Biodiversity, Environmental Change and Regional Cooperation in the Hindu Kush-Himalayas

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It was exciting to be part of ICIMOD's 'International Mountain Biodiversity Conference' and to have a chance to exchange views with representatives from UN organisations, governments, global mountain programmes, universities, non-government organisations, development agencies, conservation specialists, and others, under the umbrella of biodiversity.

The discussions covered a wide range of topics on biodiversity, environmental change and regional cooperation in the Hindu Kush-Himalayas (HKH) and ranged from 'Land Use and Biodiversity' to 'Protected Areas and Transboundary Parks'. The whole world is living through a period of ongoing climate and environmental change and nowhere are the impacts more visible than here in the HKH. Natural and human driving forces are having impacts on biodiversity, ecosystems, and water resources in the mountains and, in the near future, they will, most probably have ramifications for the livelihoods and living standards of mountain communities as well.

The HKH is a huge mountain system. It contains all or parts of eight countries, 10 immense river systems, and about 200 million people in the mountains alone, and impacts on perhaps more than 1.3 billion people in the surrounding lowlands. What does biodiversity mean in such a vast context? The HKH extends from west to east over a distance of about 3,500 km, the variability – from arid mountains with less than 400 mm (0.4 m) of annual precipitation in the west to mountains with more than 10 m of rain the east (in Cherapunjee in the Meghalaya Hills) – is overwhelming and is superimposed upon by south north differences ranging from summer monsoon precipitation regimes to a boreal winter circulation regime over Tibet and the northern mountain chains. These dimensions have created a wide-ranging diversity of genetic resources and species' diversity. A whole kaleidoscope of mountain ecosystems emanating from this variability determines natural and cultural landscapes. But what does this all mean to us? It is only a brief description and without solid knowledge about climate and water as basic elements for soil formation and vegetation growth, for land use and land cover, and especially for biodiversity, we cannot begin to predict the potential impacts of climate change and extreme events. Much less do we have concrete answers in the context of mitigation and adaptation mechanisms.

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We need basic and comparable data taken over a long period of time and in reliable series throughout this mountain system, but these are lacking. In the light of such a dearth of data how can we begin to tackle biodiversity conservation and management in such an immense mountain range? At this point in time, there is an urgent need to address the lacunae in our knowledge about biodiversity and the so-called 'biodiversity hot spots' in order to preserve mountain resources for the benefit of highland and lowland people now and in the future.

A proposal for a regional-scale concept

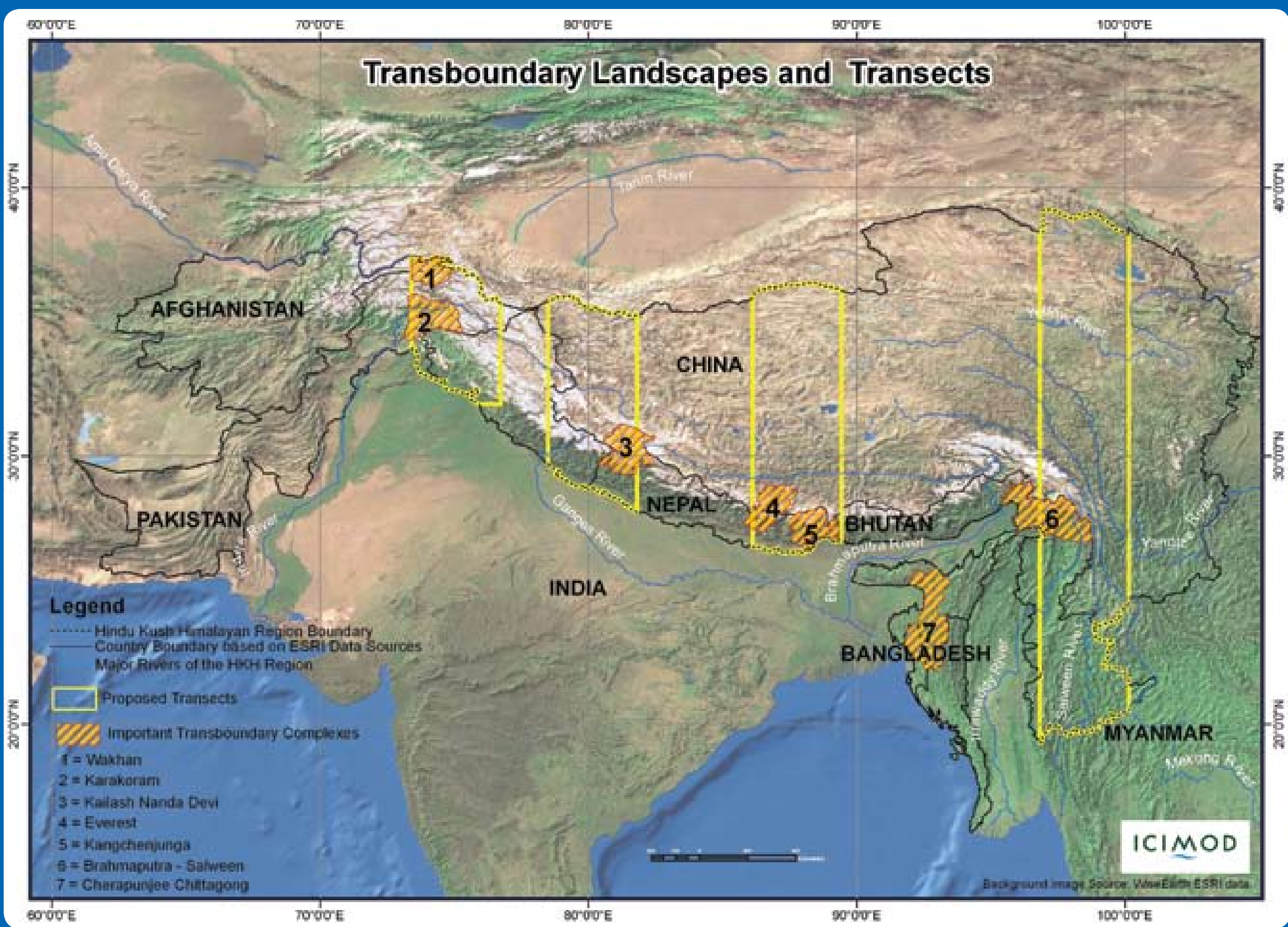
The map of the HKH in Figure 1 marks out several north-south transects from west to east. By selecting test sites from among them and focusing our research upon these, we could add an enormous amount to our current knowledge.

A team of professionals from ICIMOD have already begun to carry out some interesting research in selected places where valuable knowledge about the ecosystems and the environment can be found, e.g., in protected areas (International Union for the Conservation of Nature [IUCN] categories I – VI), in so-called biodiversity 'hot spots', in world heritage sites, in mountain biosphere reserves, in important bird areas, in Ramsar sites, and others. The map shown in Figure 1 is a first draft; it depicts four well-selected transects in colour; and, in addition, there are seven very interesting transboundary landscapes which are quite open towards the north. With the collaboration of Chinese researchers, northernmost test sites could be selected so that a comprehensive understanding and thorough documentation of the changes from the monsoon regime in the south to the climate in Tibet could be achieved.

At the test sites, thorough knowledge and long-term monitoring of every aspect of the different altitudinal belts are essential. To achieve such thoroughness, data about climate, water, biodiversity, and ecosystem services are essential. The knowledge gained will be invaluable for planning conservation and development strategies. It will also be invaluable for integrating these stations into the Global Climate Observing System (GCOS) network, so that the HKH region receives more attention than it has received in the past in climate change projections. Hopefully then the next report of the Intergovernmental Panel on Climate Change (IPCC) will be more attentive to the Himalayas. In the panel's 2007 report the Himalayas were barely mentioned.

Maps of Asia show the changes in temperature and precipitation from South Asia to the Polar Sea, but it is difficult to identify the great barrier of the Himalayas. The HKH region is often considered to be a 'white spot', meaning that the existing data are insufficient for climate modelling or for making any meaningful predictions about the future. The consequences are very clear: if the HKH countries do not improve their efforts towards transboundary cooperation, then they will miss out on integration into the

Figure 1: **Map of the Hindu Kush-Himalayan region – proposal for four north-south transects and seven transboundary landscapes from the arid mountains in the west to the humid mountains in the east (for an explanation see the text)**



global science community which is carrying out research into global and regional climate change.

In examining Figure 1, one obvious question is what can be done about the big gaps between different transects? Exhaustive coverage with field stations and field studies throughout the whole of the Hindu Kush-Himalayas is not possible at this point. Nevertheless, if well-equipped test sites are established and thorough research on them is carried out, remote-sensing methods and techniques can be used to apply what is learned at these test sites to the spaces in between, and the results can be calibrated with the knowledge gained about the test sites. This approach will need transboundary cooperation and the involvement of all the countries bordering the seven transboundary landscapes and four transects. In the case of the Wakhan, the countries involved are China, Afghanistan, Pakistan, and partially Tajikistan; for the Karakoram the countries are Pakistan and China; for Nanda Devi-Kailash the countries are India, China, and Nepal; for Everest the countries are Nepal and China; for Kangchenjunga the countries are Nepal, India, China, and Bhutan; for Brahmaputra-Salween the countries are India, China, and Myanmar and, for Cherrapunjee and Chittagong, the countries are India and Bangladesh.

A proposal for a local-scale concept

Global and regional climate change projections are very generalised, and it is difficult to downscale the results to the level of a valley or village, especially in mountain areas. We can assume, however, that there will be further increases in temperature and in extreme events. If we want to examine the impacts these changes will have on a certain place or village and its inhabitants, it will be essential to understand the relationship between the natural environment and the human system. One interesting example was developed for the village of Bagrot in the Karakoram in 2003 (see Figure 2). The researchers, Winiger and Börst, studied climate and hydrology, irrigated and non-irrigated land-use systems, and the altitudinal belts where summer and winter grazing took place. Summer grazing is limited at higher altitudes by increasing freezing conditions and at lower altitudes by increasing arid conditions. Based on the knowledge acquired, the potentials and limitations could be evaluated, and certain changes in the natural and human systems could be integrated and used for projection into the future, for example, what are the consequences of melting glaciers, shorter periods of snow cover, and changing precipitation and runoff; and what are the impacts on vegetation and biodiversity?

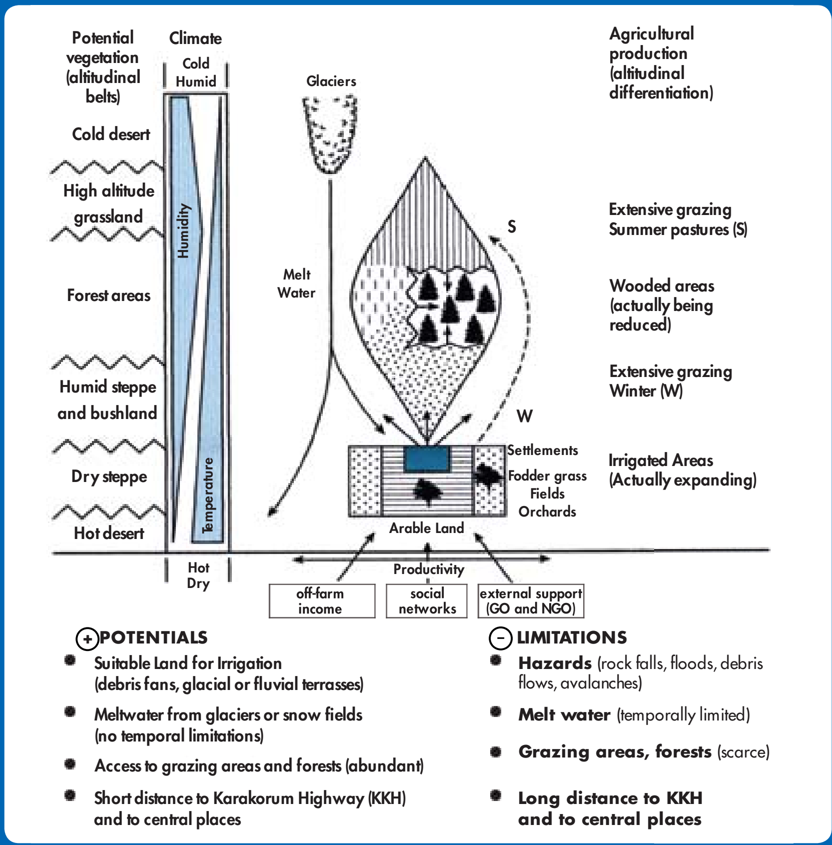
These would make useful indicators and guidelines for test sites as this kind of information if brought from regional knowledge centres can be reflected on a local scale and then observations on a local scale can be transmitted back to regional institutions. This is extremely important in light of the big gaps between the different transects. Observations from local places outside a test site can be calibrated and advice given back to the local communities outside based on an analysis of these observations.

Global support to regional and local initiatives

GCOS is a common undertaking of the World Meteorological Organisation (WMO), the United Nations Educational, Scientific, and Cultural Organisation (UNESCO), the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU). It has already commenced work and gauging stations have also been designated by the countries of the HKH region; and this is gratifying to note. Six countries have stations above 1,000 masl; China has a total of 33 stations of which 10 are above 1,000 masl (some above 3,000 masl); India has 21 stations with 4 above 1,000 masl (some above 2,000 masl); Myanmar has 3 stations but none above 1,000 masl; Nepal has one station at 1,000 masl; and Pakistan has 6 stations, 2 of which are above 1,000 masl. The precise locations are not given, but it can be assumed that several of these stations are planned for the HKH region.

In the agreement between GCOS, the World Meteorological Organisation (WMO), the Intergovernmental Oceanographic Commission of UNESCO (IOC), UNEP and the International Council for Science (ICSU), it was decided that the essential climate variables would be for the atmosphere: temperature, precipitation, air pressure, surface radiation budget, wind speed and direction, and water vapour. The composition of the air in terms of carbon dioxide, methane, ozone and aerosols will be measured. The terrestrial variables will include: river discharge, water use, ground water, lake levels, snow cover, glaciers, permafrost, land cover, fraction of absorbed photosynthetically active radiation, biomass, soil moisture, and fire disturbance. If all of these different variables could be measured, it would mean that a substantial amount of basic data on land use and biodiversity could become available, even across political borders. This would herald a new era in research for development in the HKH region. Realistically, however, this will be a long process.

Figure 2: **Conceptual analysis of the village of Bagrot in the Karakoram, Pakistan – Vertical arrangement of natural vegetation and agricultural productivity**



This basic knowledge is an important tool for observing and measuring future environmental changes (slow trends and extreme events) in order to understand and disentangle natural and human driving forces and to prepare the necessary adaptation measures in time. For further explanation see Winiger and Börst (2003).

Difficult political decisions have to be made, these stations will be very expensive, and their satisfactory functioning will depend on highly-qualified staff. Therefore, it is extremely important that, initially, the measuring programme introduced for developing countries is kept within realistic limits. By concentrating our focus, reliable and comparable climatic data can be derived from these mountain systems which are of utmost importance for their natural resources (especially water resources). Currently 13 countries have selected a coordinator and a certain amount of progress has been made in planning their national networks: China is one of these countries. To date 142 countries have nominated focal points, i.e., institutions or personalities responsible for cooperating with the global programme.

Of special interest is the planned cooperation between GCOS and the Global Earth Observation System of Systems (GEOSS) to intensify the continuous observation of the surface processes of the Earth. This could open up new possibilities for surveying the big open spaces between the transects and test sites: let us keep in mind that both programmes, GCOS and GEOSS, particularly emphasise the application of their results to weather, agriculture, water, energy, biodiversity, and climate change. Needless to say biodiversity is also included.

Interaction and cooperation in the HKH region is both a challenge and an opportunity. Interaction means participating in global and regional programmes (macro level) and undertaking the responsibility for downscaling observations and experiences to lower levels (meso and micro levels) to the greatest extent possible. On the other hand, the leading persons or institutions at the local level will be responsible for scaling up their observations and experiences to higher levels. Cooperation means the exchange of data and experts across borders, because mountains and their adjacent lowlands are units that cannot be separated. This is the way forward – a way that will help to avoid serious conflicts in future and to reap benefits of mutual collaboration.

References

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