

“Mountains, Climate Change and Water Security”

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High mountain regions provide the source waters for vast downstream populations. The juxtaposition of cold high precipitation catchments in mountains and low precipitation in downstream lowlands means that mountain water supplies support over half the world's population and sustain most irrigation agriculture. Most downstream communities are supported by mountain water from one river source. How secure is this mountain water? There are several complex aspects of its security. First, mountain cultures, economies and political institutions are often different to those downstream and so transboundary water issues arise in many parts of the world and treaties that deal with conflict between source area and downstream users are vastly important to supporting water security. Second, irrigation and other consumptive downstream use of water has put immense pressure on mountain water supplies- many mountain rivers are largely depleted by consumption before reaching the sea. But excess water from these rivers carries its own risks. Downstream communities are often located in the flood plains of mountain rivers, making them subject to the extreme hydrometeorology of the headwaters. Third, climate change is disproportionately warming high mountain areas and the impacts of warming on water are magnified in high mountains because seasonal snowpacks, perennial snowfields and glaciers form important stores of water and control the timing of release of water and the seasonal and annual discharge of major mountain rivers. Changes in mountain snow and glacial regimes are rapidly occurring in many parts of the world and this is already impacting downstream water security by changing flood risk, changing the timing of streamflows and changing the volume of streamflow. There are important regional variations and substantial uncertainty in whether changes are due to changing precipitation patterns, earlier snowmelt or greater glacial wastage. These shifts have sometimes required changing downstream water management. Future changes to climate are expected to dramatically change the timing and quantity of mountain waters and so impact the water security of downstream societies. The International Network for Alpine Research Catchment Hydrology (INARCH) project of the World Climate Research Programme contributes to the UNESCO International Hydrological Programme and is attempting to quantify water resiliency and risk in mountain headwaters so as to better assess the water security of downstream regions.