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JOSHIMATH: A VICTIM OF THE HIMALAYAN DEVELOPMENT MODEL

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A resident sits next to a cracked wall of her house at Joshimath in Chamoli district of Uttarakhand state on January 8, 2023. | Photo Credit: AFP

It is now clear that all warnings in the Mishra Committee report almost 50 years back went unheeded in the race to develop Joshimath by successive governments since 2001. It was clearly pointed out that Joshimath township is situated on debris of earlier landslides and would slip someday.

But development continued at a rapid pace with heavy construction activities such as initiating small hydro power projects at Tapovan and Rishi Ganga, tunnelling, road widening and mushrooming of buildings with scant regard to safety to accommodate increased tourist inflow, and disappearance of the green cover in the region. All elements of a disaster were primed and only a trigger was needed to initiate the crisis.

That trigger was provided by nature in February 2021 when a catastrophic flow of rock and glacier ice mass descended into Rishiganga and Dhauliganga valleys and flowed into Alaknanda river at Joshimath. This extraordinary mass flow of mobile debris that contained boulders greater than 20 metres, scoured the valley walls up to 200 metres. On the way, the half-finished Tapovan dam was washed away and the tunnel was inundated with water. The strong and violent flow sufficiently eroded the base of hill slopes in Alaknanda valley in Joshimath.

In a recent study, scientists from the Indian Institute of Remote Sensing, Dehradun, observed that Joshimath and the surrounding areas have been sinking at a rate of 6.5 cm (2.5 inches) per year based on satellite data from July 2020 to March 2022. Their findings correlate well with the base erosion of Joshimath slope along the Alaknanda river.

The impact of the event was such that at Kanpur, at a distance of about 900 km from Joshimath, an unprecedented spike (80 times higher) in suspended sediment (turbidity) was observed in a canal that draws directly from the Ganga, making this event the most likely candidate for triggering the present subsidence in Joshimath. Only two events in the past can rival this incident — the 1970 Huascarán avalanche in Peru and the 2013 Kedarnath flash flood in Uttarakhand.

Land subsidence along slopes happens due to displacement of underground material under the

influence of two important factors of gravity and water action. It is a geohazard in the mountainous region controlled by a variety of subsurface displacement mechanisms that are not very well understood.

Since the displacement mechanisms happen below the ground, their progression to the point of surface deformation can only be speculated. In nature, these processes evolve over a long period of time, and some of the significant evidence may lie outside the area of the subsidence zone. It is also possible that multiple conditions and processes come into play leading to subsidence on slopes.

In the case of Joshimath, evidences strongly suggest that certain subsurface processes such as the removal or rearrangement of subsurface materials to produce void space or significant volume reduction-solution, underground erosion, lateral flow, and compaction could have been set in motion or accelerated by construction activities. One such incident could be the reported puncturing of an underground aquifer during a tunnel boring close to Auli, discharging substantial amounts of water in December 2009. But a long-term scientific investigation to comprehend the complex processes is needed to prove the causality of this incident to subsidence.

In addition, there are several other geological evidences observed in the field around Joshimath that suggest a reduction in the shear strength of the debris leading to subsidence. These evidences are weathered and highly jointed strata, freeze-thaw cycles runoff from mountain top along vertical joints or cracks during rains, perched water tables and seeps, groundwater manipulation, and irrigation.

The Joshimath tragic event raises pertinent questions on the accelerated push by the government on clean energy and national security. While the intentions are well-meaning, risks associated with rapid expansion of hydropower or other infrastructure developments in the fragile environment of Himalayas, need to be understood. Any action without understanding the cause and effect of mountain hazards would be detrimental to the cause.

The stress should be on environment and conservation for a sustainable development in the Himalayas without ignoring human sufferings and emerging socioeconomic impacts the developments cause.

The Joshimath tragedy is just unfolding and has already caused great misery to local people in terms of displacement and economic losses. The government should speed up the process of resettlement as the consequences arising out of an earthquake at this time or heavy rains predicted in the region could be catastrophic.

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