Himalayan Disasters – A Warning for India

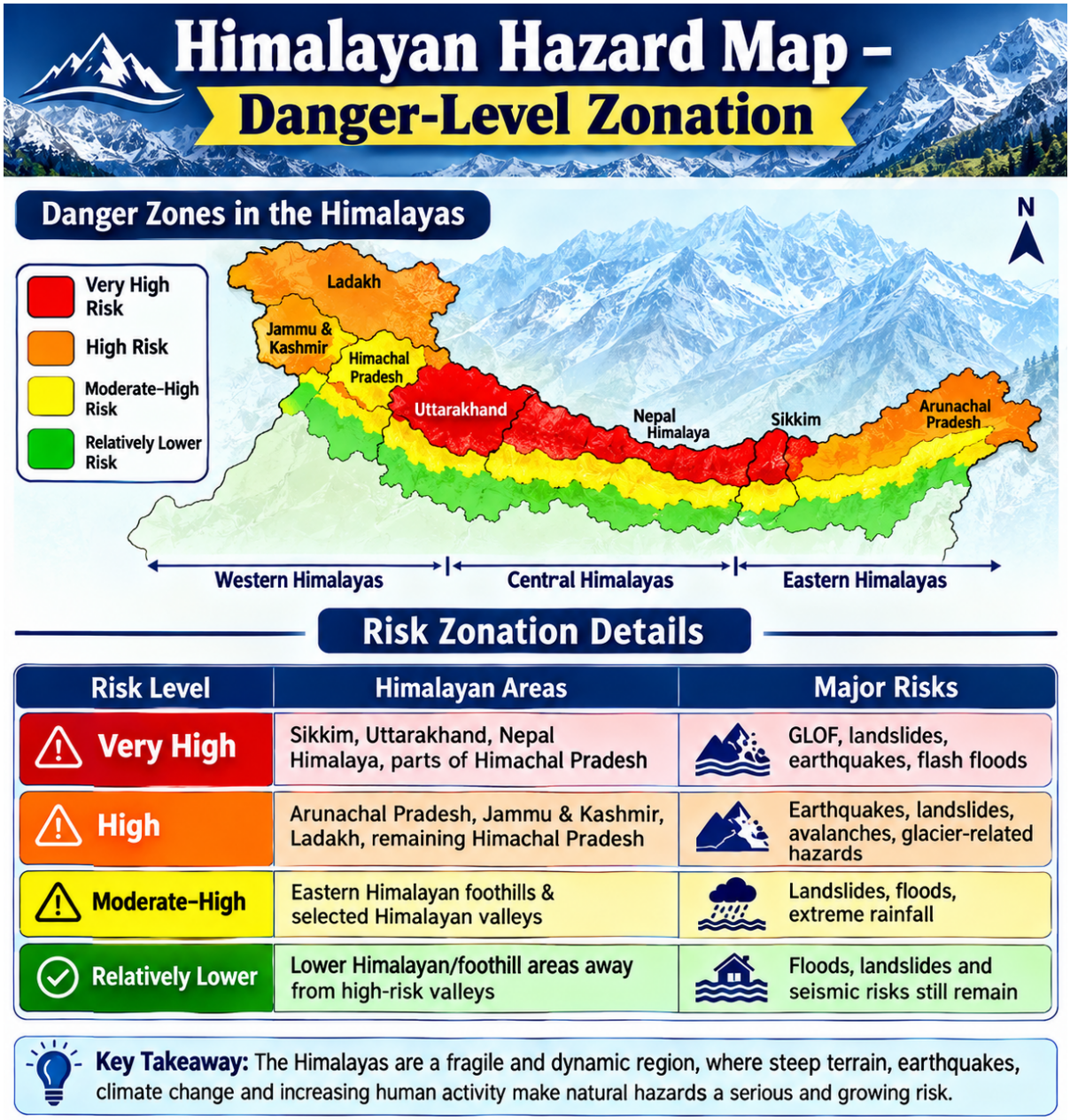
Mains: *GS I – Geography*

Why in News?

Recent Devastating floods in Nepal's Bhotekoshi–Trishuli river have claimed over 350 lives, underscoring the Himalayan region's acute vulnerability to climate-induced disasters.

Why are the Himalayas considered a dangerous zone?

- **Transboundary Dynamic Ecosystem –** Himalayan rivers cross several national borders, so disasters in Nepal, Tibet, or Bhutan often have downstream effects in India.
- Effective management of shared river systems requires real-time information sharing and coordinated disaster response among affected countries.
- **Geologically Young and Fragile Mountain Systems –** The Himalayas are classified as young fold mountains characterised by unstable slopes.
- Elevated rates of erosion and persistent slope instability significantly increase the region's vulnerability to landslides.
- **High Seismic Vulnerability –** The Himalaya is situated along the active tectonic collision zone between the Indian and Eurasian plates.
- Seismic activity frequently triggers landslides, avalanches, and breaches of glacial lakes.



- **Rapid Glacier and Cryosphere Changes –** Increasing temperatures contribute to glacier retreat and heightened instability within the cryosphere.

- The formation and expansion of glacial lakes elevate the risk of glacial lake outburst floods (GLOFs).

- **Extreme Rainfall Events –** Short-duration, high-intensity rainfall events frequently trigger flash floods and landslides.

- **Steep River Gradients –** Rivers in the region descend rapidly through narrow valleys.

- Water, rocks, ice, and debris accumulate significant destructive energy as they move through these steep gradients.

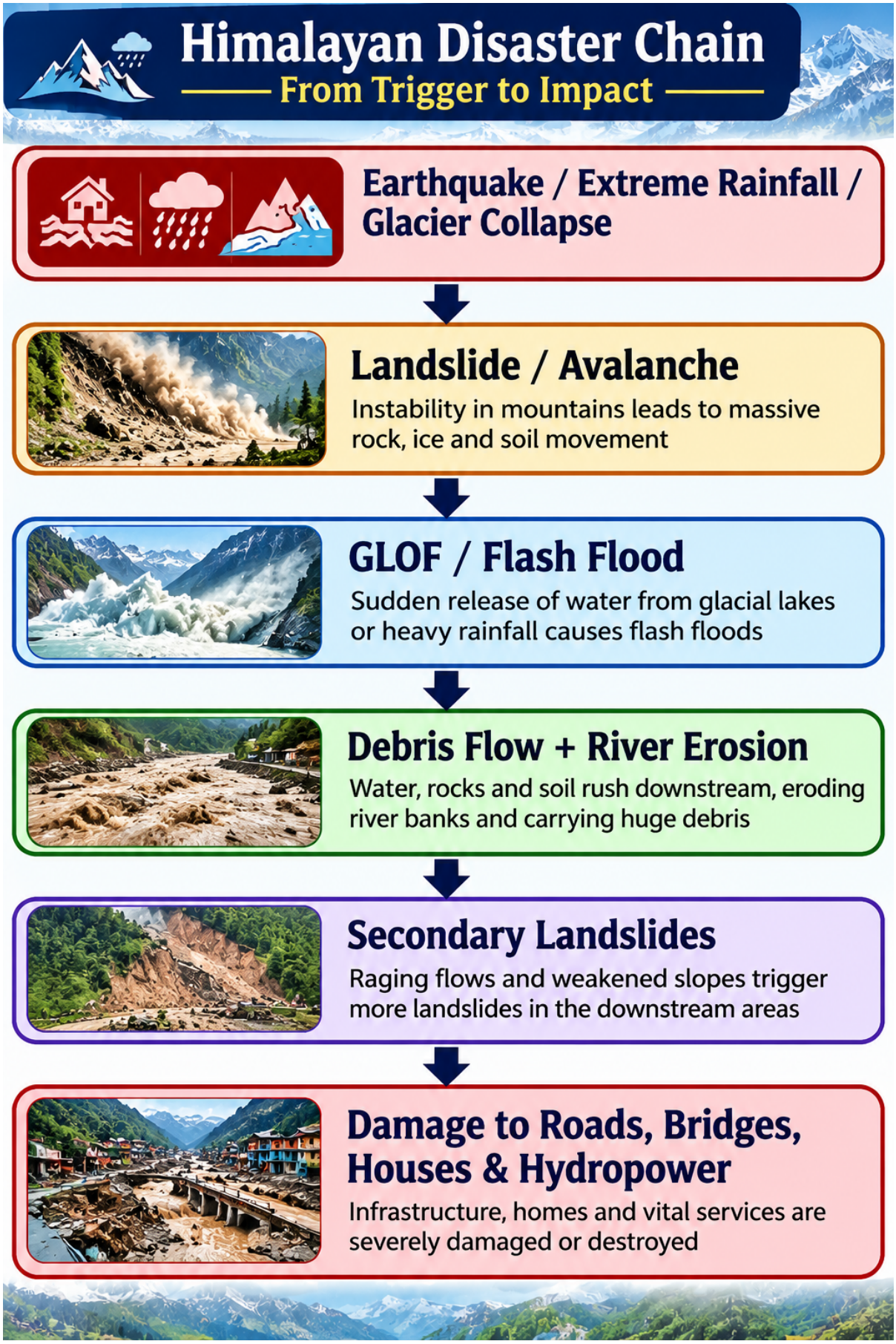
- **Plate Collision –** The collision of the Indian Plate subducting beneath the Eurasian Plate results in significant stress accumulation, which frequently leads to high-magnitude earthquakes.

- **Locked Faults –** The release of accumulated pressure along locked faults can trigger massive earthquakes.

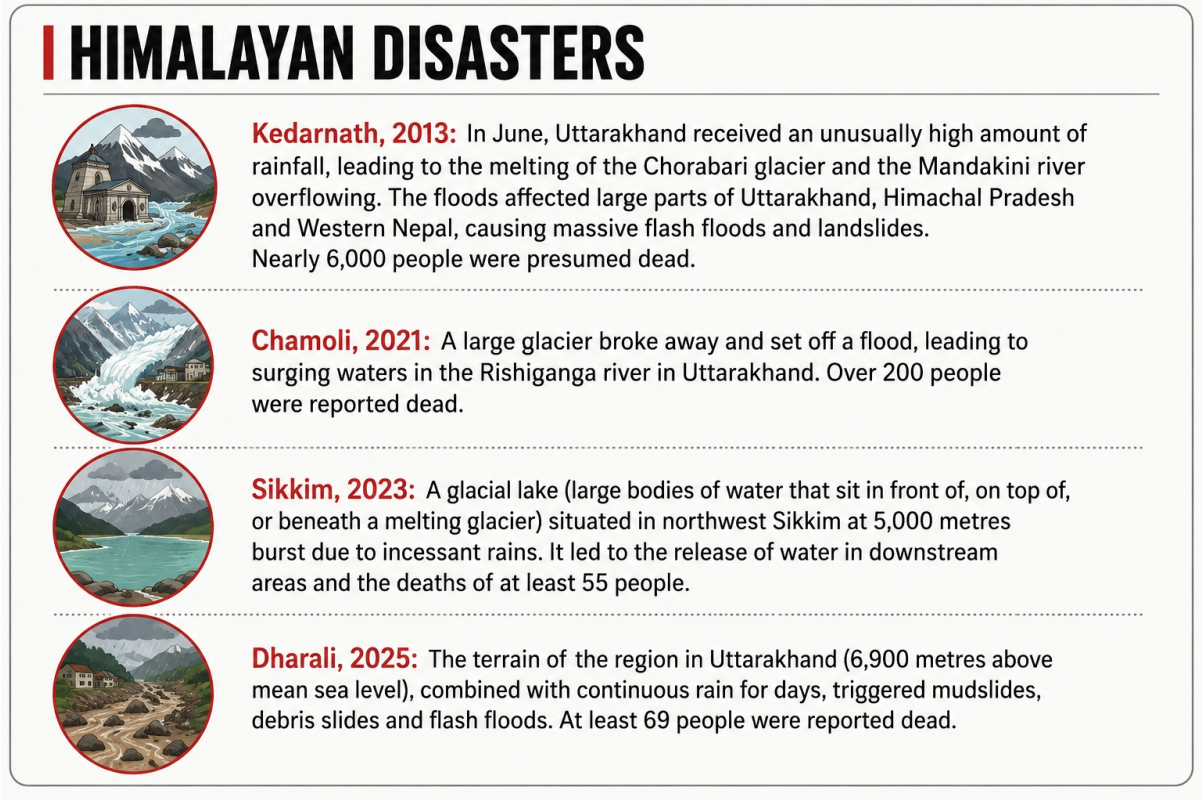
- **Unregulated Construction –** Unregulated construction activities, including road building, dam construction, deforestation, and increased tourism, place additional stress on the region's fragile terrain.

- **Carrying Capacity Failures –** Failures to respect the carrying capacity, such as overcrowded towns and unchecked infrastructure development, further amplify environmental and seismic risks.

- **Cascading Multi-Hazard Risks -** A single trigger can produce multiple hazards:



What are the past calamities faced by India?



What are the steps taken by government?

- **National GLOF Risk Mitigation Programme (NGRMP) –** The National Disaster Management Authority (NDMA) initiated this programme following the Sikkim disaster.
- **Objective –** To establish early-warning systems for glacial lakes identified as high risk.
- It targets **195 glacial lakes** located in the following regions:
    - Sikkim
    - Uttarakhand
    - Himachal Pradesh
    - Arunachal Pradesh
    - Jammu & Kashmir
    - Ladakh

- The total programme outlay is ₹150 crore.

- **Additional Risk Mitigation Measures**

    - Glaciers and glacial lakes are monitored using remote sensing and satellite technology.

    - Disaster management planning is conducted under the guidance of the NDMA and State Disaster Management Authorities.

    - Early-warning and emergency communication systems are being developed.

    - Hazard and vulnerability mapping is undertaken to identify at-risk areas.

    - Preparedness for search, rescue, and evacuation operations is being enhanced.

What are the key challenges?

- **Inadequate Early-Warning Coverage –** Numerous vulnerable glacial lakes lack real-time early warning systems.

- **Limited Scientific Data –** Continuous monitoring is hindered by challenging terrain and extreme weather conditions.

- **Unplanned Construction –** The development of roads, hotels, hydropower projects, and settlements frequently increases exposure to hazards in fragile valleys.

- **Climate Change Uncertainty –** Alterations in temperature and precipitation patterns reduce the reliability of historical risk assessments.

- **Transboundary Coordination –** Although Himalayan hazards are transboundary, real-time data sharing and coordinated warning mechanisms are still limited.

- **Difficult Terrain –** Limited accessibility frequently delays rescue operations, relief efforts, and post-disaster communication.

- **Development–Ecology Conflict –** Infrastructure and energy demands must be balanced with the carrying capacity of fragile mountain ecosystems.

What steps need to be taken?

- **Universal Early-Warning Coverage –** Deploy real-time sensors and automated warning systems in areas surrounding high-risk glacial lakes and vulnerable valleys.
- **Strengthen Himalayan Risk Mapping –** Develop micro-level hazard maps that address glacial lake outburst floods (GLOFs), landslides, earthquakes, avalanches, and flash floods.
- **Regulate Construction –** Mandate carrying-capacity assessments and implement strict land-use zoning prior to infrastructure approval.
- **Climate-Resilient Infrastructure –** Ensure that roads, bridges, hydropower projects, and settlements are designed in accordance with disaster-resilient standards specific to mountainous regions.
- **Strengthen Transboundary Cooperation –** Establish real-time information-sharing mechanisms among India, Nepal, Bhutan, and China for monitoring floods, glacial activity, and earthquakes.
- **Community-Based Disaster Preparedness –** Provide training to local communities in the following areas:
    - Early evacuation
    - Emergency communication
    - First response
    - Safe evacuation routes
- **Ecosystem-Based Disaster Risk Reduction –** Conserve forests, wetlands, and natural drainage channels to enhance ecosystem-based disaster risk reduction.
- Prohibit excessive slope cutting and riverbed encroachment to maintain natural landscape stability.
- **Integrated Himalayan Disaster Observatory –** Integrate satellite data, ground sensors, weather forecasts, seismic monitoring, and artificial intelligence-based risk

modelling to enable predictive disaster management.

What lies ahead?

- The Nepal floods illustrate that disasters in the Himalayan region are not isolated incidents but represent cascading multi-hazard phenomena.
- The interaction of climate change with geological fragility, rapid infrastructure development, and increasing population pressure significantly amplifies associated risks.
- Consequently, India should transition from a reactive, relief-based approach to an anticipatory and ecosystem-sensitive disaster management strategy.

Reference

Indian Express | Warning for India