

Climate change impacts on the water resources of the Indus Basin

Capacity building, monitoring and assessment for adaptation

The Indus Basin

The Indus basin covers an area of about 1,140,000 sq.km. A large part of the upper basin lies within the Hindu Kush, Karakorum, and Himalayan mountains; Afghanistan, China, India, and Pakistan share the basin territory. Glaciers are a major landscape feature of the region. One third of the upper Indus basin lies above 5000m and a large part of this is glaciated: an estimated 15,000 sq.km within Pakistan alone, equivalent to some 2,750 cu.km of ice reserves. Snow and glacial melt contribute more than half of the annual average flow of the Indus River and around 50% of its tributaries.

Irrigation is the backbone of the agricultural system in the basin and agriculture is a major contributor to local economies; in Pakistan, 22% of the GNP is contributed by agriculture. The Indus basin irrigation system in Pakistan is the world's largest; estimates suggest that snow and glacier melt contribute more than 50% of the total flow to this system. During the dry season the flow from the mountains is particularly important, accounting for all the total flow in the uppermost parts of the catchments. The basin is already water stressed. In Pakistan about 13 million ha of cultivable land remains barren because of water shortage.

Climate change is already impacting the glacial regime in the basin. There is a general condition of glacial retreat. Although some cases of glacial advance have been reported in the high Karakorum, it is not known if these are the result of accumulation of ice mass or simply reorientation of glacial structure under a changed thermal regime. There is a great need to fill the gap in this basic understanding. Further, it is of utmost importance to assess the impacts of glacial dynamics on water availability in the region. Agriculture and other economic activities rely heavily on water, and changes in water availability can have serious impacts on the lives and livelihoods of the millions of people living in the Indus basin.



Irrigation is lifeline for arid regions. The lush greenery is the result of an extensive network of canals.



Lack of water in the canals due to glacial fluctuation resulted in complete abandonment of this village in Hunza, Pakistan.

The Indus Basin Initiative

The Indus basin initiative has been developed to help provide the basic information needed to support wise decision-making and planning to ensure water availability. In the long-term, the initiative aims to contribute to a safe environment and reliable access to water for household consumption, food production, power generation and other sectoral usages in the Indus Basin.

The immediate aim is to support detailed monitoring of snow, ice and water resources in the region through capacity building and establishment of appropriate systems. The information gathered is intended to help inform policy and decision makers, as well as scientists, and the public at large, in the region and beyond, about the status of ice and water resources in the Indus Basin and its impact on water availability and water induced hazards. Local communities and stakeholders can then be trained in risk management and approaches and techniques for climate change adaptation.

The specific objectives of phase one are to

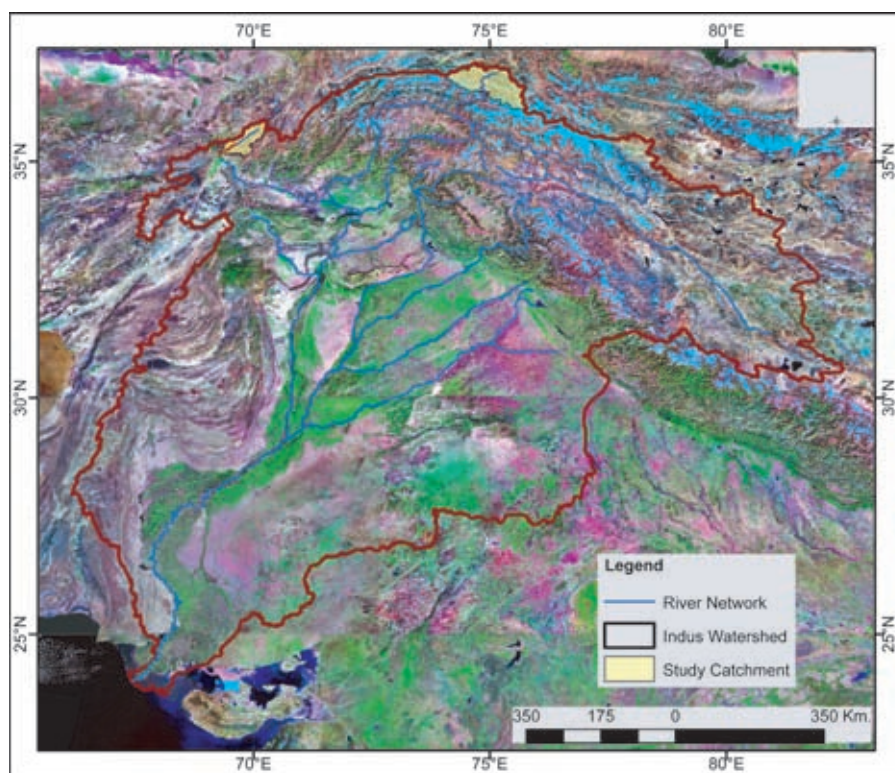
- establish systems for monitoring the status and changes over time of snow, ice, and water resources in selected pilot catchments in the basin;

- build the capacity of relevant key national institutions to monitor snow, ice, and water resources using remote sensing and field-based techniques;
- develop water availability scenarios for the Indus Basin, based on the enhanced database and using state-of-the-art models and techniques; and
- promote awareness and use of the advanced knowledge base on the status and changes of snow, ice, and water in the basin.

Initial Phase

The initial phase of the project will last for two years supported by the German government through German Technical Cooperation (GTZ) and the Asian Development Bank (ADB). Activities will focus on Afghanistan and Pakistan and include the following:

1. Compilation of knowledge and information about the snow, ice, and water resources in the Indus basin. Review studies carried out on climate change and its impact on the water resources in the basin. Map the institutions involved and their available capacity and gaps. Develop partnerships with relevant stakeholders and facilitate a dialogue among them.



Map of the Indus basin



Snow and glaciers: lifeline of the Upper Indus Basin

The snow fields and glaciers that dominate the landscape of the upper Indus Basin are the basis of life for the people of this arid region. Melted snow and ice is their only significant source of water.



Over many years, local communities have developed a specialised system of irrigation, often drawing water directly from the glacier edge.



The irrigation system is crucial for agriculture. If the system fails, if the glaciers disappear or retreat, the fields dry up. Without water, people are forced to abandon their land and their homes and resettle elsewhere (front page).



2. Build the capacity of relevant partners in monitoring of snow and ice resources and assessment of future water availability scenarios using climate projections and hydrological models at pilot scales. This involves setting up of pilot hydrometeorological monitoring stations, glacier mass balance surveys, and assimilation of the hydrometeorological data from the older historical network. Training on hydrological modelling, glacial mass balance survey, remote sensing and GIS-based monitoring of snow and glaciers, and various on-site field measurements will be provided as part of the initiative.
3. Disseminate the results of the pilot study to a wider audience; these results will form the basis for scaling up the programme.

Future of the Indus Basin Initiative

ICIMOD's overall concept for the initiative focuses on covering the entire mountain region of the Indus basin, by bringing China and India into the project and carrying out activities similar to those in Afghanistan and Pakistan. Efforts are being made to secure funds from the regional member countries and multi- and bilateral donors to expand the geographical area of the project and continue it in the whole basin for at least five years. This will enable tangible results to be obtained and ensure that the national institutions are sufficiently strengthened. Transboundary collaboration and exchange of experience will be fostered among implementing agencies and scientists working in the field of monitoring of glacial, snow, and water resources. The aim is to facilitate assessment of the current status of these resources, as well as possible future impacts of climate and other global changes on the availability of water resources and on water induced hazards. After the initial focus on improved assessments, the focus is likely to move towards community-based risk management and strengthening adaptation to climate change.

Project Partners

The partners in the present phase of the initiative are

Afghanistan: Ministry of Energy and Water; Kabul Polytechnic University; Kabul University; Ministry of Agriculture, Irrigation and Livestock; Meteorological Department, Ministry of Aviation and Transport; and National Hydrological Committee for Afghanistan

Pakistan: Ministry of Environment; Water and Power Development Authority; Pakistan Meteorological Department; Water Resources Research Institute; Global Change Impact Study Centre and Space and Upper Atmosphere Research Commission; and International Union for the Conservation of Nature (IUCN) Pakistan

ICIMOD is working in close collaboration with several other government and non-government international organisations and academics working on related topics in Afghanistan and Pakistan; and has conducted initial discussions regarding the future of the Indus Basin initiative with several institutions in China and India.

Supported by



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