

## **Mountain risks in downstream water resource management in Upper Bhagirathi basin, Indian Himalayas**

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**Abstract** Mountainous areas tend to be prone to a wide range of potentially hazardous geomorphic and hydrological processes, such as rock falls, landslides, debris flow, soil erosion, snow avalanches, flash floods and cloudbursts on higher ridges. Risk assessment is carried out by evaluating the vulnerability and types of hazards existing in the region. The Upper Bhagirathi basin, particularly between Uttarkashi town and Gaumukh, has been selected. A separate hazard map was drawn and superimposed using the GIS technique. The main basin and areas close to the road in Upper Bhagirathi basin lie in the category of very high risk zone. The regions along tributaries of the Bhagirathi River, and away from the national highway, lie in the moderate risk zone. The increasing intensity of anthropogenic activities may contribute to the fragility and the vulnerability to flooding and challenges to downstream water resource management. The afforestation programme should be promoted on the vulnerable slopes to mitigate the risks.

**Key words** mountain risk; downstream water management; Bhagirathi basin, Himalayas, India