Understanding the Effects of Climate Change in Mountain Areas: Lack of basic data is the biggest challenge

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What are the risks associated with climate change?

Climate change could lead to changing weather patterns and more frequent weather extremes such as storms and flood disasters and a general warming of global temperatures. Fresh water supplies and food production will be jeopardised, leading to environmentally-induced migration.

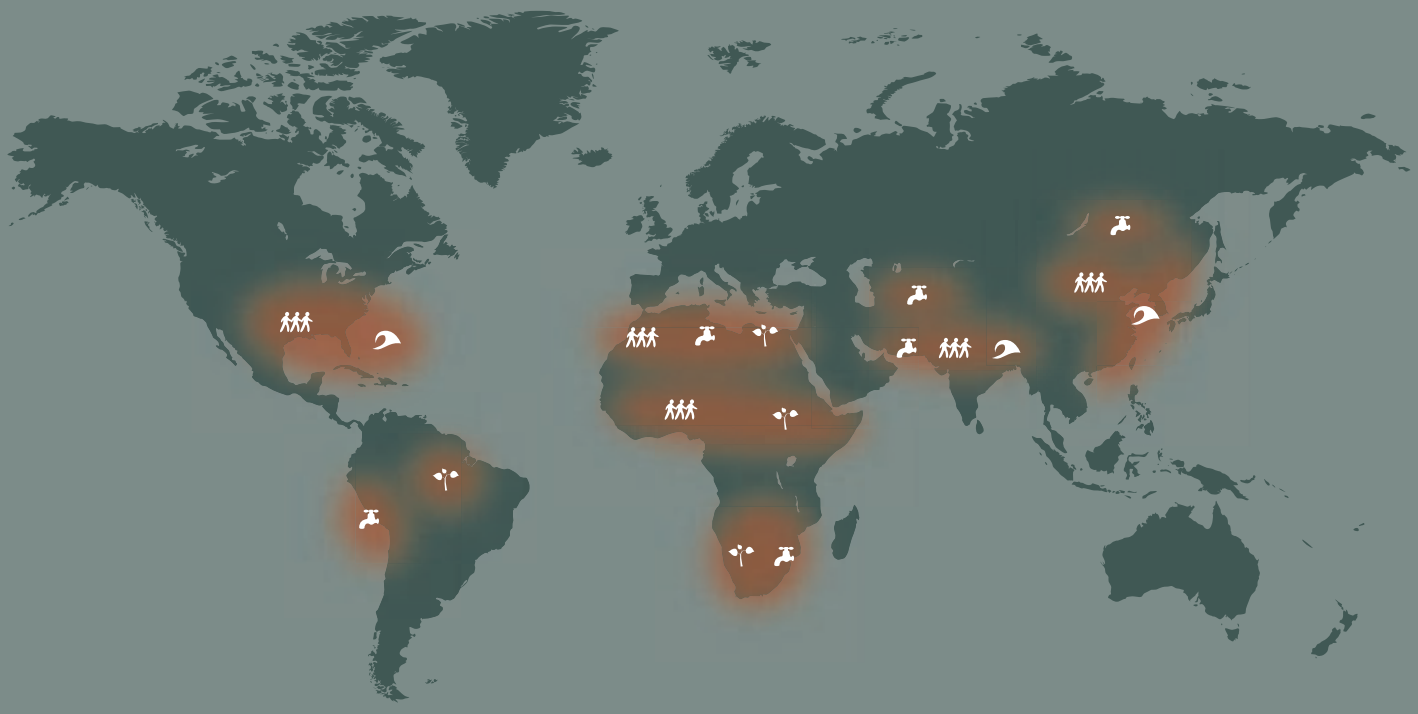
Substantial impacts in the form of contractions in species' range and extinctions could be experienced. The consequences will be greatest for the poor and marginalised people who depend almost exclusively on natural resources.

"...we shall have to know more about the origins of conflicts. ... As I see it, next to reasonable politics, learning is in our world the true credible alternative to force."

Willy Brandt in his acceptance speech for the Nobel Peace Prize in 1971

Conflict constellations in selected hotspots

Redrawn from WBGU 2007, Global change as a security risk (R. Schubert et al.) www.wbgu.de/wbgu_jg2007_engl.pdf



Why are mountains particularly sensitive to changes in climactic conditions?

Mountain environments respond strongly even to small changes in temperature because their vertical (altitudinal) dimensions create gradients of temperature, precipitation, and solar radiation. One can pass through several climatic systems in ascending one mountain slope and each system is a microcosm, a habitat in itself. Ecological zones also vary with altitude. Increasing global temperatures will result in an upward shift of these ecological zones, species' ranges, and marked ecotones such as the treeline. It is predicted that some areas of the Hindu Kush-Himalayan region will experience an altitudinal shift of approximately 80-200m per decade with the current rate of warming. Will species adapt or shift? We do not know how they will respond.

What is known about temperature trends in the Himalayas?

Currently knowledge about temperature trends is limited by both paucity of observations and insufficient theoretical attention. Despite the limitations, a growing number of studies support the IPCC reports which claim that there is a definite warming trend. Some predictions for the central Himalayas and Tibetan Plateau estimate a rise of 0.04°C-0.09°C/yr with greater shifts as altitudes increase because the rate of warming accelerates with altitude.

1950s

Imja Glacier

(Erwin Schneider, courtesy of the Association for Comparative Alpine Research, Munich. Archives of Alton Byers, The Mountain Institute)

2007

Imja Glacier

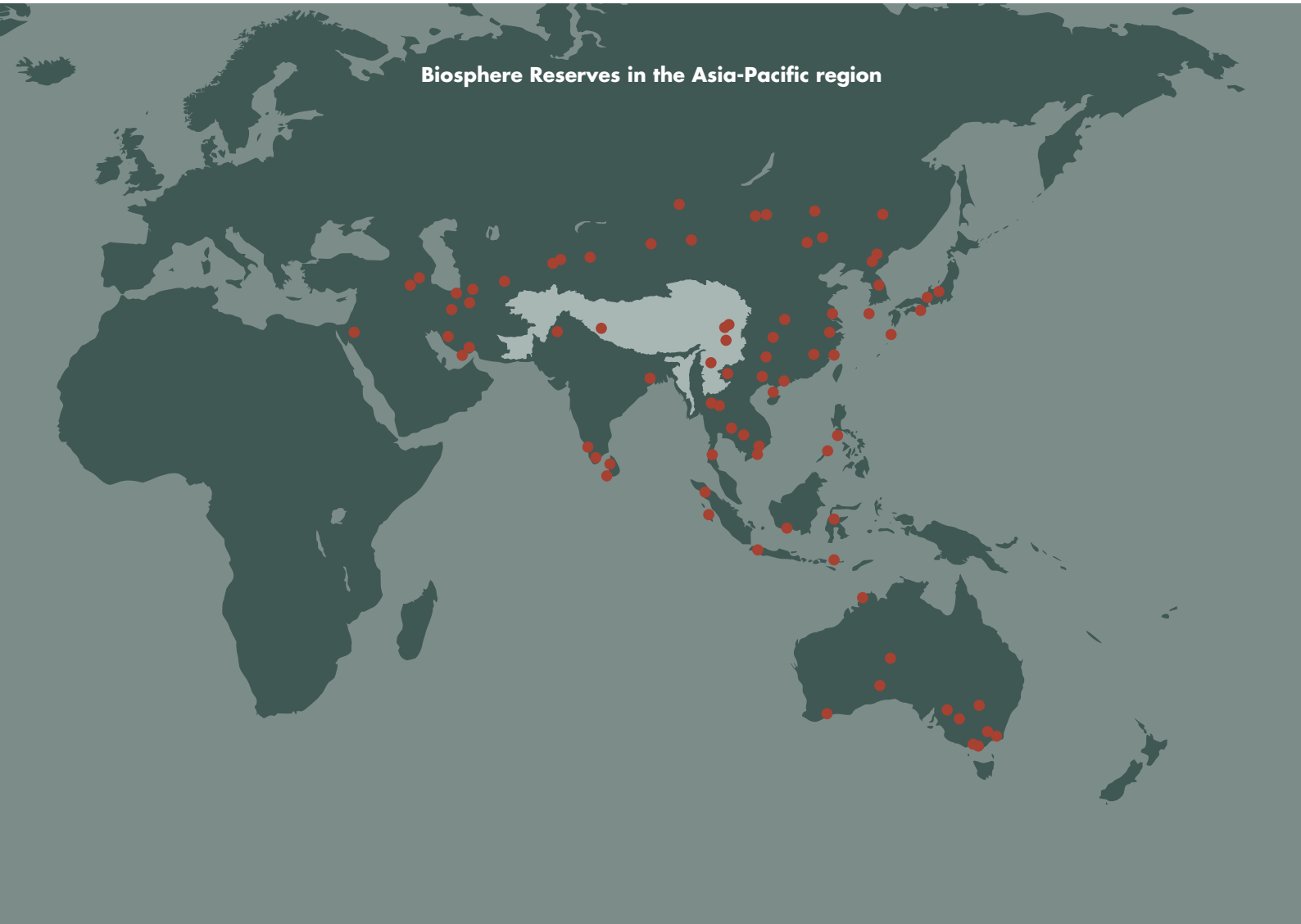
(Alton Byers, The Mountain Institute)

What climate change data are available for the Hindu Kush-Himalayan region?

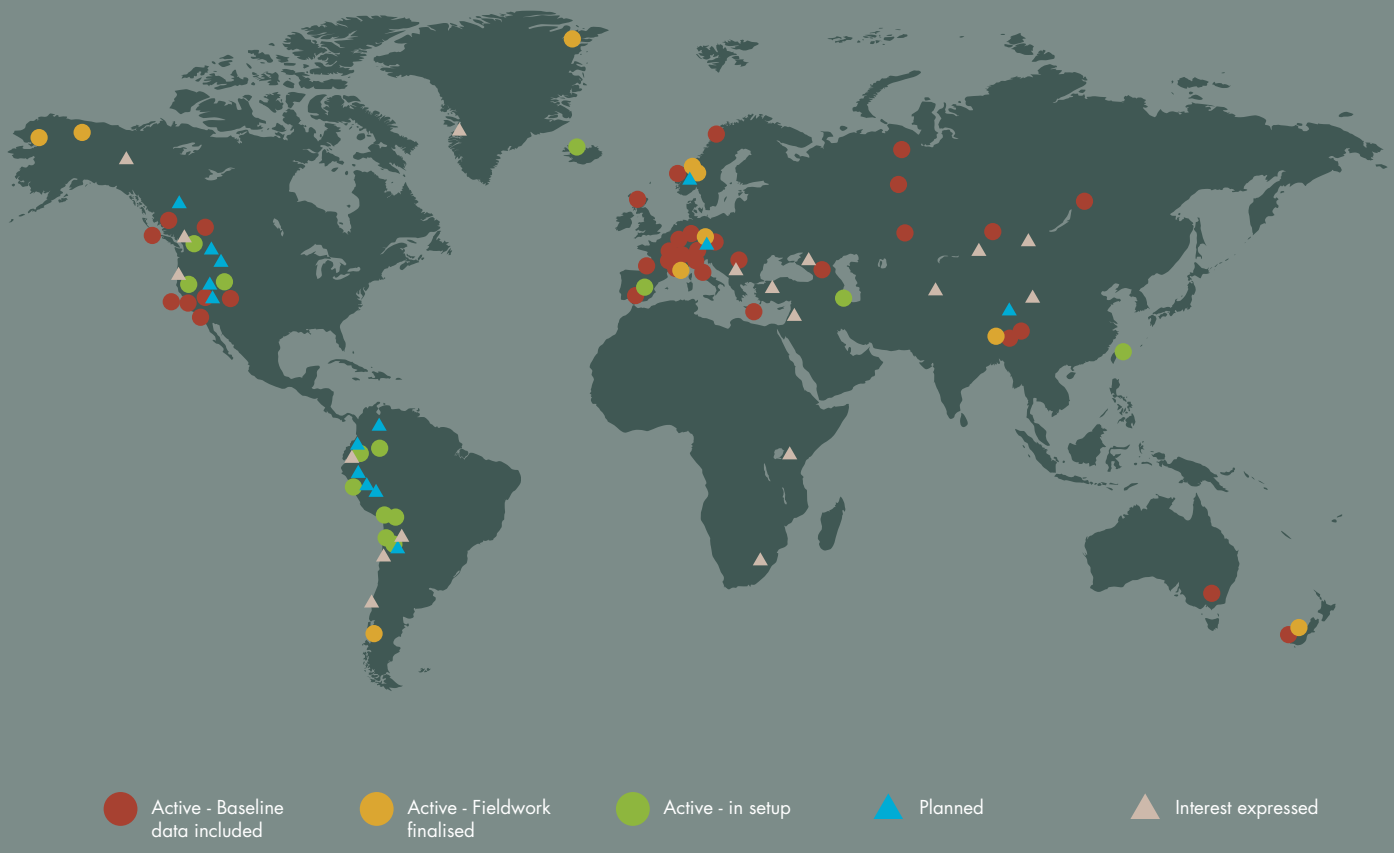
On the whole, data for the Hindu Kush-Himalayan region on climate change are fragmented and anecdotal. Anecdotes may be compelling – as seen in the time series' photos of the Imja glacier on the previous page taken 50 years apart – but they are not sufficient. Scientists consider the entire Himalayan region to be almost a 'white spot' in terms of climate data. For example, the map from the IPCC Assessment Report 2007 shows that whereas 28,115 significant, observed biological changes were reported for Europe: the number reported for the whole of Asia during the same period, was only 8!

Since UNESCO's Biosphere Reserve sites provide, among other things, logistical support for research and monitoring, the presence of these sites is a good indication that monitoring is taking place and that data are available for the area where they are located. UNESCO has 531 sites worldwide in 105 countries; the whole of the Hindu Kush-Himalayan region has five of these, four of them in the far eastern part in China, (although India has many national Biosphere Reserves that are not [yet] included in the UNESCO list). Similarly, the target regions for the Global Observation Research Initiative in Alpine Environments (GLORIA) shows that the Hindu Kush-Himalayan region is virtually devoid of test sites (next page).

The data that exist for the region are focused, as with the majority of conservation approaches in the past, on altitudinal gradients, critical ecological zones, and areas rich in biodiversity concentrated mainly in an east-west direction. It is now known that it is important to consider latitudinal changes too as there are special risks for high-altitude species in the transition zone where they are particularly vulnerable to climate change. Data on how climate change affects south-north aspects in the Hindu Kush-Himalayan region are almost completely lacking, however.



Gloria target regions



"There is a shortage of facts. Plausibility should not be taken as evidence."

Christian Körner, Univ of Basel, Switzerland

Why is there a lack of systematic environmental data on the Hindu Kush-Himalayan region?

The Hindu Kush-Himalayan region covers a massive geographical area (more than 3,500 km from east to west covering about 4.3 million sq.km in area) with inaccessible terrain and diverse ecological conditions. Hence there are practical limitations to comprehensive research initiatives. Also, until very recently, many of the regional countries were among the poorest in the world with great geo-political and socioeconomic differences and disparate research capacities among them. Environmental issues are regional, but most research efforts are local and national; which limits opportunities for comparing regional data. Projects are scattered and there is no central repository for data from the region as a whole.

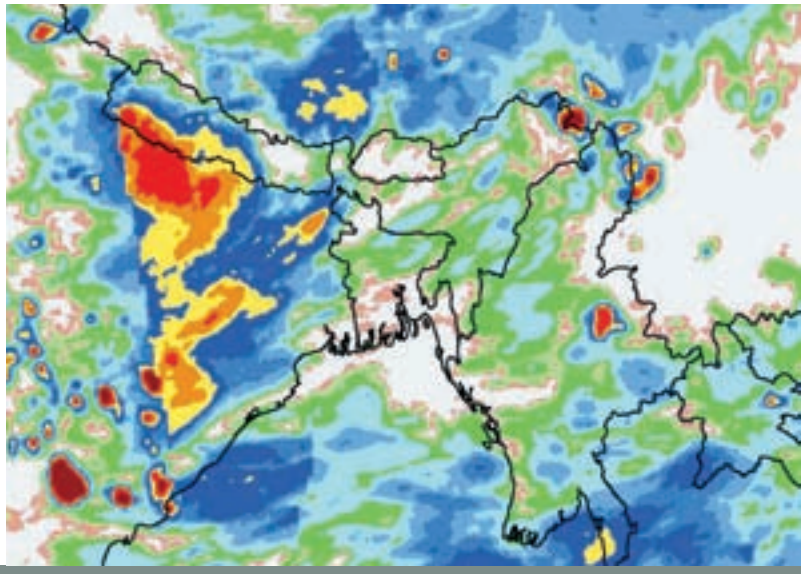
How can better data on climate change make a difference?

"Reduce talking, increase doing!… wherever you have influence …and, make your own hands dirty."

A comment by Christian Körner, applauded by the participants of the Conference

The link between climate change and biodiversity is poorly understood. Unless data are reliable, plans (such as access and benefit sharing and payment for ecosystem services) can neither be formulated nor implemented. The countries of the region are aware that collection of basic data is the first step and they have volunteered to collaborate with global data-sharing mechanisms and to be part of the international process.

Satellite precipitation estimate (NOAA/CPC)



Linking geodata with biodiversity information in the Himalayas*

The inventory and assessment of biodiversity resources and ecosystem dynamics have become essential for policy-making and management strategies as well as for developing and testing scientific hypotheses. Mountain biodiversity databases need to be compiled and made available to the wider community of climate change scientists in order to address climate change scientifically. The workshop brought together representatives of the Global Mountain Biodiversity Assessment of DIVERSITAS in cooperation with the Global Biodiversity Information Facility (GBIF) and national partners from the Hindu Kush-Himalayan region to explore the possibility of hosting a regional platform for mountain biodiversity data from the Hindu Kush-Himalayas.

The workshop highlighted the usefulness of geo-referenced data on biodiversity for the integrated analysis and spatial visualisation of information on biodiversity in relation to climate, land use, physiography, and other important parameters. Among the issues discussed were the following. How to design a GBMA/ICIMOD mountain biodiversity portal? How to promote geo-referenced data on biodiversity? How to improve biodiversity databases on the Hindu Kush-Himalayan region? The regional perspective and issues related to specific geo-referencing tools, mountain specific location, capacity building, and linkages with regional and global initiatives were considered also.

The participants unanimously recommended that ICIMOD take on the role of a regional knowledge hub for information about biodiversity in the Himalayas and that it become a regional node of GBIF. The platform, to be housed at ICIMOD's MENRIS facility, would provide easy and open access to data and metadata on Himalayan biodiversity and make it available for widespread dissemination both regionally as well as among the global change research community. Furthermore, the workshop recommended that ICIMOD facilitate or encourage key national partners in the regional member countries to become national nodes of the Global Biodiversity Information Facility.

*A workshop convened in partnership with Global Mountain Biodiversity Assessment of DIVERSITAS and the International Centre for Integrated Mountain Development (ICIMOD). The Workshop was held at ICIMOD Headquarters, Kathmandu, Nepal, on 15-16 November 2008.

How is ICIMOD addressing the scarcity of data related to climate change in the region?

ICIMOD's programmes on Integrated Water and Hazard Management, Environmental Change and Ecosystem Services, and Sustainable Livelihoods and Poverty Reduction focus on adaptation in the region and by its mountain population to the changes brought about by globalisation and climate change.

ICIMOD is also addressing the serious problem of data scarcity in the Hindu Kush-Himalayan region, since this lies at the root of many of the challenges to development that are commonly encountered. ICIMOD brought representatives from global programmes, respected conservationists, and countries sharing the Himalayan region together to participate in a series of workshops and a conference about various aspects of the problem. By convening the International Mountain Biodiversity Conference (Nov.16-18, 2008) ICIMOD provided a forum where world-renowned experts and professionals from global programmes could discuss issues with the countries of the Himalayan region with a view to developing a common strategy. A method of bridging the data gap was proposed in the concept of transects and transboundary landscapes for long-term monitoring in the Hindu Kush-Himalayas.

"There is a gap in our knowledge of biodiversity (in the region) particularly of the lower groups of plants and invertebrates."

Ram P. Chaudhary, Tribhuvan University, Nepal

What controls the edge? - Keystone species contribute to a diversity of life

Common to both the ecological and the economic motive for caring for biological diversity is the insurance principle. This states that there is a reduced risk of losing the integrity of a system when it depends upon many different players. The more diverse a system is, the more likely it is that there will be species that can cope with extreme events. In some cases, important 'keystone' species are obvious, but in others they may remain hidden and only emerge under extreme environmental conditions. Nevertheless their absence or presence is vital to ecosystem functioning.

The example shown in these photos is of a landslide area in the central Caucasus – here deep erosion gullies have cut into an ancient montane pasture rich in species. Close examination reveals that the eroded edge is inhabited by only a single grass species *(Festuca valesiaca)* that plays no spectacular role in intact grassland but becomes vital at erosion edges. The harsh life conditions at the edge eliminate most other species, and this little grass plant, owing to its dense root system and drought resistance, seems to single-handedly 'engineer' the edge and delay the erosion process. A small species may suddenly become a keystone species and its presence or absence can emerge as decisive for survival of the landscape.