

Gravity Erosion:

Gravity is an agent of erosion. Rocks break apart only when a force makes them to do so and gravity is one of these forces that help the rocks to break down into smaller pieces. This never ending force works 24 hours a day, 7 days a week and 365 days a year.

- Water running down all the mountains and valleys is pulled down by this force of gravity.
- Wind is ultimately a result of air molecules being held to earth's surface due to gravity.
- Water, wind and ice working under the force of gravity are the greatest source of erosion on the surface of earth.
- The effects of gravity combined with wind, water and ice create many types of geological features. So gravity is the primary driving force of erosion.

Gravity

It refers to the gravitational force exerted by the earth on objects in its vicinity. Or the force with which the earth attracts the material objects towards its centre is called gravity.

Gravity Erosion

Gravity erosion is generally termed as mass wasting or mass movement because in this phenomenon large masses of soil move. The mass movement may be instantaneous as in land sliding or slow and persistence over many decades as soil creep.

Mass movement

Movement of sediments caused by gravity alone is known as mass movement. Mass movement is an process that moves rocks and sediments down the slope due to the force of gravity. The material is transported from higher elevation to lower elevation where other transporting agents like streams or glaciers can pick it up and move to even lower elevation.

When mass movement occurs?

When gravitational force is greater than force of friction between a sediment and the surface, then mass movement process is active.


$$\mathbf{F_g} > \mathbf{F_f} \longrightarrow \mathbf{Mass\ movement}$$

Where

$\mathbf{F_g}$ is gravitational force and $\mathbf{F_f}$ is force of friction between a sediment and its surface

Hence, mass movement/mass wasting is a balance between gravity pulling soil down the hill and the friction holding the soil in its place.

Different ways of Mass movement/mass wasting

- a) **Fall:** Gravity pulls apart a steep slope
- b) **Rotational slide or slumps:** Rotate around a point in the centre of a slump 
- c) **Compound slide:** A combination of fall and rotational slide
- d) **Transitional slide:** It occurs when a break causes a slide along the face of the supporting mass.

Types of Gravity Erosion

Various types of gravity erosion/mass movement/mass wasting are as under:

1. **Creep:** Creep occurs when sediments slowly shift their position down the hill. Creep of the soil and rock materials down the hill may occur through the action of gravity but very slowly. The movement of particles down the slope occurs in expanding type of soil being lifted normally to the slope angle and then dropping under the influence of gravity.
2. **Slumping:** Slumping occurs when a mass of material slips down a curve surface. It takes place in steep hillsides and among distinct fracture planes. In some cases, it is favoured by water and often associated with clay like material which once released will more rapidly fall down the hill. It will show a spoon shaped depression from which material moves to downhill.
3. **Land sliding:** Any noticeable down slope movement of rock or sediment is often referred as landslide that can be classified in a way that reflect the mechanism responsible for the movement and velocity at which this movement occurs. Slide involves the movement of cohesive block of material. The majority of the slides is small and shallow and involves soil and rocks. This type of movement may be very rapid and very destructive.
4. **Rock fall:** Rock fall occurs when blocks of rock breaks from a steep slope. To be classified as a rock fall, the rock or block of earth must fall through air.
5. **Mud flow:** Mud flow occurs when it has just rained and the land slip down the slope. Flows consist of non cohesive material which flow like a fluid. A common example of earth flow is solifluction.
Solifluction: It is the slow movement of saturated soil down the slope. It may occur in any environment and on slope as low as 1° . However, it is more prevalent in periglacial environment where permafrost cracks and impermeable subsurface layer is found. Hence, this is sometimes also known as gelifluction.
6. **Avalanche:** It is an abrupt and rapid flow of snow often mixed with air and water down a mountain side. Avalanche is among the biggest danger in the mountains both for life and property because during rapid flow of snow, the breakdown and movement of rocks occurs down a slope.
7. **Debris flow:** Debris is a fast moving mass of unconsolidated saturated debris that looks like flowing concrete.
8. **Sinkhole:** A sinkhole is also known as sink, shake hole or swallow hole. It is a natural depression or hole in the surface topography caused by the removal of soil or bedrock by water. Mechanism of formation may include the gradual removal of slightly soluble bedrock such as limestone by percolating water.

Factors Affecting Gravity Erosion / Mass Movement

- 1. Weathering of surface material:** Gravity erosion depends upon the weathering of surface material because when the rate of weathering of surface material will be high, it means material will be available in free form for gravity erosion. e.g., mud flow, debris flow etc.
- 2. Excess water contents:** Water increases the force pulling down the hill and reduces static friction (lubricates).
- 3. Slope:** Increase in slope may cause mass movement. So longer the slope greater will be the potential for erosion. e.g., earthquake resulting into rock slide.
- 4. Soil characteristics:** Physical characteristics of soil also affect gravity erosion. e.g, fine textured soil that have high water holding capacity can slide easily than sand. Shallow soils slide easily.
- 5. Rainfall:** Heavy rains may increases the weight and reduce force of friction. e.g., mud slide.
- 6. Reduced vegetative cover:** It is the most important physical factor influencing erosion. A good cover of vegetation shields the soil from the impact of raindrops. It also binds the soil together making it more resistance to runoff.

Control of Gravity Erosion

Not much can be done once gravity erosion /mass movement occurs because it occurs on very large scale and cannot be controlled easily. However, there are some preventive measures:

1. Minimize cutting of hill slopes.
2. Aim to remove water from potential slip areas (diversion ditches and drains).
3. Vegetation coverage can reduce the mass movement.
4. Engineering or mechanical practices i.e., terracing can also reduce mass movement.
5. Conservation tillage/no till can protect the soil from erosion.