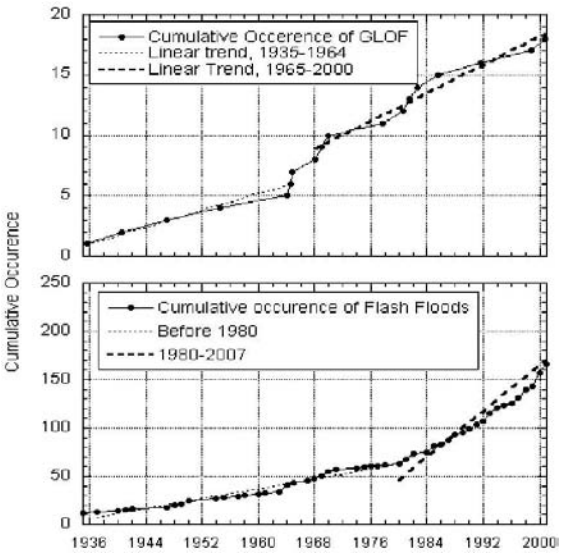

Fig. 2 Cumulative frequency of GLOFs and flash floods in the HKH region

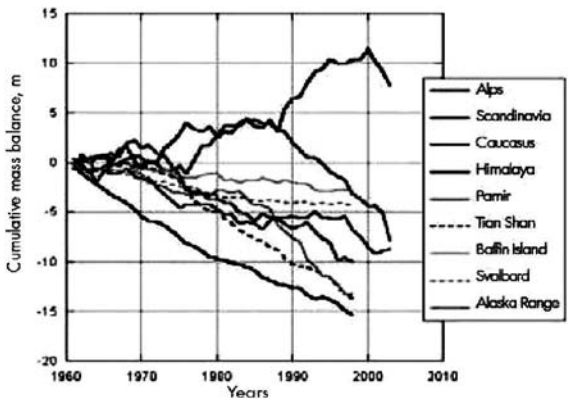

Fig. 3 Retreat of Himalayan glaciers in comparison to the global average (Source: Dyurgerov & Meier, 2005)

There have been at least 35 GLOF events in Bhutan, China and Nepal during the 20th century (ICIMOD, 2010). There are confirming indications that the earlier recordings of flash floods in the Ladakh Range in Jammu and Kashmir of India were actually glacial lake outburst floods (Gergan et al., 2009). Catastrophic events that propagate for considerable distances downstream from their point of origin are also liable to cross international boundaries. There are well-documented examples whereby lake outbursts have occurred in Tibet AR (China) and have crossed the borders into Nepal and Bhutan. Preventing Tsho-Rolpa Glacial Lake of Nepal from bringing catastrophic disaster in the downstream by installing early warning system with participation of local population at a cost of about USD 3 million is an example of how possible damages can be prevented by investments in the right place at the right time.

The IPCC Fourth Assessment Report (IPCC, 2007a; 2007b) states that many glaciers in the region will retreat in the coming decades, while smaller glaciers may disappear altogether. Attempts to model changes in the ice cover and discharge of glacial melt have been made by assuming different climate change scenarios. With a 2 $^{\circ}$C increase in temperature by 2050, one model suggests that 35% of the present glaciers will disappear and runoff will increase, peaking between 2030 and 2050 (Qin, 2002).

The South Asia Environment Outlook 2009 published by UNEP, SAARC and DA reported that nearly 15,000 glaciers are likely to retreat from their present total area of 500,000 km^2 to the total area of 100,000 km^2 by 2035 in the South Asian Region. This shrinkage of the glaciers will severely impact water supply, agricultural production, wildlife habitat, and will affect socio-economic conditions of millions of people (Paudel, 2011).

b. Impact on biodiversity

Half of the global biodiversity hotspots are in mountain regions. They are the important global heritage that are at risks of climate change impacts and increased anthropogenic activities. In Nepal, 68% of high mountain in Nepal (Shrestha et al., 2010) and almost all the high mountain areas in Bhutan (RGoB/NEC, 2009) are under protected area coverage, as Bangladesh, India, and Myanmar have also given high priority to mountain areas. In total, the HKH countries have established 488 protected areas covering 39% of the total HKH geographical area (Chhetri et al., 2008). Despite the fact that 25% of protected land area, in the said eight countries, is found in the mountainous region, there are still gaps in terms of eco-regions, biomes, and vegetation types (Chettri et al., 2008, Shrestha et al., 2010).

The current prediction of temperature rise estimates an increase of 1.4-5.8 °C by 2100. Warming of 3-4 °C would eliminate 85% of all wetlands, which are habitats of fishes, amphibians, insects, molluscs, reptiles etc. For every degree Celsius increase in temperature wheat production will reduce by 4-5 million tons (Singh et al., 2011).

According to Korner (2009), and Scherrer and Korner (2011) the real issue of the ongoing and expected climatic changes in the Himalayas is not the pace and magnitude of the changes but how the changes are affecting the ecosystem dynamics forcing species to migrate from lower to higher altitude. In response to fast rising temperatures and changing rainfall patterns, species are moving upslope into already occupied territory and are facing heavy competition, and many may not be able to adapt and eventually may face extinction (Eriksson et al., 2008).

c. Impact on agriculture and food security

Changes in temperature, precipitation, and solar radiation have immense influence on crop production (Malla, 2008). The effect of climate change on agriculture is related to variability in local climates rather than in global climatic patterns (Sapkota et al., 2010). Global food production potential is likely to increase with increase in global average temperature up to about 3 °C, but above this it is very likely to decrease (IPCC, 2007a). The hill and mountain farmers are expected to be more vulnerable to any shift in climate due to their dependence on natural resources, poor risk bearing ability with lack of credits. The existing trend of climate change is attributed to extinction of many plants, animals and microbes. The loss in biodiversity can be reduced to 1-2 million tons only if farmers change to timely planting (Singh et al., 2011).

In South Asia region, Afghanistan is the most vulnerable in terms of food security. Wheat– the staple food crop– has seen a decline in both the productivity and production of other major crops has also suffered owing to conflicts and droughts. Because of its mountainous terrain and an arid to semi-arid climate, crops are cultivated on only about 14% of the country's total area (Singh et al., 2011). India experienced the success of the green and white revolutions, and has made significant progress in food production since 1960s. It became self-sufficient in food grain and was exporting a sizeable volume of food until the late 1990s. However, production began declining from 2000 while the population has increased unabated (Rasul, 2010). This scenario has caused considerable trouble to policy makers to set a plan for the future.

d. Impact on Water Resource

Studies have shown that the climate change has become one of the critical reasons for building pressure in hydrological systems and water resources of the world (IPCC, 2001). The most critical point to be considered while analyzing the impacts of the climate change particularly for Eastern Himalayan region is the cascading property of the impact along the altitudinal gradient caused due to the hydrological connectivity between higher elevations to lower elevations (Xu et al., 2009). The rate and magnitude of temperature rise, along with changes in water availability from precipitation and runoff are critical factors which can affect Asia's seven most important rivers that originate in the Himalayas. A runoff sensitivity analysis by Mirza and Dixit (1997) in the Ganges River showed that a 2 °C rise in temperature would cause a 4% decrease in runoff, while a 5 °C rise in temperature and 10% decrease in precipitation would cause a 41% decrease in the runoff. In the long term by 2050, global warming may lead to water shortage for more than one billion people who depend upon melt water from the Himalayas (Cruz et al., 2007). In the Himalayas, the peak melting season usually coincides with the summer monsoon season. As a result, any amplification of monsoon or stimulating melting would result increasing summer runoff which may contribute to enhance the risk of disasters (IPCC, 2001a). The various types of natural hazards in the Eastern Himalayas are due to the intense seasonal precipitation occurring during the summer monsoon. One of the major consequences of climate change is related to changes in magnitude, frequency and duration of the hydrologic extremes (Sharma & Shakya, 2005). Thus, the expected impacts of climate change include water shortages in the dry season due to rapid glacial retreat, drying out of springs and depletion of groundwater, and increasing threats from glacial lake outburst floods. On the other hand, erratic rainfall during monsoon poses the threat of reduced groundwater reserves due to excessive surface runoff and increased water-induced hazards that include landslides, floods and erosion. These impacts would have serious implications particularly with regards to hydropower development, water resources management, and agriculture. The impacts would be most felt by the poor who live on a subsistence basis.

e. Impact on health

Changes in the frequency and intensity of thermal extremes and extreme weather events (i.e. floods and droughts) will directly influence people's health. World Health Organization suggests that the current health impacts of climate change are comparable to the impacts of air pollution in South-East Asia and Africa (WHO, 2005).

The spread of malaria, Bartonellosis, tick-borne diseases and infectious diseases is linked to the rate of pathogen replication enhanced by rise in temperature. Malarial mosquitoes have recently been observed at high altitudes in the region (Eriksson et al., 2008). The incidence of Japanese encephalitis and Kala-azar are increasing across Nepal. People's health would be at risk caused by favourable conditions for spreading disease vectors; forest fires; avalanches, heavy snowfalls, major storms, floods, droughts; depth and duration of snow cover and length of snow-free season; and changes in cloud cover and sunlight available.

f. Impact on tourism

Tourism holds special significance for Himalayan countries like Nepal and Bhutan. Nepal earns around 7% of the GDP from tourism. During best tourism years the industry generated 4.7% of the total employment in Nepal. Tourism's share in India's GDP is 8.6%. Most of the northern frontier of Nepal and Bhutan are inhabited by poor people. The climate in the area is harsh. Natural vegetation is declining due to pressure for firewood and grazing. Livelihood suffers from low productivity and limited access to services and information. However, things have changed in areas where eco-tourism has developed. Eco-tourism has helped in reducing poverty.

Shifting of snowline further up and drying out of drinking water sources in mountain regions will have serious implication on the tourism sector. Los of tourism will put back people in the vicious cycle of poverty at the cost of declining natural resources.

g. Impact on women

The women are traditionally responsible for and concerned with the wellbeing of all family members. Shortages of fuel, water, electricity, and gas all over the regions affect women's work. The frequent migration of men for herding and trading means that women have to be involved more in managing household and community resources (Fig. 4). Women living in the HKH region know how to maximize the use of the natural resources of the fragile mountain ecosystem. Their knowledge also contributes to the survival and care of their families and to their adaptation in extreme situations such as conflicts, natural disasters, and displacements. However, their knowledge and skills are still not acknowledged and valued.

Fig. 4 Girls in the Hilly region of Nepal with their load

Climate change adaptation

Many mountain countries are far less the cause of the problem than they are victim of the climate change. Nevertheless, the vulnerability caused by climate change can be addressed through various adaptive and mitigation measures. Adaptation and mitigation can complement each other and significantly reduce the risks of climate change (IPCC, 2007).

A number of barriers need to be overcome for successful adaptation planning in the HKH region. The barriers fall into two categories:

- Barriers related to the process of adaptation planning; and
- Barriers related to governance issues

Barrier related to adaptation planning

a. Poor understanding of the concept of adaptation

The lack of knowledge about the concept of adaptation can be attributed to limited in-country capacity to tailor this information to different audiences, translate it into local languages, and communicate it to decision-makers and stakeholders. Because adaptation concepts are so noble, many have not been translated into local languages. In absence of access to this information, most decision-makers often ignore the linkages between adaptation makers often ignore the linkages between adaptation and development, the differences between adaptation and mitigation, or the synergies that could be built through adaptation and mitigation. They also fail to realize that efforts to address climate impacts are no different from addressing other types of development constraints and stressors.

b. Weak capacity

Planning and implementation of adaptive measures requires capacity at all stages of the process, from understanding climate impacts and scenarios, through vulnerability and adaptation assessment, mainstreaming adaptations into sector plans, preparing adaptation strategies, and designing and implementing adaptation projects.

c. Lack of coordination on adaptation planning

To be most effective, adaptation planning requires leadership to guide the planning process, coordination among major sectors and stakeholder groups to ensure that integrated assessments consider cross-sector impacts, and consensus building to promote widespread support for adaptation strategies.

Barriers Related to Governance Issues

a. Weak governance structures

The benefits of adaptation measures can be significantly attenuated, if effective governance structures at both the national and sub-national levels are not in place or underfunded. Successful adaptation requires governmental accommodation for civil society engagement in adaptation planning, and commitment and resources available for enforcement of laws, policies, and regulations. In addition, governments need to address non-climate stressors such as inefficient public service delivery, water pollution, illegal logging, destructive land use practices, and overfishing. However, strengthening governance structures is a long-term and uncertain process. Opportunities may be missed to facilitate effective adaptation if good governance is viewed as a pre-condition for engagement.

b. Poor trans-boundary coordination

Jurisdictional constraints or rigidities may impede cooperation and coordination on the development of trans-boundary adaptation strategies. Sharing of information and analyses of potential economic and environmental impacts of actions taken by one country on its neighbours is critical to understanding and promoting mutually-supported trans-boundary objectives and programs to effectively address climate impacts on a broad geographic scale.

Regional cooperation and output

Founded in December 1985, the South Asian Association for Regional Cooperation (SAARC) is dedicated to economic, technological, social, and cultural development of the region. The stated areas of cooperation under SAARC include agriculture and rural development, biotechnology, culture, energy, environment, economy and trade, finance, funding mechanism, human resource development, poverty alleviation, people to people contact, security aspects, social development, science and technology; communications, tourism (SAARC, 2008). SAARC represent one-fifth of humanity with a sizeable number of people below the poverty line, remain deeply concerned with the adverse effects of climate change that threatens lives and livelihoods, sustainable development, and the very existence of some of our Member States. Myanmar and China within HKH region are not SAARC members.

The SAARC Member States are committed to contributing to global efforts to address the threat of climate change. Climate change was the theme of the sixteenth SAARC summit held in Thimphu in April 2010 and, among others, the Heads of State or Government of SAARC member states adopted the Thimphu statement on climate change through which SAARC will undertake a number of initiatives in a focused manner to further strengthen and intensify regional cooperation to address the adverse impacts of climate change. In addition, the SAARC plan of action on climate change adopted in July 2008 also provides for enhancing and intensifying regional cooperation to combat climate change. These initiatives are a reflection of the commitment of SAARC towards addressing the challenges posed by climate change and the implementation of these initiatives are being pursued in earnest. A SAARC Convention on Cooperation on Environment to strengthen and institutionalize regional cooperation in important areas was also signed during the sixteenth SAARC summit.

Another initiative is the South Asian Regional Conference on climate change held in Kathmandu on August 2009. It issued a final statement noting that South Asia is a climate change hotspot that influences the lives of half of the world's population, is highly vulnerable to the adverse impacts of climate change, and is characterized by critical knowledge gaps, especially of mountain ecosystems within and across its constituent units (IIDS, 2009). The final statement also stresses the need to translate the principles of common but differentiated responsibilities and respective capabilities and historical responsibility of the developed countries as envisaged in the UNFCCC into operational practice.

In order to promote regional cooperation for the conservation and wise use of the wetlands in the greater Himalayan region, a series of regional meetings and workshops (Urumqi, 2002; Kathmandu, 2003; Sanya, 2004; Evian, 2004; Delhi, 2006; and Changwon, 2007) were organized since 2002, which has taken the form as 'Himalayan Wetland Initiative' forum. The forum has successfully achieved regional dialogue that involved all governments in the region except Afghanistan and Uzbekistan (i.e. Bangladesh, Bhutan, China, India, Kyrgyzstan, Myanmar, Nepal, Pakistan, Tajikistan, and Kazakistan), inter-governmental organizations such as Ramsar Convention Secretariat and International Centre for Integrated Mountain Development (ICIMOD), international environmental organizations (WWF International, Wetlands International, and IUCN), as well as universities, academic institutions and civil society partners.

Apart from these regional dialogues, many actions have been taking place at local, national and regional levels. Constructive and participatory process promoted by the forum resulted into a common agreement to gain the forum as formal regional initiative of Ramsar Convention. In 2005, Ramsar Conference of Parties officially recognized 'Himalayan Wetlands Initiative' as an important potential regional initiative defined by Ramsar Resolution VIII 30, and has encouraged this initiative to be further developed for its official recognition towards Ramsar COP10 in 2008. The Himalayan Wetlands Initiative aims to cover all countries sharing the greater Himalayan region. Currently, it covers the countries such as Bhutan, Bangladesh, China, India, Myanmar, Nepal, Pakistan, Kyrgyzstan, Kazakistan, and Tajikistan.

Across the HKH region, various bi- and multi-lateral institutions have pursued projects to demonstrate sustainable mountain development. The World Bank has been active in Pakistan, and also in the lower hills across India and Nepal; the International Fund for Agricultural Development (IFAD) has a fairly large portfolio in the region and so has the Asian Development Bank (ADB); and IUCN is active in many countries of the HKH region.

There are also other regional initiatives in relation to climate change impacts and adaptation measures in the South Asian Region. Some of these initiatives include the integrated research and development in Hindu-Kush Himalayan Region by ICIMOD, the Rice-Wheat Consortium (RWC) for Indo-Gangetic Plains (an alliance of the national agricultural research system of Bangladesh, India, Nepal, and Pakistan); the SAARC's regional cooperation on coastal and marine risk mitigation plan for South Asia; and the Dhaka declaration of August 2008 on creating South Asian Network on Climate Change and Food Security and establishing South Asia Climate Outlook Forum (SAARC, 2008).

The key issues related to regional cooperation in climate change adaptation are as follow:

- Regional cooperation is very important, as it is needed to pull resources together efficiently. The needs are such that no country can shoulder the burden alone, and regional cooperation could bring about sense of coherence. Climate change knows no borders and certain problems such as exploitation of underground water and development and management of trans-boundary rivers would require joint efforts and regional approaches.
- Strategies for influencing the regional process and putting in place the relevant infrastructure for adaptation policies would differ depending on the context, region and geographical attributes.
- Networking can be an important criterion in building a strong advocacy base around the benefits of regional sharing, particularly over a common issue such as droughts and floods that will enable regional partners to coalesce behind such compelling issues. This calls for the need to channel resources in network support and development to allow different institutions to share information on adaptation research, and local and regional observatory systems.
- Capacity building is equally important to build skill base and to make the necessary connections between climate change and critical sectors such as agriculture, water and energy. It should adopt an endogenous approach building on regional cadre of experts that would serve as a knowledge base and bank to advice, support and guide policy makers, the private sector and other research bodies.
- Identifying interventions that can be implemented at regional levels, and ensuring that this is done in a way that does not exclude the participation and involvement of local communities.

Future of cooperation

Since the HKH region has intricately linked hydrology, landscapes, and eco-regions across the nations, it is important to have a sound regional, in addition to national and local, focuses on climate change adaptation research and development. The regional climate change adaptation research results will allow planners and governmental agencies to share information, coordinate activities, avoid duplication of resources, develop regional capacity for addressing climate change impacts, and expedite the implementation of climate change adaptation measures across the region. A sound regional climate change adaptation research and development requires an identification of clear sub-regions for detailed and focused studies.

The unsustainable consumption pattern, as is apparent in developed countries, is also growing in this region with growing income level and market access. This may lead to unequal wasteful and development. Hence, there must be a regional networking and endeavour to achieve, food and energy security at regional level.

There should be a regional centre for the knowledge management. The centre should provide platform to share, learn and use the knowledge to adapt to climate change. Organisation like the ICIMOD is a regional knowledge development and learning centre for the HKH region. These kinds of organisation without political influence strengthen the regional tie in the HKH region.

HKH region is rich in environmental resources which is generating valuable environmental services. The countries associated with this region should come together to protect, conserve, enhance these resources irrespective of the countries these resources belong to. Regional cooperation is necessary for assessing the value of these services and the contributions made by these resources to humanities. HKH region expects a renewed commitment of member states for preserving the Rio principles and fostering implementable consensus for fulfilling the implementation gaps in the Rio declaration and other associated commitments, and addressing new and emerging challenges in a fair and equitable manner based on the principle of common but differentiated responsibilities (CBDR). Nepal has also similar expectation for balanced and integrated approach for addressing all the three pillars (social, economical and environmental) of sustainable development with poverty alleviation and inter-generational human wellbeing.

Technology transfer is the area where countries of HKH benefit from cooperation. The access of the member countries to the indigenous, intermediate and modern technologies of the region may help grow productivity of the region, resolve technological problem and add value.

In present scenario China and India could play a vital role in the regional cooperation in HKH region. Global economy has also undergone profound changes over the last 15 years. The most spectacular change has taken place in China and India. China is likely to become the second biggest economy in the world by 2016, and India the third largest by 2035. With growing economic leverage, China and India are in a position to play a major role in the global economic, technological, and political arenas and will influence the ''rules of the game'' in international trade and other aspects of the global political economy. Considering China and India have 17% and 14% of the respective country's area in HKH region, they can be the strong moderator for the regional cooperation. They have major position in global economy and they can also have major role in channelizing adaptation technology transfer and implementation in this region.

Conclusion

Adaptation is an ongoing, flexible process that seeks to increase resilience to present and future risks. It is necessary to develop and adopt a proactive, systematic, and integrated approach, which is cost-effective and offers durable and long-term solutions. It is also important to remember that climate risks and adaptation priorities vary across regions, countries and sectors. There is no one-size-fits-all and adaptation strategies should be based on local resources and constraints. Most adaptation policies recognize that their successful implementation is contingent upon the availability of international funding and technology transfer. National, regional and local governments' initiatives are required to address the climate change through appropriate measures of adaptation. Regional adaptation measures will be significantly expedited if China and India assume a joint leading role and other countries share responsibility in their joint effort of adapting climate change in the HKH region.

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