

Climate Change Impact and Vulnerability  
in the Eastern Himalayas – Synthesis Report

ICIMOD

FOR MOUNTAINS AND PEOPLE

# Climate Change Vulnerability of Mountain Ecosystems in the Eastern Himalayas

MacArthur  
Foundation

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# Preface

Mountains are among the most fragile environments on Earth. They are also rich repositories of biodiversity and water and providers of ecosystem goods and services on which downstream communities (both regional and global) rely. Mountains are home to some of the world's most threatened and endemic species, as well as to some of the poorest people, who are dependent on the biological resources. Realising the importance of mountains as ecosystems of crucial significance, the Convention on Biological Diversity specifically developed a Programme of Work on Mountain Biodiversity in 2004 aimed at reducing the loss of mountain biological diversity at global, regional, and national levels by 2010. Despite these activities, mountains are still facing enormous pressure from various drivers of global change, including climate change. Under the influence of climate change, mountains are likely to experience wide ranging effects on the environment, natural resources including biodiversity, and socioeconomic conditions.

Little is known in detail about the vulnerability of mountain ecosystems to climate change. Intuitively it seems plausible that these regions, where small changes in temperature can turn ice and snow to water, and where extreme slopes lead to rapid changes in climatic zones over small distances, will show marked impacts in terms of biodiversity, water availability, agriculture, and hazards, and that this will have an impact on general human well being. But the nature of the mountains, fragile and poorly accessible landscapes with sparsely scattered settlements and poor infrastructure, means that research and assessment are least just where they are needed most. And this is truest of all for the Hindu Kush-Himalayas, with the highest mountains in the world, situated in developing and least developed countries with few resources for meeting the challenges of developing the detailed scientific knowledge needed to assess the current situation and likely impacts of climate change.

The International Centre for Integrated Mountain Development (ICIMOD) undertook a series of research activities together with partners in the Eastern Himalayas from 2007 to 2008 to provide a preliminary assessment of the impacts and vulnerability of this region to climate change. Activities included rapid surveys at country level, thematic workshops, interaction with stakeholders at national and regional levels, and development of technical papers by individual experts in collaboration with institutions that synthesised the available information on the region. A summary of the findings of the rapid assessment was published in 2009, and is being followed with a series of publication comprising the main vulnerability synthesis report (this publication) and technical papers on the thematic topics climate change projections, biodiversity, wetlands, water resources, hazards, and human wellbeing.

Clearly much more, and more precise, information will be needed to corroborate the present findings. Nevertheless, this series of publications highlights the vulnerability of the Eastern Himalayan ecosystems to climate change as a result of their ecological fragility and economic marginality. It is hoped that it will both inform conservation policy at national and regional levels, and stimulate the coordinated research that is urgently needed.

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# Executive Summary

From July 2007 to December 2008, the International Centre for Integrated Mountain Development (ICIMOD) carried out a rapid 'Assessment of Climate Change Vulnerability of Mountain Ecosystems in the Eastern Himalayas', with support from the MacArthur Foundation. This synthesis report is the outcome of this work.

The Eastern Himalayas (EH) lie between 82.70°E and 100.31°E longitude and 21.95°N to 29.45°N latitude, covering a total area of 524,190 sq.km. The region extends from the Kaligandaki Valley in central Nepal to northwest Yunnan in China, and includes Bhutan, parts of India (North East Indian states, and the Darjeeling hills of West Bengal), southeast Tibet and parts of Yunnan in China, and northern Myanmar. These five countries have different geo-political and socioeconomic systems, as well as diverse cultures and ethnic groups.

The project undertook various research activities to assess the climate change vulnerability of mountain ecosystems in the EH. Activities included surveys at country level, thematic workshops, interaction with stakeholders at national and regional levels, and development of technical papers by individual experts in collaboration with institutions that synthesised the available information on the region. Available climate models were used to develop climate predictions for the region based on the

observed data. The findings are summarised in detail in this synthesis report, following publications of a brief summary in 2009, preparation of an internal in depth report, and individual papers, all of which feed into this synthesis. The six technical papers produced on thematic areas are being published separately and are included on a CD-ROM with this synthesis.

Recent scientific opinion led by the Intergovernmental Panel on Climate Change (IPCC) is that global climate change is happening and will present practical challenges to local ecosystems. The analysis and predictions showing an increase in the magnitude of climate change with altitude (in terms of both temperature and variation in precipitation). The study explored the impact and future projections of changing climatic conditions and showed the critical linkages between biodiversity, ecosystem functioning, ecosystem services, drivers of change, and human wellbeing. The study highlights the region's vulnerability to climate change as a result of its ecological fragility and economic marginality. This is in line with the broad consensus on climate change vulnerability, and need for adaptation of conservation policy at national and regional levels.

Many factors contribute to the loss of biodiversity such as habitat loss and fragmentation, colonisation by invasive



species, overexploitation of resources, pollution, nutrient loading, and global climate change. The threats to biodiversity arising from climate change are very acute in the EH as the region is rich in threatened and endemic species with restricted distributions. Fragmentation and loss of habitat directly impinge on the survival of species, especially those that are endemic to the region. Species in high altitude areas – especially in the transition zone between sub-alpine and alpine – are more vulnerable to climate change. In addition, the region's wetlands are being affected by the erratic weather observed in many parts of the region.

The assessment also looked at the perception of climate change by the people in the region. People see climate change as a big threat and challenge. They perceive climate change to be a result of excessive human activity and, to a certain extent, natural cyclical climatic variation. The majority of the respondents from the region associated climate change with floods, landslides, increases in temperature, land degradation, the drying of water sources, pest outbreaks, and food shortages.

The assessment revealed a gap in our knowledge on the climate change vulnerability of mountain ecosystems in the EH and the inadequacy of human resources and institutional setups, as well as a lack of policy imperatives to address the issues. The lack of systematic research, monitoring, and documentation on the status of biodiversity in the region was highlighted in all the studies undertaken for this assessment. The region also lacks

adequate scientific evidence to determine the impact of climate change on human wellbeing with any certainty. Equally, the majority of available research focuses on the adverse impacts of climate change and overlooks both the adaptation mechanisms adopted by the local people and the new opportunities presented. The enormous challenge for the region is to adapt to the impacts of climate change by integrating responses and adaptation measures into local level poverty reduction strategies.

In the process of assessing climate change vulnerabilities in the EH, ICIMOD has been able to network, initiate, and advocate for biodiversity conservation with regional cooperation on critical areas. This assessment is expected to advance our thinking about climate variability and change, and the vulnerability and adaptation of important impact areas, with a view to developing future strategies on both conservation and development. It indicates shortcomings and identifies research gaps in relation to biodiversity, wetland conservation, the resilience of ecosystems and their services, and hazards assessment, and points out the unreliability of trends and model projections due to the lack of country-wise consistent data related to climate change. The research gaps and lessons learned provide a good platform for initiating concrete projects and activities on biodiversity and climate change in the Eastern Himalayas. It is also hoped that the rapid assessment will be helpful in guiding the MacArthur Foundation, ICIMOD, and their partners in developing new strategies and plans for research on biodiversity conservation and enhancing human wellbeing.



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