

Action for Mountain Adaptation: Solutions beyond the Boundaries of Science, Policy, and Practice



Ministry of Science, Technology
and Environment, Nepal



About ICIMOD

The International Centre for Integrated Mountain Development (ICIMOD) is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalayas (HKH) – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – based in Kathmandu, Nepal. Globalization and climate change are having an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream and downstream issues. ICIMOD supports regional transboundary programmes through partnerships with regional partner institutions, facilitates the exchange of experiences, and serves as a regional knowledge hub. It strengthens networking among regional and global centres of excellence. Overall, ICIMOD is working to develop economically- and environmentally-sound mountain ecosystems to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now and in the future.



About HICAP

The Himalayan Climate Change Adaptation Programme (HICAP), one of the initiatives under ICIMOD's regional programme on Adaptation to Change, is a six-year research programme initiated in 2012. It is being implemented by ICIMOD in collaboration with CICERO and GRID-Arendal. With 27 international and regional partners, HICAP carries out basic and applied research to enhance resilience to change, particularly climate change, through an improved understanding of vulnerabilities, opportunities, and potentials for adaptation. It covers five river sub-basins: the upper Indus (Pakistan), Koshi (Nepal), upper Brahmaputra (Tibet Autonomous Region, China), eastern Brahmaputra (India), and Salween/upper Mekong (China). The programme is supported by the governments of Norway and Sweden.

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Action for Mountain Adaptation: Solutions beyond the Boundaries of Science, Policy, and Practice

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Disclaimer

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Message from Christiana Figueres, Executive Secretary, United Nations Framework Convention on Climate Change (UNFCCC)

As a daughter of the mountainous region of my country, Costa Rica, I know what you are all very well aware of: mountains play a great part in human existence. Mountains provide for everything that is important to humanity. They are key sources of freshwater and they spawn the rivers that billions rely on. They are home to half of our biodiversity hotspots and an integral part of a rich global ecosystem. And, for millennia, mountains have inspired us spiritually and intellectually.

My own journey to respond to climate change began in the mountains of Monteverde cloud forest, where the golden toad once lived. The loss of this beautiful species due to human encroachment and climate change inspired me to act.

I see similar inspiration wherever I visit mountains. When I attended community-based adaptation conference in Kathmandu earlier this year, I saw first-hand how climate change is impacting the mountains and the people who live there. Melting glaciers, landslides, and newly-formed unstable glacial lakes make it clear that mountains are extremely sensitive to climate change. They are upstream early-warning systems and can signal significant risk for downstream communities.

The fact that what happens in mountains affects so many things clearly shows that scaling up adaptation action and strengthening adaptation policy is of utmost importance for mountain people. The good news is that the world has woken up to the urgent need to scale up and speed up mitigation to avoid the worst climate impacts as well as adaptation to prepare communities for the impacts that we know are coming.

The recently concluded climate change summit hosted by the UN secretary-general in New York saw multiple pledges and announcements by governments, companies, investors, cities, and public-private coalitions – including adaptation assistance and innovative financial tools to boost action. These new resources, alongside the array of funds and projects of the UN, the World Bank, regional development banks, bilateral donors, and others in the UNFCCC negotiations, provide more options than ever before for effective adaptation.

These funds represent over USD 1.3 billion and support countries' national adaptation programmes of action and the long-term national adaptation plans. These funds are making a difference with projects that range from climate proofing infrastructure in Bangladesh to building resilience to climate-related hazards in Nepal. Sharing knowledge, increasing engagement, and building strong partnerships allow more countries to tap into these resources and open doors for further action.

This conference holds great potential to build on the growing momentum and provide valuable input to programmes of action and adaptation plans. I urge all countries to accelerate the development of these plans and act now to maximize effective deployment of funds. In doing so, please keep in mind that climate change impacts do not know national boundaries. Many countries in the Hindu Kush Himalayas face similar adaptation challenges. Successful adaptation depends on unprecedented levels of international cooperation. I urge you to identify common approaches and how national planning and the international process can strengthen these approaches.

The next international climate change conference will be held at the base of the Andes in Lima, Peru, in December 2015. Peru is another mountainous country already experiencing severe climate change impacts, particularly in terms of freshwater supply and receding glaciers. At this year's conference, countries will look to place a draft of the new universal climate change agreement on the table and clarify what each country can contribute to that agreement. This is an opportunity to put the world on the path to low-carbon development and a stable and secure future. There is no better venue for mountain countries to accelerate action, both with ambitious mitigation goals and a strong commitment to adaptation. A weak agreement will spell disaster for mountain people. Without enough mitigation, we will never be able to adapt enough.

I ask you all to seize this great opportunity while the momentum is on your side. I ask you to channel your energy into crafting an agreement that bends the curve of emissions this decade and takes us to full climate neutrality by the second half of the century. John Muir, the noted naturalist, wrote that the mountains are useful not only as fountains of timber and for irrigating rivers, but as fountains of life. With your active participation in the process and vocal advocacy for a strong agreement, we can protect these invaluable and inspiring fountains of life for generations to come.

We must do it together and we must do it now.

Christianiana Figueres
Executive Secretary of the UNFCCC

Foreword

The Hindu Kush Himalayas are home to 210 million people and provide services to 1.5 billion people across eight countries. In addition to being some of the most populous countries in the world, these countries are also among the poorest. Mountain people in the Hindu Kush Himalayas face diverse physical challenges and socioecological difficulties, including poor infrastructure, severe disaster risk, and high male outmigration. Despite these vulnerabilities, communities across the region have managed to maintain their resilience to changing conditions.

Today, accelerating climate change is threatening the ability of mountain people to continue to adapt. Mountain populations are among the first to experience its effects, particularly the increased risk of floods and landslides, increased food insecurity, migration, and gender inequity. It is therefore time for a convergent and harmonized response from scientists, policy makers, and local actors to supplement the local adaptation practices of mountain communities.

The insufficiency of global and regional knowledge on mountain specificities, particularly with regard to mountain agriculture, climate change, water availability, and social change, is a key challenge in attempting to improve the resilience of communities in the region. Scientific communities must shift their paradigm of solely generating scientific information to the practical communication of relevant and actionable data. At the same time, global climate stakeholders must act swiftly to recognize the uniqueness of adaptation action in the mountains and provide a global platform for discussions on mountain issues. Ground-level action must also keep up by devising efficient solutions to communicate disaster risks and diversify mountain livelihoods.

Focusing on the nexus between science, policy, and practice, the international conference on Mountain People Adapting to Change was a milestone event, bringing together over 300 policy makers, climate experts, development practitioners, and journalists to devise a holistic approach to mountain adaptation. We agreed to put ideas generated at the conference into action through capacity building, pilot testing, and scaling up successful action research programmes; to support national adaptation plans across the region; to take the mountain agenda to regional and global fora; and to encourage participation of youths in building resilience in mountains.

However, much remains to be done. Only with a concerted effort can we unite science, policy, and practice toward our common goal of improved resilience for the men, women, and children of the Hindu Kush Himalayas and mountain regions across the world. By acting upon the recommendations contained in this working paper, I am confident that we can generate a strong and unified voice to represent mountains worldwide.

David Molden, PhD
Director General
ICIMOD

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Acronyms and Abbreviations

CICERO	Center for International Climate and Environmental Research – Oslo
GRID	Global Resource Information Database
HICAP	Himalayan Climate Change Adaptation Programme
HKH	Hindu Kush Himalayas/Himalayan
ICIMOD	International Centre for Integrated Mountain Development
ICT	information and communications technology
IPCC	Intergovernmental Panel on Climate Change
NAP	national adaptation plan
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

Around 90 per cent of almost a billion mountain people in the world today live in developing and transitioning countries, such as those in the Hindu Kush Himalayan (HKH) region (Mountain Partnership et al. 2012). Many live in poverty, and a third of mountain dwellers are vulnerable to food insecurity and acute hunger, often due to climatic stressors (such as droughts, floods, and landslides) coupled with economic, political, demographic, and social changes (Mountain Partnership et al. 2012). These vulnerabilities to changes, which are largely outside of mountain communities' control, require a multifaceted approach to adaptation that addresses the needs and changing realities of mountain communities and the underlying causes of their vulnerability.

The 'international conference on Mountain People Adapting to Change: Solutions beyond boundaries bridging science, policy, and practice', held in Kathmandu from 9 to 12 November 2014, sought to break down the boundaries between science, policy, and practice in adaptation to climatic and other changes in the mountains and downstream areas of the Hindu Kush Himalayas. The purpose of the conference was to find holistic approaches to adaptation that extend beyond political, sectoral, and national boundaries, and that bridge mountain and non-mountain interfaces. Organized by ICIMOD in partnership with the Ministry of Science, Technology, and Environment, Nepal, the conference brought together over 300 policy makers, development practitioners, climate experts, researchers, and journalists working in the area of climate change and adaptation. It provided a platform for the sharing of information and fostered rich discussions between policy makers, researchers, and practitioners.

Sessions were devoted to consolidating global and regional knowledge and translating it into systematic policy and action; transboundary and transdisciplinary benefit and knowledge sharing; disaster risk reduction and preparedness; the vulnerability and resilience of communities and livelihoods; adapting global climate science and models to the HKH context; and emerging fields of climate research such as black carbon and its impacts on the cryosphere. The conference also addressed a number of crosscutting themes such as gender and power imbalances, knowledge management and dissemination, and enhanced communication between groups of stakeholders. This working paper details the key recommendations that emerged from the conference.

Recommendations

The following are the key recommendations from the panellists and participants in the areas of knowledge generation, regional and global cooperation, multistakeholder engagement, communication and engagement, and technological and financial innovation.

Knowledge generation

Robust knowledge creation at the regional level is a necessary first step for informed decision making. To that end, we need to:

- Address climate data constraints by developing region- and topography-specific climate models based on comprehensive local data
- Scale up regional information to general circulation models to improve the accuracy and relevance of these models to mountain regions
- Build regional knowledge on mountain food security in order to facilitate mountain-specific agricultural research and planning

Regional and global cooperation

A stronger voice for mountain people will require greater participation and inclusiveness of scientists and policy makers from mountain regions. We must therefore:

- Engage in specific and targeted communication across local, national, regional, and global levels to highlight the urgency of adaptation action in the world's mountains and its significance for the rest of the world's population
- Generate a unified mountain voice through strong regional and global cooperation between communities, institutions, and non-governmental actors
- Promote institutional pluralism while carrying out global assessments, with more inputs from the HKH and other mountain regions
- Enhance crossborder flows of knowledge, especially in transboundary landscapes, to minimize adverse effects and to enhance the benefits for the entire region

Multistakeholder engagement

Creative and multilayered adaptation solutions will require consultations and knowledge sharing among diverse stakeholders. Adaptation policy makers must:

- Create and support mechanisms for collective reflection and learning among diverse stakeholders (particularly researchers, policy makers, practitioners, and communities)
- Increase consultation with stakeholders across local and subnational levels, and across upstream and downstream communities, to enhance benefit sharing across communities and regions
- Support local-level adaptation through technology, capacity building, and greater financial resources
- Improve institutional mechanisms to address the trade-offs between ecosystem preservation and development needs and provide adequate resources and funding
- Integrate bottom-up and top-down methods of data collection and policy formulation for a holistic approach to adaptation
- Enhance efforts to address power differentials across genders and social classes by addressing historic and contemporary limitations in the agency and decision-making power of women and other marginalized groups

Technological and financial innovation

Innovative technological solutions and financial products can be instrumental to improved resilience by providing timely information on disaster warnings or market prices for products, and by reducing the financial risks of climate-induced disasters. Efforts must be made to:

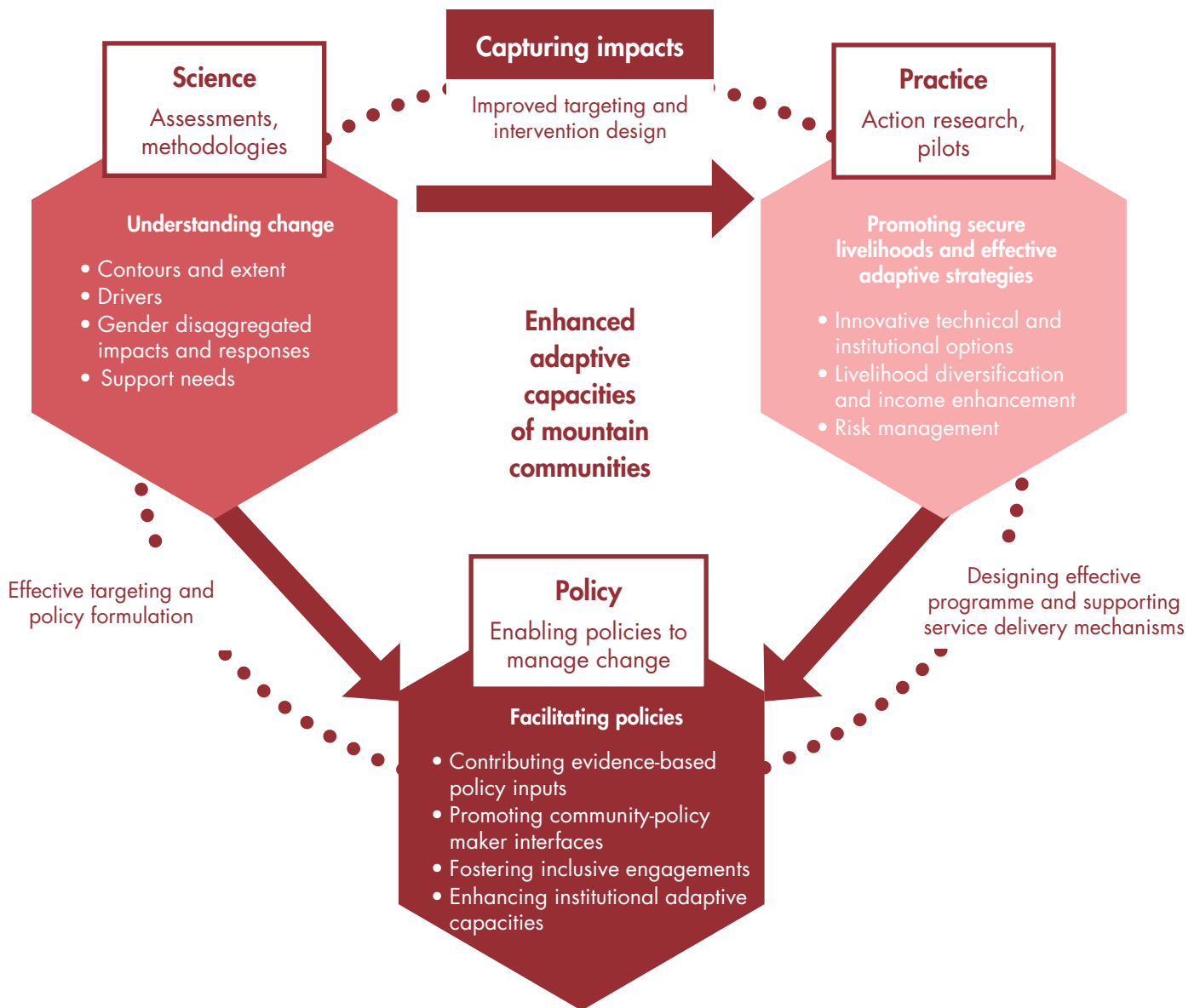
- Develop needs-based technological solutions for disaster warning, favouring hand- or solar-powered technology over complex technology
- Use information and communications technology (ICT) solutions including SMS-based technology for real-time communication of early disaster warnings and more regular seasonal information such as updates on ongoing droughts
- Promote innovative multiperil and location-specific crop and property insurance schemes that ensure quick insurance payments and sufficient coverage of hazards, as well as closely match premiums to risk levels as a means of mitigating risk and improving adaptation
- Design insurance policies to combine risk-mitigating and risk-diversifying instruments to reduce basis risk and lessen losses

Communication and engagement

To ensure that emerging adaptation knowledge in the region leads to informed policy making, we must:

- Enhance collaboration with the media and civil society to facilitate a better communication of the science on adaptation and climate change to the public and magnify the voices of local communities in policy formulation
- Focus on locally-relevant issues and communicate new and existing knowledge in simple language to facilitate informed policy making that is relevant to local communities
- Shift the paradigm from solely focusing on the generation of scientific information to the practical communication of relevant data such as that from high-impact weather forecasting
- Ensure two-way flows of communication between local communities and scientists to incorporate the wealth of traditional indigenous knowledge within the scientific knowledge generation process

Figure 1: **Framework for Adaptation to Change**



Source: ICIMOD (2015)



Introduction

As the source of ten of Asia's major river systems, the Hindu Kush Himalayas provide water, ecosystem services, and livelihoods to more than 210 million people. The region is also a source of water for more than 1.3 billion people – almost a fifth of the world's population – living in downstream river basins. However, climate change and other changes have already begun to impact the ecosystems and communities across the region, as well as those living downstream. Traditional adaptation techniques that have supported people in mountain areas for centuries are no longer able to keep up with the rapid pace of change.

To effectively support communities in adapting to change, solutions that look beyond political, sectoral, and national boundaries must be developed. This requires in-depth knowledge of both local conditions and broader global climate change trends. Although new reports, such as the Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC 2014), have provided fresh insights, there are still gaps in our knowledge about how climate change is affecting, and will continue to affect, the HKH region.

The international conference on Mountain People Adapting to Change sought to fill some of these knowledge gaps by bringing together over 300 experts and stakeholders from around the globe, including government representatives and high-level dignitaries from the HKH, to discuss the status of adaptation. The conference approached climate change adaptation in the HKH region from a holistic perspective, seen it in the context of other change processes and in relation to changes in mountain areas around the globe. By drawing together the latest knowledge, policies, and practices on adaptation, the conference aimed at strengthening the interface between science, policy, and practice.

Scientists, data, local knowledge, and experience from the HKH region continue to be poorly represented at the IPCC and other global forums. There is, therefore, a need for greater regional participation in such forums to generate a unified mountain voice to represent the HKH. Moreover, there is slow uptake of new scientific knowledge generated by regional scientists in global processes and regional institutions. Mechanisms need to be urgently established to integrate scientific and traditional knowledge, local adaptation methods, and local and national adaptation policy and action to reduce the vulnerability of the people of the Hindu Kush Himalayas to climatic and other changes.

The conference also highlighted the importance of more precise science on the region and the need to communicate scientific findings in simple language for the ease of implementation of this knowledge through national and local policy. This requires strengthening global and regional climate science in order to better inform policy makers in the region about the impact of climate change on local people.

Scientific efforts can aid adaptation by informing policy and practical action in numerous ways. These include more detailed studies on black carbon impacts; linking scientific information such as weather forecasting with needs-based technological solutions and infrastructure for disaster preparedness and management; and increasing interdisciplinary and participatory processes to integrate indigenous and local knowledge into academic and formal reporting.

Scientists must move beyond viewing their work as isolated academic knowledge production and instead endeavour to understand and engage with climate policy and action frameworks. They also need to develop a deeper understanding of, and connection with, affected communities. A two-way flow of information and knowledge between scientific and local communities is needed to ensure that local knowledge is incorporated into science and policy, while also making scientific knowledge accessible to the communities.



Knowledge Generation: Strengthening regional knowledge for informed decision making

Decision makers in the HKH region are facing increased demands to meet the needs of small landholders and farmers as well as address the challenges that climate change is posing to their livelihoods. For this, decision makers depend on reliable scientific information based on locally relevant data that captures the diversity of the region. While greater attention has been paid to knowledge creation in the region since the IPCC's Fourth Assessment Report in 2007, there are still gaps in scientific knowledge regarding the extent and progress of climate change, particularly in the HKH region. Hence, robust knowledge creation at the regional level is a necessary first step.

Towards mountain-specific regional climate models

Generating new knowledge must come to the fore and processes of knowledge generation need to be critically evaluated for their relevance to HKH contexts. Although a lot can be learned from global climate models and assessments, there is a need for comprehensive regional analysis for targeted and locally relevant adaptation strategies.

It is particularly important to develop region- and topography-specific climate models based on comprehensive local data. High-altitude climates are particularly uncertain and commonly used climate datasets are grossly inaccurate at high altitudes. These data constraints make it difficult to develop accurate climate scenarios for the HKH region using either statistical or dynamic downscaling techniques.

A systematic approach to downscaling general circulation models to the local level requires radically improving the science of climate modelling while simultaneously providing simple options for decision makers based on already available information. This requires improving the accuracy of general circulation models by scaling up regional information, quantifying the uncertainties inherent in modelling, and carrying out ensemble projection. Simple options can then be provided to decision makers by communicating 'what-if' scenarios and collecting detailed information about the needs of local communities.

Downscaled global and regional models may then be used to project change at the local level by superimposing projections of large-scale change on information from local climate stations and by ensuring that the information generated by downscaling is focused on locally relevant issues. Through this process, information can be generated to support local adaptation in conjunction with a focus on flexibility and co-benefits, bringing all stakeholders together to discuss and share information and knowledge, as well as local risks and options, while also involving the private sector in mainstreaming this process.

Emerging concerns: Black carbon and the cryosphere

The vast majority of HKH glaciers are shrinking rapidly. Black carbon is a significant contributor, affecting local livelihoods and water resources over large areas. Particulate black carbon, with a particle size below 2.5 microns (PM_{2.5}), strongly exacerbates regional warming by settling on snow and ice, darkening the surface, and thereby increasing the absorption of solar radiation. It also heats the air while being suspended or transported by winds. Scientists generally agree that both of these processes contribute to the melting of glaciers.



Research has shown that the most significant sources of black carbon emissions in the region are biomass burning (open burning and cooking stoves), diesel vehicles, and the industrial burning of coal. However, knowledge gaps remain regarding the extent to which black carbon contributes to melting and the direct linkages between black carbon emissions and impacts. More detailed in situ and remote-sensing studies are needed to understand these processes.

Improvements from reduced black carbon emissions in terms of climate change could be observed within a few decades and could contribute to facilitating adaptation to climate change in many parts of the region. The major sources of black carbon affecting the HKH are located within the region, so those who reduce emissions will also reap benefits in terms of both improved health and the slowing of glacial melt and mountain climate change.

Adaptation science for holistic perspectives in upstream and downstream contexts

Mountain people and downstream communities are closely connected and changes in upstream areas can have tangible impacts on downstream areas. However, upstream and downstream contexts are often viewed separately when it comes to policy making due to national and administrative boundaries. However, these areas are closely linked by political, geographical, and social factors. Changes that primarily affect either area can have significant spillover effects on the other. Hence, adaptation efforts aimed at improving the resilience of upstream or downstream communities must take these linkages into account.

To ensure that adaptation science coheres with the needs of local communities, holistic policy perspectives and sufficient stakeholder consultations are required at the local and subnational levels so that outcomes benefit both upstream and downstream communities. New knowledge in adaptation science, as well as policy and action to improve the resilience of communities, should be marked by a shared understanding of the priorities of and challenges faced by local communities.

A dearth of global and regional knowledge and research on food security in the mountains has resulted in a bias towards national agricultural planning based on crop varieties and irrigation methods that are more suitable for downstream areas, such as plains, compromising the ability of mountain societies to benefit from national food security and adaptation plans. Adaptation science needs to formulate a convergent and harmonized response to the needs of upstream and downstream communities. Researchers also need to learn from local knowledge on issues such as food security and to harness local inputs and traditions. For instance, there are documented cases of local Himalayan seed varieties being more effective in countering variable climate conditions.

To achieve this, a bottom-up approach can be useful in integrating adaptation science with the needs of local communities. This should include stakeholder consultations involving the documentation of agrobiodiversity and traditional knowledge on conservation and crop varieties. Stakeholder engagement processes may also need to take place at higher levels in order to ensure that the outcomes of consultations are acceptable to both upstream and downstream communities. While promoting research on adaptation, action should be planned along with communities according to their priorities, and it should take into account their short- and long-term needs.

Regional and Global Cooperation: Translating adaptation science into policy

For robust regional knowledge to trickle down to reduce vulnerability, good science must be integrated into adaptation policy at the national, regional, and global levels. This requires regional and global cooperation between governments and effective communication between scientists and policy makers to ensure that science produces actionable results.

Regional cooperation in the HKH

At the regional level, sustainable development in the mountains of the HKH region would benefit from an intergovernmental panel to address issues specific to the region, along the lines of the Arctic Council. Networking between the Hindu Kush Himalayan countries is key to translating scientific knowledge, particularly with regard to transboundary resource management, biodiversity conservation, and disaster risk reduction, with the aim of integrating these issues into adaptation policy for the mountains of the region.

It is also important to develop the concept of adaptation as a regional public good, and to build the capacity of regional institutions and empower them to engage with national policy makers and politicians more directly, focusing on the speed of implementation, scale of adaptation projects, and scope of comprehensive action.





Connecting national adaptation plans with global strategies

As climate change and its impacts become increasingly apparent, national and international agencies are stepping up their efforts to address the challenges. The UN Framework Convention on Climate Change has initiated action to support nations, particularly the least developed countries, to prepare National Adaptation Plans (NAPs) that address these challenges. Complementing the UNFCCC initiative, the United Nations Development Programme and the United Nations Environment Programme have launched the NAP global support programme. In parallel, the UN sustainable development goals articulate targets for action that can have a tangible impact on mountain communities. Despite these efforts, adaptation action is unsatisfactory and is not progressing at a sufficiently urgent pace. Although many countries have initiated action on climate change adaptation, affected communities remain vulnerable and adaptation strategies do not seem to be integrated into national development plans. In particular, the integration of issues related to gender equality remains a big concern.

As a result, global and national strategies and programmes need to be synchronized with governments and local institutions to prepare NAPs and ensure that their integration with national development programmes is more effective. It is important to engage institutions and transfer ownership to national-level centres and networks by providing a platform to implement activities. Community-level adaptation practices should be integrated with national-level processes and budgetary provisions should be made for this. At the same time, efforts should be made to build the capacity of local and regional institutions, and improve sociopolitical and ecological systems.

Getting mountains on the global agenda

Meaningful inclusion of mountain issues in global processes requires a meaningful participation of experts from mountain regions as well as mountain dwellers. Currently, despite the fact that 40 per cent of the world's population lives in HKH countries, scientists from the region represent less than six per cent of all expert reviewers of the IPCC assessment reports (IPCC, 2014a; 2014b). There needs to be a push to promote institutional pluralism while carrying out global assessments and to include more input from the HKH and other mountain regions in these processes.

The focus for the future must be on using regional and global cooperation to generate a unified mountain voice that is sensitive to, and inclusive of, local needs. This unified approach will form the basis for making sure that mountain issues are included as key considerations in upcoming processes to determine global action on climate change and adaptation, including the UNFCCC conference of the parties, future IPCC assessment reports, and the Convention on Biological Diversity.

Multistakeholder Engagement: Mainstreaming effective policy and adaptation action for improved resilience

Multilayered and creative adaptation solutions for HKH communities require the inclusion of multiple diverse stakeholders in the policy formulation process. Scientists and local-level administrators must involve local communities in devising adaptation solutions that are responsive to local needs, while taking into account biophysical, sociopolitical, and infrastructural challenges specific to each community or area.

Predicting uncertainties: The challenges of disaster risk management

As the risk of extreme climate events grows, sustainable adaptation and resilience in mountain communities urgently require creative and multilayered responses and solutions for disaster preparedness and risk reduction in the HKH region. The gaps in our scientific understanding of disasters and the associated uncertainties, the communication gap between scientists and the wider community, and failure to integrate local knowledge into disaster planning have resulted in available data not being turned into actionable information.

Current disaster management systems must be strengthened by engaging with communities to create feedback mechanisms through which ground realities and local knowledge are communicated to the scientists who devise solutions. This input will streamline and improve systems each time they are tested, making the prediction of risk and response planning more effective.

Preparedness is particularly important given the positive trade-offs in terms of the cost of risk reduction and preparedness as compared to the high cost of recovery and rehabilitation in the absence of such measures. While both warning and response systems are crucial, policy makers must also focus on actively reducing risk by mainstreaming disaster risk reduction practices and requirements into development planning and policy.

Scientific and technical communities must also make an effort to shift their paradigm of solely generating scientific information to the practical communication of data, for example, by emphasizing the importance of improving high-impact weather forecasting, which better informs practical action by focusing on short-term predictions of nature's most adverse climatic conditions. At the policy level, disaster management plans need to be detailed at various levels of action. This should involve creating plans at three or more levels – district, provincial, and national – and ensuring that these plans work hand in hand.

Sustaining the mountains: Ensuring food security through flexible production systems

Mountain ecosystems are particularly fragile as a result of extreme vulnerability to climatic and socioeconomic changes. Efforts in recent years to commercialize mountain agriculture have contributed to food security risks, which are magnified by the increasing impacts of climate change such as lower crop productivity, degradation of natural resources, frequent floods, and prolonged droughts. Moreover, socioeconomic factors such as physical inaccessibility, demand uncertainty, increased outmigration, and population pressure adversely affect mountain ecosystems. Despite recent economic development in the HKH region, the security of grain production remains a fundamental challenge as intensive agriculture is often not possible in mountain regions.

Taking into account the climatic, topographical, and socioeconomic challenges, there is a need to identify opportunities in the mountains to reshape local production systems so that they may flexibly react and adapt to



changes without harming local diversity and ecosystems. Key to achieving this is strengthening the inherent resilience of mountain agriculture and restoring flexible production systems, keeping in mind the agroecological potential and market access in the mountains.

Flexible production systems are of crucial importance in achieving food security in the mountains. Effective adaptation policy must support mountain farmers engaging in diverse services such as the production of cash crops, raising livestock, agroforestry production, beekeeping, and poultry, to reduce risks to livelihoods. Non-agricultural opportunities, such as the productive use of remittances, promotion of handicrafts and tourism, and small enterprises can also be instrumental in diversifying mountain livelihoods. Such opportunities will not only strengthen local food systems, but also improve the resilience of farming households to climate and associated changes.

Challenges in integrating adaptation knowledge into development

Mountain ecosystems are rapidly changing and widening the range of development challenges faced by mountain people. This has created an urgent need to integrate climate change adaptation into development planning and further into development policy. However, the integration of adaptation approaches into national and subnational development planning remains highly inadequate and is a critical challenge in the large-scale implementation of these approaches.

Adaptation and development planning should be seen as interdependent, rather than isolated, processes. It is crucial to integrate the adaptation process with development planning, particularly in vulnerable mountain regions, and to translate national-level strategies and policies for local governments and communities. However, the major challenges are the low participation of communities, low level of government ownership, preference for meeting immediate development needs at the cost of long-term needs, and weak coordination between subnational and national governments.

One of the major challenges is that of timescale: climate science talks about the long-term future, whereas decision makers and politicians need information about the short term. Climate change adaptation is about effective risk management and the informed pricing of risk, and climate change risks should be considered among other risks in risk management and planning. Therefore, we need to look beyond trade-offs to maximize benefit sharing. There is also a need to divert available funds to the most appropriate institutions. Moreover, a significant share of available funds must reach the local level where adaptation actions are implemented.

Engaging directly with local communities: Traditional knowledge and local adaptation practices for managing livelihoods

Mountain communities have a wealth of indigenous knowledge about their environments, including water management, agricultural and horticultural practices, biodiversity conservation, and ecosystem preservation methods. This knowledge often enables communities to flexibly develop local strategies to adapt to the changes that they are experiencing. Some of these strategies are longstanding, traditional methods of coping with diverse changes, while others are local practices that are emerging in response to new challenges. Regardless, it is essential to bring this knowledge to scale and assimilate knowledge from the local level to the national level.

While these strategies have generally been unable to evolve fast enough to keep up with climate change, there is a wealth of knowledge in these practices. At the same time, there is clearly a demand for increased scientific knowledge to keep up with the rapid pace of climatic change and support local and national adaptation strategies. It is particularly important that knowledge from local and indigenous communities be incorporated into the discussion and planning processes of these adaptation and development plans.

To facilitate this, it is important to establish knowledge platforms or institutions with participation from local communities. In establishing these platforms and institutions, there should be a focus on providing proportional representation for marginalized groups within the communities and establishing balanced power relations, particularly with regard to gender and class imbalances. It is also essential that development practitioners understand and communicate with local communities through such institutions before formulating any local- or national-level policies.

Transboundary benefit sharing as an adaptation mechanism

Adapting water management to climate change in the transboundary river basins of the Hindu Kush Himalayas requires prudent sharing of the benefits that arise from water use between the major production sectors of agriculture, energy, and industry. Given the challenges of river water allocation during the last decades, it is important to seek innovative solutions to promote benefit sharing in transboundary river basins.



Building transboundary cooperation requires mutual trust, which can be a basis for identifying common benefits or threats in a basin. A regional transboundary water management strategy, therefore, needs to be anchored within national development plans to ensure a strong base. Attending to energy security and developing a consensus-based framework for disaster risk reduction offer ample avenues for water cooperation in the HKH river basins.

The economic integration of the HKH region and the downstream river basins would create an effective environment for benefit sharing. Economic integration and private sector involvement can strengthen actions grounded in consensus and commitment. While such a strategy would have a central focus on water as a natural resource around which regional economic exchange takes place, the approach extends beyond water and could encourage balanced trade and investment across various sectors. The hydroelectric power generated could be a natural starting point from which to promote regional economic integration.

Private sector involvement can be instrumental in speeding up the development of hydropower in the region. By negotiating separately with policy makers and communities in upstream areas, where power is developed, and in downstream areas, where it is marketed, the private sector can often expedite the development of the necessary infrastructure and institutional arrangements.

Technological and Financial Innovations: Emerging practices from the periphery of adaptation action

In recent times, climate change has extended beyond the domain of environmentalists and NGOs to become integral to the work of policy makers, scientists, and practitioners. It is now very much part of the agenda of governments and their institutions, as well as the private sector. Integrating climate change and climate change adaptation into the national agenda, therefore, requires bringing together various stakeholders from diverse regions and from all levels, including global, regional, national, and subnational actors.

Climate-smart strategies: Large- and small-scale innovations and services for a changing climate

While top-down approaches are more visible at regional and national levels, bottom-up, socially innovative approaches are effective at the community level. For climate-smart strategies to be successful, it is important to effectively integrate the two approaches.

When integrating these approaches, it is crucial that diverse examples of successful climate-smart strategies are studied and adapted to the context of the HKH region. Several innovative strategies have successfully merged technological innovations with community participation. Many of them involve crop insurance, weather-based agricultural advisories, early warning systems for floods, flood-resistant crops, and the use of ICT to link farmers with markets.

It is also important to study the potential effectiveness of scaling out strategies. Key to this process are the ability to identify the right technology for a particular community and climate situation, creating a clear impact pathway for scaling out that includes identifying partners and the capacity building of all key actors, and the use of appropriate business models to scale out institutional mechanisms focusing on policy-based support to potential public-private partnerships.

ICT strategies, in particular, can be scaled out with great success. They can involve simple, innovative tools such as customized SMS services that provide information on weather, the availability of seeds, market locations for the sale of agricultural produce, market prices, optimal seasonal crops, and other relevant information. Such messages conveyed in a local language can foster direct market linkages and remove the need for middlemen in the sale of produce. ICT tools can also be instrumental in empowering women and giving them information related to poultry and dairy farming, or other information relevant to their roles in the production process. In communities where large differences in decision-making power and resource-controlling agency is skewed towards males or other groups, special attention should be paid to avoiding the capture of resources and technology by elites or dominant groups. Women, in addition to men, should be provided with training, including training on innovative cropping, irrigation practices, and capacity-building.

Insurance and risk mitigation strategies: Ensuring recovery after climate-induced loss

Insurance and other financial mechanisms are often overlooked in discussions of adaptation to change, but they have the potential to act as significant components of long-term adaptation strategies. In the wake of climate-induced loss, attention often turns exclusively to large government or aid-based relief efforts. However, insurance



and other forms of financing such as remittances and saving schemes can also improve the resilience of vulnerable communities to the effects of change and may even prove more efficient in immediate post-disaster scenarios. It is, therefore, crucial that policies to promote financial adaptation practices are backed by good scientific information and centrally address climate adaptation and resilience.

As both the scale and frequency of climate-related disasters increase, the question of how insurance systems can provide security to vulnerable communities while remaining financially and commercially viable will become increasingly complex. However, insurance has the potential to help with recovery and resilience to the effects of climate change, and it may even work indirectly as a mitigation and adaptation strategy. For instance, if insurance is made mandatory and the cost of coverage is tied to the level of risk, consumers are likely to adopt behaviours that reduce those risks.

Insurance schemes that reward planning with higher indemnities for long-term policy holders may also encourage farmers to invest in better management practices, such as reinvesting payouts in risk-reducing innovations. Additional incentive approaches, such as making female household members the beneficiaries of policies or schemes that link savings to insurance coverage, can assist in attaining development goals such as gender equity and improved household indicators of health and education.

However, for insurance to be part of the portfolio of disaster responses, there must be a focus on making insurance policies both innovative and efficient. For it to remain beneficial to farmers, insurance companies, and the relevant governments, the system must be designed such that it results in overall positive development, reduces disaster risk, and enhances adaptation to climate change. Appropriate and innovative policy design must be the focus; multiperil and location-specific approaches and the mandatory combination of risk-mitigation and risk-diversifying instruments can reduce basis risk and lessen losses.

Communication and Engagement

Translating climate and adaptation science into good policy at various levels and ground-level action requires a system of simple and effective communication to ensure the uptake of scientific knowledge by policy makers and to increase the understanding of climate issues by the general public. It is, therefore, important to identify ways to simplify messages from the scientific community and build bridges between science and policy as a means to effectively disseminate information to potentially affected communities and the general public.

Integrating science, policy, and practice through targeted communication

Science – particularly climate science – may be difficult for communities and policy makers to understand and match with their local needs and political interests. Moreover, climate science is not always compatible with politics and the media. Climate change is uncertain, but politicians and the media dislike uncertainty; they want definite answers. The impact of climate change is long-term, but politicians and the media typically think in terms of short-term consequences. Climate change demands large-scale global actions, but politicians and journalists have to operate within local or national parameters. There is also a danger of climate change becoming a scapegoat to excuse inaction on the part of institutions and to absolve them of blame for problems that are caused by other dynamics.

As a result, for scientists to influence policy making, they need to understand the policy formulation process and identify key policy institutions and persons who are best positioned to understand and act on new knowledge. Civil society can play an important role in bridging this gap. Likewise, media collaboration can improve communication between groups and can contribute to effectively bridging the gap between science and policy.

Communicating science in simple terms

Policy makers and local leaders have greater access to communities than scientists and are better positioned to understand their ground realities. As a result, it is essential that policy makers understand scientific findings and their relevance to local communities, and the importance of informed policy formulation. At the same time, it is important to convey adaptation science with a focus on actionable information, including providing policy recommendations.

It is, therefore, vital to use language that is understandable to policy makers and the people on the ground. Talking about real problems faced by people is more likely to convince them of the need or urgency of a measure than dense scientific messages. While abstract science may not be understood, people comprehend messages quickly if they are linked to the local systems and pertinent issues such as food, water, resources, and livelihoods.

Two-way flows of knowledge from scientists to local communities

Mountain communities and institutions often struggle to understand the change processes and their differential impacts on various groups of people. The difficulty in comprehending and acting upon these processes stems primarily from the lack of two-way flows of information. For instance, in the HKH region, socioeconomic realities such as climate-induced outmigration are often not identified by research institutions, resulting in strategies that can be ineffective in the presence of such factors. For example, the large proportion of female inhabitants in regions with high male outmigration may make some strategies inappropriate or unfeasible. Local means to adapt to these changes take into account these specificities and, therefore, need to inform the work of scientists and policy makers.



At the same time, wider global changes including globalization, liberalization, urbanization, increased connectivity, and mobility, as well as changes in land use, bring new challenges that are often not addressed by traditional adaptation strategies. There is a role for scientists studying these challenges and policy makers implementing strategies to increase awareness among mountain communities and improve their capacity to adapt to such changes. There is an urgent need for the sharing of knowledge and practices between local communities and scientists, with a focus on communicating the results to policy makers such that the findings are implemented into national- and regional-level adaptation and development plans.

Engaging with the media through locally sensitive and sociopolitically relevant science

It is necessary to understand local values and the structure of power and politics in framing communication tools to convey scientific knowledge to policy makers. A simple, understandable, and evidence-based scientific message is more attractive to both local communities and the media and more useful in prompting action.

It is also important to engage with the media and enhance its capacity to communicate climate science to the public and policy makers. Journalists should not only understand the relevant scientific terminology, but also the policy formulation process. They also need to be given sufficient training to understand local socio-political systems so they are able to produce media outputs that are more critical and pertinent to local communities.

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