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Field Observations from the Pindari Valley, Kumaon Himalaya, India

Anup Upadhyaya, PhD

Centre for Ocean, River, Atmosphere and Land Sciences (CORAL),
Indian Institute of Technology (IIT) Kharagpur, West Bengal, India 721302
upadhyaya.anup@gmail.com



1. Motivation and Field Context

The Himalayan glaciers form the largest body of ice outside the polar regions and act as a source to a few of the largest river systems in Asia, with a glacier area of $\sim 33,000 \text{ km}^2$ (Dyurgerov and Meier, 1997). Glaciers and ice sheets worldwide are shrinking and have been a major cause of sea level rise, contributing approximately $29 \pm 13\%$ from 2003 to 2009 (Gardner et al., 2013). The snow-melt runoff is the source of around 30 to 50% of the annual flow of all the rivers emanating from the higher Himalayas (Aggarwal et al., 1983).

In November 2021, I set out along with two helpers up the Pindari Valley in the Kumaon Himalaya of Uttarakhand. My aim was to reach the Pindari Glacier, and although I did not finally stand at its snout, the journey became a firsthand encounter with the mountain hazards that I study as a researcher. Pindari Glacier ($30^\circ 16' 5''$ – $30^\circ 19' 10''$ N and $79^\circ 59' 00''$ – $80^\circ 01' 55''$ E) is located in the Kumaon region of the Central Indian Himalayas. It has a length of about 9 km, and the location of its snout is recorded at $80^\circ 00' 29''$ E and $30^\circ 16' 28''$ N. According to a recent study, the snout position of the Pindari Glacier has retreated by ca. 1.5 km from 1976 to 2014 (Pandey et al., 2018).

2. The Route and Rising Landscape: Observations of Slope Instability

From the roadhead, I travelled by shared vehicle to the start of the trail, and from there the walking began. The route led through Khati to Dwali, then up to Phurkia, and onward toward Zero Point, which is the last point before the glacier. The trek to Khati is about six kilometres, and even there my lungs were already working hard. The real climb came between Dwali and Phurkia, which was uphill almost the whole way. The thinning oxygen as I gained altitude impacted my climb, and we halted often, not only to rest but to take in the views around. Midway up the trek, the end of the treeline could be seen. Grasses became more abundant, with patches of rhododendron marking the higher slopes. Phurkia sits at almost ~ 3200 metres above sea level, and by evening the temperature



there fell to around four degrees. It was only during the trek that I realised how high-altitude mountain life looks attractive from the cities and on screens, but is difficult in reality.

The Pindari valley carries clear marks of past disasters such as damaging landslides and debris flows. Due to multiple episodic high-magnitude events such as the Chamoli disaster (Shugar et al., 2021), many rivers, including the Pindar River, became severely disturbed, and this was evident all the way to Dwali. The initial descent toward the river brought me down to its level, and the scars along its course were hard to miss. The trail itself repeatedly crossed unstable ground. At more than one point the path narrowed to a very thin road filled with sand, pebbles and boulders, while the other side fell away in a steep slope. It was a scary moment indeed. The steep mountains, bare of vegetation and coloured by loose material, look genuinely unstable. These sections show how active the slope processes are along the valley, and how exposed a mountain trail can be to rockfall and sliding debris. For a valley that carries a steady flow of trekkers and pilgrims, this exposure is not a small matter. Near Zero Point the instability became severe. On the day I attempted that final stretch I met a series of landslide points across the trail. I managed to cross the first with support. The second was a little more frightening than the first. The third was the most difficult of all. There was no trail left, only a slope of pebbles and sand, with a faint lane visible across it. My heart pounded and my legs began to shake.

Along the way I spoke with a local companion who had known this landscape for many years. By his account the snow cover has decreased drastically over the years, and the glacier snout has retreated significantly within his own lifetime. This was his impression rather than my own measurement, and I record it as such. It is broadly consistent with the published retreat of about ~1.5 km between 1976 and 2014 (Pandey et al., 2018), though the exact rate deserves proper study before any firm figure is stated. Even so, standing before the snow-clad peaks at the head of the valley, with the bright sun falling on them, it was easy to understand why the loss of that snow matters so much to the rivers and the people downstream. The steep mountains with so little vegetation can seem forbidding, yet the snow-clad peaks under sunlight tell an altogether different story. It is this contrast, between a fragile high mountain environment and the communities that depend on it, that gives the region its urgency for a hazards researcher.

The upper valley is also a lesson in remoteness. Khati is a small village of roughly seventy five houses and about five hundred and fifty people. There is a single school up to class twelve, and

the nearest college and a proper medical hospital lie about two hours of trek, followed by a further cab ride, away. One government medicine shop exists, stocked only with the most basic medicines. In the absence of a mobile network, people speak to the next village over walkie-talkie.

This remoteness matters for hazard and disaster planning. In a valley marked by slope instability, river disturbance and glacier change, the same isolation that gives these villages their calm also leaves them exposed. Access is slow, help is far, and communication is limited. Understanding vulnerability in the Himalaya means understanding this everyday distance between mountain communities and the services that a sudden hazard would demand.

3. Conclusion and Turning Back: A Reflection



Figure 1. DGPS survey conducted about six kilometres before Zero Point.

At the third and worst landslide crossing near Zero Point, I finally decided to turn back. The decision was not simply about fear. The slope ahead offered no stable trail, only loose pebbles and sand crossing a steep face. Pindari Glacier was only about six kilometres ahead, but the crossing was simply too unsafe to attempt. It was a hard choice after so many days of climbing, yet it was the right one, and in hindsight it is the clearest lesson of the whole trek.

I was carrying a DGPS to measure the glacier snout and to conduct glaciological studies. As I could not reach the Pindari Glacier, I instead carried out the DGPS survey at the point where I



turned back, roughly six kilometres before Zero Point. The hazard was real enough to force me to turn back. That is precisely the point. As someone who studies glacial lake outburst floods and slope instability from data and models, walking this valley on foot gave me a direct sense of the terrain behind those datasets. The thin trails, the disturbed river, the retreating snow and the active landslide sections are not abstract layers on a map. They are the lived surface of a fragile mountain system. Reconnaissance of this kind, even when it stops short of its goal, sharpens the questions a researcher brings back to the desk.

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