

COURSE : DISASTER MANAGEMENT (MA/MSc PART I)

Paper : III

Prepared by : Prof. B. K. Mishra, Course coordinator

Topic : Landslides

INTRODUCTION

The terms *landslide* or *mudslide* refer to the downward movement of large masses of rocks, soil, mud and organic debris. Areas with steep slopes, for example mountainous regions, are particularly susceptible to landslide hazards. Most landslides are caused by multiple factors that act together to destabilize the slope.

A landslide is the rapid mass movement of soil, mud and/or rocks downhill due to the pull of gravity. Landslides are very common and occur in a variety of forms. Land may topple off in a big chunk, or slip down in bits. Landslide may be composed of mud or may contain rocks and other debris. Most landslides occur gradually, but some may be sudden.

Causes of Landslides:

The primary cause of a landslide is the influence of gravity acting on weakened materials that make up a sloping area of land. While some landslides occur slowly over time (e.g., land movement on the order of a few meters/yards per month), the most destructive ones happen suddenly after a triggering event such as heavy rainfall or an earthquake.

Natural causes of landslides include:

1. Heavy and/or prolonged rain

Gravity is an invisible force that pulls all objects towards Earth. The effect of gravity is more prominent on a steep slope or on a hilly area. Water can trigger landslides and mudslides because it alters the pressure within the slope, which leads to slope instability. Consequently, the heavy water-laden slope materials (soil, rock, etc.) will succumb to the forces of gravity. Excessive water is thought to be one of the most common triggers for landslides. When rain falls, water enters or infiltrates into the top soil which makes the soil become heavier and therefore more vulnerable to the pull of gravity. When soil absorbs all the water that it is capable of holding, it is said to be saturated. Soil is therefore heaviest and most susceptible to the effects of gravity, when saturated. When large areas of soil become saturated on steep slopes, the pull of gravity causes the top layers of the soil to slide downhill, therefore resulting in a landslide.

2. Tremors And Shakes

An Earthquake is a tremor or movement in the Earth's crust. They are a deadly and unpredictable type of natural disaster and are the leading reason for landslides or Rock falls occurring worldwide. Loose soil, rocks and boulders can easily be dislodged from

hilly areas and allowed to move downhill when the violent shaking of the ground transpires. Landslides are more likely to take place when the earthquake is of a high magnitude.

Human Induced Activities that produce landslides:

1. Deforestation
2. Quarrying/ Rock Mining
3. Bad agricultural practices such as slash and burn agriculture

Deforestation is the removal or cutting down of trees and other types of vegetation from the land. The firm roots of the trees also help to keep the soil in place, even when it absorbs water, thus diminishing the effects that gravity has on the soil. It is when these trees are removed that the bare and exposed soil is left defenceless against the pulling force of gravity when saturated since trees help to keep soil firmly in place. Soil movement takes place more easily and rapidly resulting in deadly landslides.

Quarrying or rock mining refers to the cutting away or excavation of hilly or mountainous areas so that rocks and minerals can be extracted from the land. Quarrying is rampant in the Northern Range and results in the land being left devoid of trees and vegetation. Without trees to hold the soil in place, soil movement occurs easily and rapidly.

Types of Landslides

- **Falls**

Falls are sudden movements of loads of soil, debris, and rock that break away from slopes and cliffs. Falls landslides occur as a result of mechanical weathering, earthquakes, and force of gravity.

- **Slides**

This is a kind of mass movement whereby the sliding material breakaways from underlying stable material. The kinds of slides experienced during this type of landslide include rotational and transitional. Rotational slides are sometimes known as slumps since they move with rotation.

Transitional slides consist of a planer or 2 dimensional surface of rupture. They involve landslide mass movement following a roughly planar surface with reduced rotation or backward slanting. Slides occur when the toe of the slope is undercut. They move moderately, and the consistency of material is maintained.

- **Topples**

Topple landslides occur when the topple fails. Topple failure encompasses the forward spinning and movement of huge masses of rock, debris, and earth from a slope. This type of slope failure takes place around an axis near or at the bottom of the block of rock. A topple landslide mostly lead to formation of a debris cone below the slope. This pile of debris is known as a Talus cone.

- **Spreads**

They are commonly known as lateral spreads and takes place on gentle terrains via lateral extension followed by tensile fractures.

- **Flows**

This type of landslide is categorized into five; earth flows, debris avalanche, debris flow, mudflows, and creep, which include seasonal, continuous and progressive.

Flows are further subcategorized depending upon the geological material, for example, earth, debris, and bedrock.

The most prevalent occurring landslides are rock falls and debris flow.

The study of landslides is critical considering the annual economic losses they bring. Globally, landslides result in expenditure of billions of dollars towards rehabilitation of affected areas. Due to these astonishing annual losses, most governments have instituted bodies to deal specifically with landslides.