


Chapter 8


Landslides and Mass Movements: Natural and Human Triggered

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ABSTRACT

Natural or man-made landslides and mass movements are important geophysical processes that may cause disastrous effects on the environment, as well as social and economic directions. Natural factors include excessive rain, earthquakes, volcanic activities and fast melting of snows, whereas the human aspect includes clearing forests, mining and infrastructure construction, as also the poor land-use methods. Such convulsions cause soil erosion culminating in infrastructure damages and loss of lives. Disaster prevention and mitigation requires knowledge on the reasons behind the disaster, risk assessment and early warning systems. This chapter discusses the forces behind landslides and mass movements, the impact of climate change, and how effective mitigation measures such as slope stabilization, afforestation and the community awareness programs are in alleviating them. The main objective of using interdisciplinary methods is to bring better resilience and policy options on sustainable management of land.

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1. INTRODUCTION TO LANDSLIDES AND MASS MOVEMENTS

Landslides and mass movements: These are natural geo-physical phenomena, which entail the down-slope movement of soil, rocks and debris under the impact of gravity. They frequently happen in mountainous and hilly regions even though they can take place anywhere whose slopes are not stable. Landslides and mass movements are also major natural hazards which may lead to unimaginable harm to life, property and the environment (Fayaz et al., 2022). They occur because of natural and man-made conditions. Natural causes are heavy rainfall, earthquakes, volcanic eruptions, and rapid snowmelt whereas man-made factors such as deforestation, mining, construction activities, and alteration of land use are anthropogenic causes. These movements are categorized broadly on the basis of the nature of movement and the material moved over. Falls, slides, flows, creeps and topples are considered to be the main types of mass movements. Falls are rock movements related to sudden dislodging of rock and falling down the steep slopes (Mollamahmutoglu & Acar, 2020). Slides happen when a coherent mass of the earth or rock moves on a well defined surface and it often produces rotational or translational slide. Flows Materials that react as a fluid take the form of flows such as mudflows and debris flows most often in events that follow or accompany high amounts of rainfall when the soil is completely wet. Creeps are gradual, undetected movement of soil and rocks that occur over a long time and topple are forward rotation and the movement of big blocks of rock.

The history of mankind is full of landslides and mass movements that in many cases can be devastating. The Vajont Dam in Italy 1963 is one of the most devastating of incidents. A huge landslide fell into the reservoir creating a wave that rose above the dam and washed away a waterfall, killing some 2,000 people in the downstream. This is a reminder that a geological risk assessment in large complex projects is important. The second significant event was the debris avalanche in Yungay, Peru in the year 1970 caused by a fierce earthquake (Strupler et al., 2018). The landslide engulfed the whole town and led to massive casualties of more than 20,000 people. The Oso mudslide in Washington state in 2014 also exemplified how unstable slopes represent constant risks since the engulfment of an avalanche swept off houses and the loss of lives (43 people were killed). These disasters have more than just direct human deaths. Long-term consequences of landslides include permanent settlement displacement, agricultural land being rendered unproductive and infrastructural destructions such as roads, bridges and other infrastructural facilities (Damm & Klose, 2015). Vegetation is destroyed, levels of sedimentation in rivers and streams are enhanced and eco systems are disrupted. At an economic level, the expenses involved in the recovery, rehabilitation and recreation are very

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