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Premium

Explained: Danger from landslides

Cyclone rain-triggered landslides in the Northeast spotlights need for building resilience to multi-hazard disasters. About 13% of India's area, spread over 15 states and four Union Territories, is prone to landslides

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Rescue workers and officials inspect the damaged area after a stone quarry collapsed in Melthum near Aizawl, on Tuesday. (Photo: AP)

Six people were killed in West Bengal in incidents triggered by cyclone Remal that struck the coastline on Sunday night. At least 27,000 houses were damaged in the coastal districts. Though effective early warning systems and timely evacuations have greatly reduced human casualties from cyclones over the years, a few deaths of accidental nature, and destruction of thatched or weak structures in coastal areas are possible.

But Remal has led to largescale damage in the relatively faraway Northeast as well. Heavy rain caused by the cyclone triggered landslides in several places in Meghalaya, Mizoram, Assam, and Nagaland, which have resulted in the deaths of at least 30 people so far. The collapse of a stone quarry in Aizawl, Mizoram, alone has killed at least 14 people. The toll is expected to rise.

The heavy downpour in the Northeast was not unexpected. The India Meteorological Department (IMD) had warned of this in all its cyclone bulletins. Almost the entire region, including Sikkim and northern West Bengal, is landslide prone. Cyclone-triggered landslides have hit Northeastern states on earlier occasions as well. Cyclone Aila had caused landslide events in this region in May 2009.

The latest episode spotlights the need for building resilience to multi-hazard disasters. One event can trigger another, and can lead to multiple disasters simultaneously. Over the last few years, India has witnessed events in which heavy rainfall has resulted in a breach of glacial lakes, causing flash floods that have resulted in landslides and flooding. Massive power outages, transport and communication failures, disruption of health services, and difficulties in rescue and relief operations have followed.



Rescue work underway after a stone quarry collapsed amid heavy rain in the aftermath of Cyclone Remal, in Aizawl district on Tuesday. (PTI Photo)

Although India has done well to prepare and safeguard itself against certain natural events such as cyclones, landslides remain a weak point. An early warning system is still being tried out, and pressures from population, development, and infrastructure projects have increased vulnerability.

Landslide vulnerability

About 0.42 million square km of India's landmass, or about 13% of its area, spread over 15 states and four Union Territories, is prone to landslides, according to the Geological Survey of India (GSI).

This covers almost all the hilly regions in the country. About 0.18 million square km, or 42% of this vulnerable area is in the Northeastern region, where the terrain is mostly hilly.

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This area is also prone to earthquakes, which too, are a major trigger for landslides.

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Government data show that between 2015 and 2022, the eight states in this region, including Sikkim, recorded 378 major landslide events which resulted in loss of life or damage to property. These events constituted 10% of all major landslides in India during this period. In the country as a whole, Kerala saw the largest number of landslides — 2,239 — most of which occurred after the disastrous 2018 floods in the state.

The National Disaster Management Authority (NDMA) has been working with GSI and other agencies to mitigate and manage the risks from landslides. A National Landslide Risk Management Strategy was finalised in 2019, which talked about vulnerability mapping, identifying the most vulnerable locations, development of

an early warning system, and preparation of mountain zone regulations. But most of the work still remains to be done.

Early warning

Some early warning systems have been developed and deployed on a trial basis at a few locations. These warning systems are linked to rainfall forecasts from IMD. The rainfall prediction is combined with soil and terrain information to calculate whether it is likely to result in displacement of land.

“Most landslides in the hilly regions are caused by heavy rainfall. Earthquakes can trigger landslides too, but we do not see that very often. In the Northeastern region, for example, no major landslide has been triggered by an earthquake in the last one or two decades,” Debi Prasanna Kanungo, a scientist at Central Building Research Institute (CBRI), Roorkee, said.

“In any case, since earthquakes themselves cannot be predicted, we cannot have a landslide early warning based on earthquakes. But rainfall-based early warning systems for landslides seem to work well,” Kanungo added.



Rescue work underway after a stone quarry collapsed amid heavy rain in the aftermath of Cyclone Remal, in Aizawl district on Tuesday. (PTI Photo)

Kanungo has been involved in setting up an early warning system in Nagaland to protect the state's legislative Assembly. However, as of now, only a few of these location-specific early warning systems have been deployed.

CBRI and IIT Roorkee are in the process of installing these at two locations in Sikkim, another two in Uttarakhand, and one in Kerala. Other institutions like IIT Mandi are also working to develop and set up early warning systems.

Rainfall forecasts, on the other hand, come quite early. Reliable location-specific predictions are available at least a day in advance. Scientists create a rainfall threshold for land movement and soil displacement at each landslide-prone location. If the rainfall forecast is higher than the threshold, an early warning for landslides is issued.

“Usually, a single day's rainfall does not trigger landslides, unless there is a cloudburst event. Sustained heavy rainfall over a week or 10 days is what becomes

dangerous,” Kanungo said. A prolonged spell of heavy rain in Himachal Pradesh last year resulted in almost 500 landslide events.

Human pressure

The risk from landslides has been exacerbated by the failure to remain mindful of the terrain’s ability to withstand the load. Many hilly areas do not have building regulations. Often, regulations are not implemented effectively. New constructions, infrastructure development, and even agricultural practices can increase the risk of landslides.

“Every mountainous area has a carrying capacity. Development is essential, and one cannot stop the creation of infrastructure or new facilities or economic activity for local populations. But these have to be regulated. Sustainability has to be factored in, so that the load does not exceed the carrying capacity. This is where zoning regulations come in. These have to be finalised and implemented strictly,” Kanungo said.

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