Soil Erosion and Conservation by S. Manna, Department of Geography, Narajole Raj College

Soil Erosion

“A nation that destroys its soil destroys itself.”

Quote by Franklin D. Roosevelt in a letter to all State Governors on a Uniform Soil Conservation Law.

Soil Erosion

In this process, the soil particles are loosened or washed away in the valleys, oceans, rivers, streams or far away lands. This has been worsening due to human activities such as agriculture and deforestation.

Soil erosion is a continuous process that occurs either slowly or at an alarming rate. It results in a continuous loss of topsoil, ecological degradation, soil collapse, etc.

Let us have a detailed look at the causes, effects and prevention of soil erosion.

Causes of Soil Erosion

Following are the important causes of soil erosion:

Rainfall and Flooding

Higher intensity of rainstorm is the main cause of soil erosion. Four types of soil erosion are caused by rainfall:

- Rill erosion
- Gully erosion
- Sheet erosion
- Splash erosion

The raindrops disperse the soil, which is then washed away into the nearby streams and rivers. Regions with very heavy and frequent rainfall face a large amount of soil loss. The flowing water during floods also erodes a lot of soil by creating potholes, rock-cut basins, etc.

Agriculture

The farming practices are the major cause of soil erosion. The agricultural activities disturb the ground. The trees are cleared and the land is ploughed to sow new seeds. Since most of the crops are grown during the spring season, the land lies fallow during winters. Most of the soil is eroded during winters.

Also, the tyres of tractors make grooves on the land, making a natural pathway for water. Fine soil particles are eroded by wind.

Source: https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/soil-erosion/
https://www.researchgate.net/publication/305781065_Degraded_Soils_Origin_Types_and_Management

Grazing

The grazing animals feed on the grasses and remove the vegetation from the land. Their hooves churn up the soil. They also pull out plants by their roots. This loosens the soil and makes it more prone to erosion.

Logging and Mining

A large number of trees are cut down to carry out the logging process. Trees hold the soil firmly. The canopy of the trees protects the soil from heavy rainfall. The leaf litter that protects the soil from erosion, is also lost during logging.

Mining activities also disturb the land and leave the soil more prone to erosion.

Construction

The construction of roads and buildings exposes the soil to erosion. The forests and grasslands are cleared for construction purposes, which exposes the soil making it vulnerable to erosion.

Rivers and Streams

The flowing rivers and streams carry away the soil particles leading to a V-shaped erosion activity.

Heavy Winds

During dry weather or in the semi-arid regions, the minute soil particles are carried away by the wind to faraway lands. This degrades the soil and results in desertification.

Effects of Soil Erosion

The major effects of soil erosion include:

Loss of Arable Land

Soil erosion removes the top fertile layer of the soil. This layer is rich in the essential nutrients required by the plants and the soil. The degraded soil does not support crop production and leads to low crop productivity.

Clogging of Waterways

The agricultural soil contains pesticides, insecticides, fertilizers, and several other chemicals. This pollutes the water bodies where the soil flows.

The sediments accumulate in the water and raise the water levels resulting in flooding.

Source: https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/soil-erosion/
https://www.researchgate.net/publication/305781065_Degraded_Soils_Origin_Types_and_Management

Air Pollution

The dust particles merge in the air, resulting in air pollution. Some of the toxic substances such as pesticides and petroleum can be extremely hazardous when inhaled. The dust plumes from the arid and semi-arid regions cause widespread pollution when the winds move.

Desertification

Soil erosion is a major factor for desertification. It transforms the habitable regions into deserts. Deforestation and destructive use of land worsens the situation. This also leads to loss of biodiversity, degradation of the soil, and alteration in the ecosystem.

Destruction of Infrastructure

The accumulation of soil sediments in dams and along the banks can reduce their efficiency. Thus, it affects infrastructural projects such as dams, embankments, and drainage.

Soil Erosion Prevention

Soil erosion is a serious environmental issue. Steps should be taken to curb this problem. Following are some of the methods of soil erosion prevention:

1. Plant trees on barren lands to limit erosion of soil.
2. Add mulch and rocks to prevent the plants and grass underneath to prevent soil erosion.
3. Mulch matting can be used to reduce erosion on the slopes.
4. Put a series of fibre logs to prevent any water or soil from washing away.
5. A wall at the base of the slope can help in preventing the soil from eroding.
6. Every household should have a proper drainage system so that water flows down into proper water collecting systems.

Key Points Of Soil Erosion

- It is the natural process of wearing away of the topsoil, but human activities have accelerated the process.
- It is usually caused due to the removal of vegetation, or any activity that renders the ground dry.
- Farming, grazing, mining, construction and recreational activities are some of the causes of soil erosion.
- The effects of soil erosion are not just land degradation. It has led to a drastic increase in pollution and sedimentation in rivers that clogs the water bodies resulting in a decline in the population of aquatic organisms.
- Degraded lands lose the water holding capacity resulting in floods.

Source: https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/soil-erosion/
https://www.researchgate.net/publication/305781065_Degraded_Soils_Origin_Types_and_Management

Soil Erosion and Conservation by S. Manna, Department of Geography, Narajole Raj College

The health of the soil is of utmost importance to the farmers and the population that depends upon agriculture for food and employment. There are several challenges to resist soil erosion, but there are solutions to prevent it as well.

Type	Causes (not one to one along row)	Degradation process	Impact on soil processes
Physical	Deforestation	Breakdown of soil structure, aggregation and porosity	Reduction in infiltration capacity Changes in soil water-retention characteristics
	Biomass burning	Crusting and surface sealing	Increase in runoff rate and amount
	Tillage up and down slope, excessive animal, human, and machine traffic, overgrazing	Compaction of surface and subsoil, reduction in proportion and strength/stability of aggregates	Accelerated erosion by water and wind Increase in bulk density leading to reduction in porosity Water logging and anaerobiosis
Chemical	Irrigation with poor quality water, inadequate drainage	Salinization, alkalinization	Accumulation of base-forming cations
	Little to no use of fertilizers	Nutrient depletion	Decreased levels of macronutrients on exchange sites, soil organic matter, and in soil solution
	Excess use of fertilizers	Acidification, eutrophication	Leaching and runoff of nutrients to water sources
	Application of industrial, urban wastes	Toxification, contamination with heavy metals, pollution	Excessive build up of some elements (e.g., Al, Mn, Fe) and heavy metals (e.g., lead and mercury); increase in soilborne pathogens
Biological	Removal of or burning residues	Depletion of soil organic carbon	Reduction in N mineralization, soil aggregation, and related properties
	Little or no use of organic inputs	Decline in diversity and abundance of soil biota	Shift in species composition and diversity of favorable soil organisms
	Monoculture, excessive tillage	Loss of soil structure	Reduction in porosity and infiltration, reduction in activity of soil biota

[a]Modified from Reference 104.

Importance of Preventing and Stopping Soil Erosion

According to the UN's Food and Agriculture Organization (FAO), some key roles of soils are:

- Soils help fight and adapt to climate change by collecting and storing carbon and reducing greenhouse gas emissions (GHG) in the atmosphere;
- Resilient soils allow for water infiltration through the soil, filtering pollutants and preventing them from leaching into the groundwater;
- Soils capture and store water for crops, whereas degraded soils retain less water;

GEOGRAPHY (U.G), SEM-V I, Paper – DSE3: Soil Erosion and Conservation

Source: https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/soil-erosion/
https://www.researchgate.net/publication/305781065_Degraded_Soils_Origin_Types_and_Management

- Reducing surface evaporation and increasing water use efficiency and productivity are also processes enhanced by healthy soils;
- Soils provide fiber, fuel, medicinal products, and other ecosystem services;
- Soils are home to 1/4 of biodiversity and they are a key part of the global cycles that make all life possible.

How to Prevent Soil Erosion

Despite the fact human activities have accelerated soil erosion, there are ways of repairing the damage we have created. From reforestation and windbreaks to stone walls or more sustainable agriculture techniques. Let's analyze them in greater detail.

1. Stopping Soil Erosion via Sustainable Farming Practices

Regenerative agriculture techniques have the potential to preserve and restore ecosystems and habitats and improve the quality and health of the soil.

2. Protecting the Soil by Planting Windbreaks

Windbreaks are linear plantings of shrubs and trees with the goal of improving crop production, protect the soil, people, and livestock. According to **FAO**, windbreaks can reduce wind velocities for a distance approximately 15 times the height of the tallest trees. As a result, there is a lower rate of soil loss across large crop areas.

3. Stone Walls to Prevent Soil Erosion

According to Camera et. al (2018) the sediments accumulating behind the dry-stone walls create suitable land for farming and prevent soil erosion.

4. Reforestation Helps Protect Soils

According to **FAO**, reforestation helps reduce sedimentation rates in downstream valleys. According to this UN agency, reforestation on unstable land and around water regions such as rivers increases the *water-retention capacity of land and improve water quality, both of which benefit food production.* Moreover, according to a recent study published in Nature, reforestation also has a tremendous potential to help fight climate change as trees capture huge amounts of CO2.

5. Conservation Tillage and Soil Erosion

Conservation tillage stands for as any form of tillage that minimizes the number of tillage passes. Conservation tillage techniques have the potential to reduce the vertical movements of soil. In this way, more crop residues are left on the soil surface reducing the exposure to water or wind erosion.

GEOGRAPHY (CVS), SEM-VI, Paper – DCE3: Soil Erosion and Conservation

Source: https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/soil-erosion/
https://www.researchgate.net/publication/305781065_Degraded_Soils_Origin_Types_and_Management

Source: https://youmatter.world/en/definition/soil-erosion-degradation-definition/
https://byjus.com/biology/soil-erosion/
https://www.researchgate.net/publication/305781065_Degraded_Soils_Origin_Types_and_Management