Q14

"The Himalayas are highly prone to landslides."Discuss the causes and suggest suitable measures of mitigation.

UPSC Civil Services Mains 2016 · GS I · 12 marks · Geophysical Phenomena

Important Geophysical phenomena such as earthquakes, tsunami, volcanic activity, cyclone etc., geographical features and their location-changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes.

Core demand of the question

- Show why the Himalayas are highly prone to landslides
- Discuss natural and human causes, then suggest workable mitigation

Revision summary

Himalayan landslides follow young thrusts, steep slopes, weak debris, monsoon rain, and earthquakes.

Road cuts, blasting, hydropower, and deforestation add human load to a naturally unstable belt.

Kedarnath-type events show rain plus debris can destroy valleys in hours.

Mitigation needs GSI-NDMA mapping, engineered roads, vegetation, and rainfall-based warning.

Relocation and tourist limits are needed where the slope cannot be made safe.

Introduction

The Himalaya is a young, steep, and still-rising mountain belt on an active plate edge. Heavy rain, earthquakes, weak rocks, and roads cut into slopes make landslides a regular hazard from Jammu and Kashmir through Uttarakhand and Himachal to the North-East.

Body

Why the Himalayas are so prone

- The range is geologically young; the Indian plate still pushes under Eurasia, so rocks are crushed, folded, and cut by thrusts such as the Main Boundary Thrust and the Main Central Thrust.
- Slopes are steep, valleys are deep, and gravity is always ready to pull debris once a trigger comes.
- Many slopes are made of fractured sedimentary and metamorphic rocks, old landslide debris, and glacial till that lose strength when wet.
- The monsoon and cloudbursts deliver intense rain in a short time, raising pore-water pressure and turning soil into a flow, as seen in Kedarnath (2013) and later hill disasters.
- The belt is seismic; shaking from Himalayan earthquakes loosens slopes and can start slides during or after the event.

• Rivers undercut toes of slopes, and glacial lake outburst floods can strip valleys in hours.

Human causes that raise the risk

• Hill roads, often cut without proper benches, drains, or disposal of spoil, remove the toe of the slope and load the downhill side.

• Hydropower tunnels, blasting, and unplanned construction on old slide fans put buildings on unsafe ground.

• Deforestation, road-edge grazing, and slope farming without terraces reduce root strength and increase runoff.

• Encroachment on floodways and debris fans, plus tourism load in pilgrimage towns, puts more people in the path of the next slide.

Mitigation measures

• Map landslide hazard at large scale through the Geological Survey of India, state disaster authorities, and NDMA guidelines, and ban construction on very high-hazard slopes.

• Design hill roads with controlled blasting, retaining walls, catch drains, and safe dumping of muck, not a vertical cut and a heap on the riverbank.

• **Use bio-engineering:** grass, shrubs, and trees on cuts, plus check dams and contour drains to slow water.

• Early warning from rainfall thresholds, slope instruments, and community watch in monsoon weeks, linked to NDMA and state control rooms.

• Catchment treatment, restricted hydropower in fragile belts, and honest environmental clearance that treats landslide as a design input, not a footnote.

• Relocate chronic slide villages where repair is cheaper than risk; insure and train local masons in safer hill building.

• Keep pilgrimage and tourist numbers within the carrying capacity of towns such as those on the Char Dham routes.

• After a slide, drain the scarp, remove hanging blocks, and do not rebuild on the same debris without geotechnical sign-off.

Way forward for the answer

• Join plate tectonics, rain, and earthquakes with roads and hydropower, then list mapping, better cuts, bio-engineering, and early warning as mitigation.

Flow diagram

Young thrusts steep weak rock -> Landslide

Monsoon cloudburst earthquake -> Landslide

Roads dams deforestation -> Landslide

Mapping bio-engineering warning -> Lower loss

Conclusion

The Himalayas are landslide-prone because they are steep, fractured, wet in the monsoon, and seismically alive. Human cuts and loads make the hazard worse. Mitigation is hazard mapping, safer roads, slope drainage and vegetation, early warning, and keeping people off the worst fans.

Facts & figures

Main Boundary Thrust / Main Central Thrust
Major Himalayan fault zones along which rocks are sheared and slopes are especially weak.

Kedarnath disaster, 2013
Uttarakhand cloudburst and debris flows that showed how rain, ice, and settlement on fans combine.

NDMA landslide guidelines
National framework for hazard zonation, land-use, and slope safety in hill states.

Geological Survey of India
National agency that maps landslide-prone sectors and advises on mitigation.

Bio-engineering
Use of plants with drains and small structures to hold hill cuts cheaper than only concrete.