

**03– 08 – 2024**

**News:** Wayanad landslide

- Recently, the Wayanad district of Kerala has witnessed one of the most devastating landslide-related disasters due to extreme rainfall and fragile ecological conditions.
- The district received over 140 mm of rain in 24 hours, surpassing expectations.

## **Landslide**

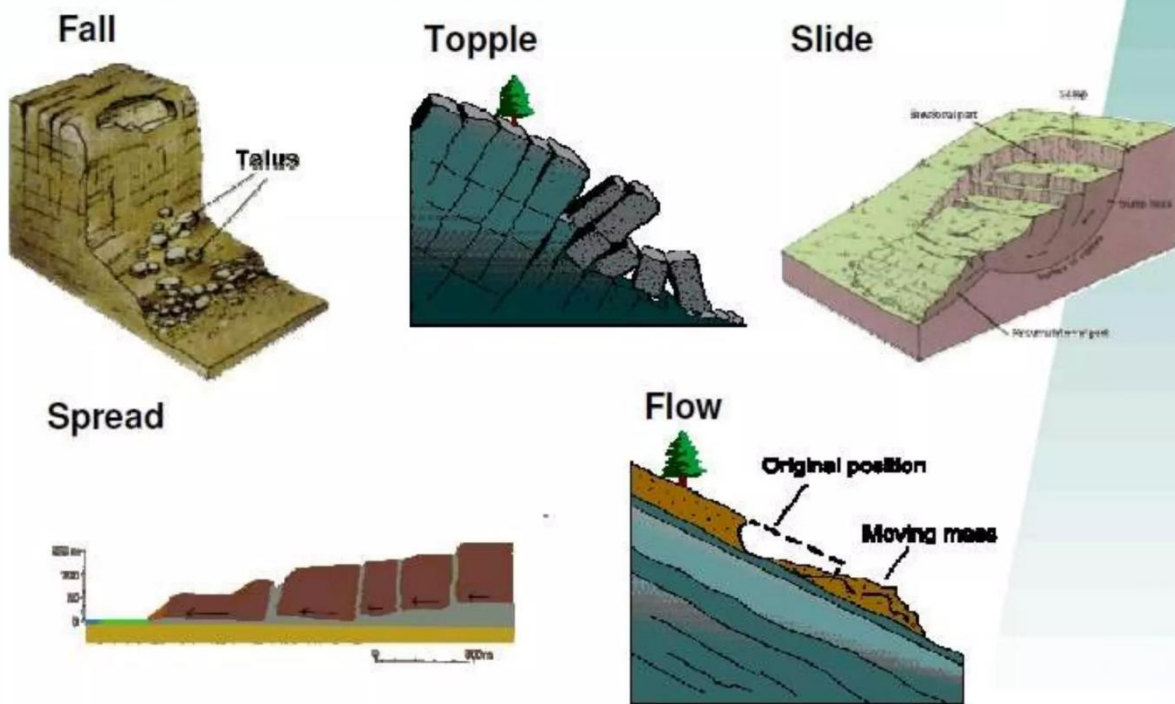
- A landslide is the downward movement of rock, soil, and debris on a slope, ranging from small shifts to large, destructive events.
- It can occur on natural or man-made slopes and is triggered by factors like heavy rainfall, earthquakes, volcanic activity, human activities, and changes in groundwater levels.

### **Types**

- **Slides:** Movement along a rupture surface, including rotational and translational slides.

- **Flows:** Soil or rock mixed with water moving like a fluid, such as earth flows, debris flows, mudflows, and creep.
- **Spreads:** Lateral extension and cracking of the mass, often due to liquefaction.
- **Topples:** Forward rotation and free-fall from a vertical or near-vertical slope.
- **Falls:** Detachment from a steep slope or cliff, descending by free-fall, bouncing, or rolling.

## Types of landslides



## Landslide Atlas of India by ISRO

- India is among the top 5 landslide-prone countries globally.
- Others are China, US, Italy and Switzerland.
- In India, about 0.42 million sq. km (12.6% of land area) is prone to landslide hazard.

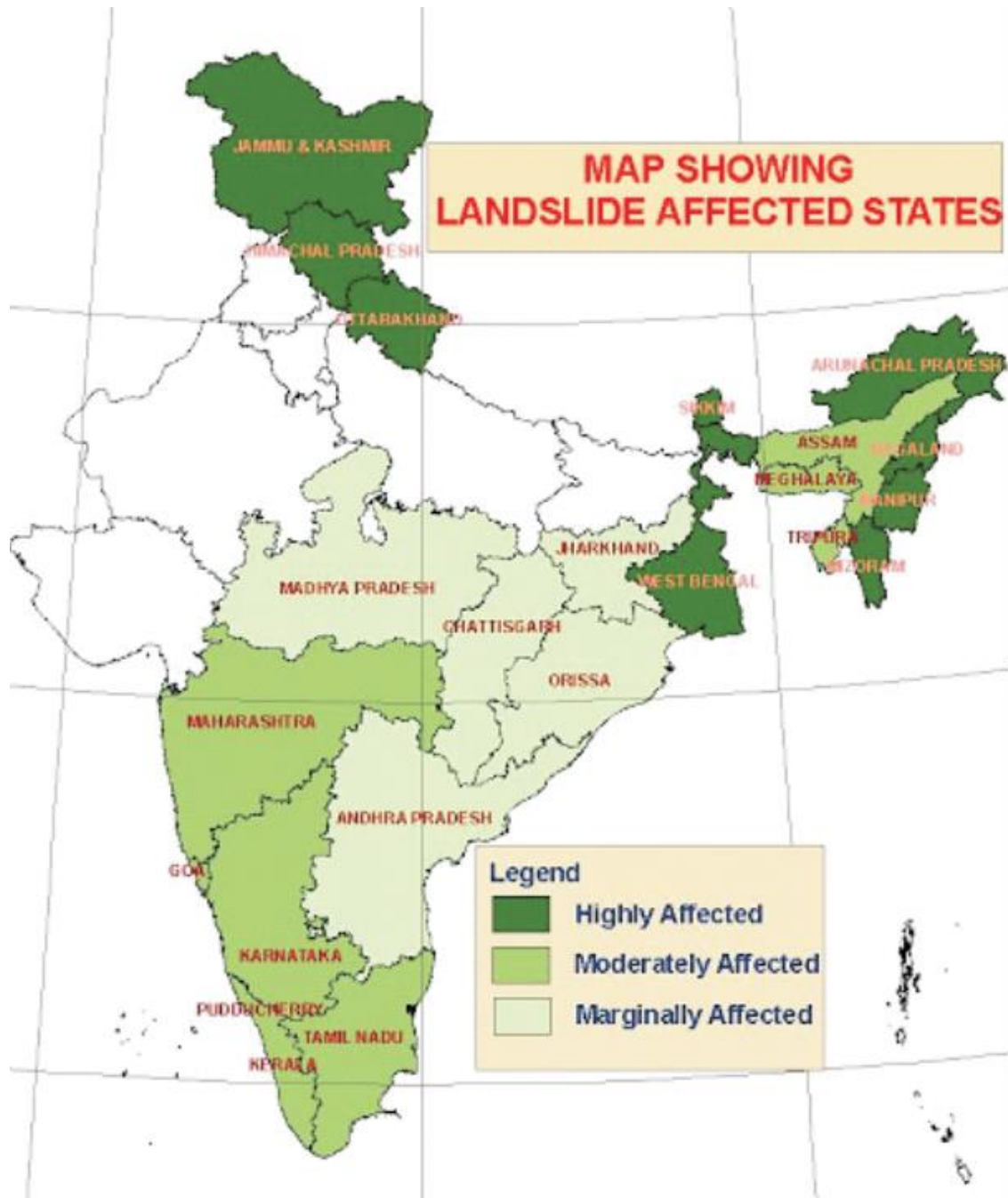
Reported landslides in India are distributed as follows:

- 66.5% in the Northwestern Himalayas.
- 18.8% in the Northeastern Himalayas.
- 14.7% in the Western Ghats.
- As per the Geological Survey of India, the economic loss due to landslides may amount to as much as 1% to 2% of the Gross National Product (GNP) in many developing countries.

## \Major Landslide-Prone Areas in India

- The Northeastern Region (comprising about 50% of the total landslide-prone areas).
- Uttarakhand, Himachal Pradesh, and Jammu & Kashmir along the Himalayas.
- Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu along the Western Ghats.

- The Araku region in Andhra Pradesh along the Eastern Ghats.
- Nearly 17,000 sq km of area in Kerala, mostly on the western side of the Western Ghats, is mapped as landslide-prone.



## Causes of Landslides

- **Gravitational Forces:** These are the primary cause of landslides, constantly pulling materials on slopes downward.
- When gravity exceeds the shear strength of geomaterials like rocks, sand, silt, and clay, the slope fails, resulting in the downhill movement of these materials.

## Natural Triggers

- **Rainfall:** Prolonged or intense rainfall increases soil water content, reducing cohesion and adding weight to slopes, making them more prone to failure.
- The terrain in Wayanad has two distinctive layers: a soil layer atop hard rocks. Heavy rainfall saturates the soil with moisture, weakening the force binding the soil to the rocks, triggering landslides.
- Also, the recent warming of the Arabian Sea has led to deep cloud systems and extremely heavy rainfall in the Western Ghats, heightening landslide risks. Climate change has also shifted the rain-bearing belt, increasing convective rainfall in southern regions like Wayanad.
- Convective rainfall occurs when heated air from the earth's surface rises upwards with water vapour, condensing at higher altitudes. The clouds carrying the water vapour are not carried away by wind, resulting in rainfall at the same place.

- **Earthquakes:** Earthquakes destabilise slopes by shaking the ground and weakening the structural integrity of geomaterials, especially in tectonically active regions like the Himalayas.
- **Erosion:** Natural processes such as river or wave action can erode the base of slopes, undermining their stability. Coastal areas are particularly susceptible to landslides due to wave-induced erosion.
- **Hydrological Factors:** Groundwater movement can contribute to landslide risk. Water can seep through porous materials, increasing pore pressure and reducing effective stress, thereby weakening the slope.

### **Anthropogenic Influences**

- **Deforestation:** This has removed vegetation, destabilising slopes by eliminating tree roots that provide natural reinforcement and water drainage.
- **Construction and Land Use Changes:** Activities such as mining, road construction, and urban development have disrupted natural drainage and load distribution, increasing landslide risks.
- Also, historical deforestation for agriculture and tea plantations by Britishers has weakened soil stability, making the region (western ghats) more prone to landslides during heavy rains.

- **Infrastructure Development:** Tourism and infrastructure development, including resorts, artificial lakes, and construction activities, have intensified land pressure and disrupted natural drainage, increasing landslide risks.
- **Geological Factors:** Geological factors, such as the composition, structure, and weathering state of materials, significantly affect slope stability.
- The Western Ghats have a fragile ecology with steep slopes and dual-layered terrain, making them prone to landslides when rainwater saturates the soil, increasing its weight and reducing stability.
- **Defunct Quarries:** The presence of quarries in the vicinity, even after they have ceased operations have also contributed to soil destabilisation as the vibrations and shockwaves from these activities could weaken the geological structure, making the area more prone to landslides during heavy rains.