

Types of Degradation \Rightarrow Soil Erosion

Soil erosion is the detachment of soil particles by the action of wind or water. Though soil erosion is a natural process but is accelerated by anthropogenic activities like deforestation, overgrazing, improper agricultural practices and cultivation techniques. This is a widespread problem due to which our fertile ecosystems are losing their fertility and result in degradation of all ecosystems. Loss of agricultural land is observed due to human induced erosion and other related damages. This leads to ^{desertification} desertion and lowered productivity of agricultural lands which are also somewhat made up by addition of fertilizers over many years.

Every year almost 10 million hectares of cropland are deserted worldwide due to soil erosion.

Erosion is mainly caused by two agents, water and wind and thus soils erosion is divided into main categories viz . water erosion and wind erosion.

Water Erosion

Water erosion is the detachment of soil particles by the action of water. Particles are detached by raindrop impact or transported by overland water flow. Raindrop impact breaks down the aggregate of soil particles into smaller parts, these suspended particles deposited in the pores between the aggregates and clog them resulting in 'soil crust' formation. Soil crusting seals the surface by blocking the spaces between aggregates, lowering infiltration rate and drainage while increasing the run-off. Uncovered land is more susceptible to rain drop impact compared to vegetative covered land. Thus more and more water is lost due to run-off, the upper fertile layer of the soil is lost and soil becomes less productive. As soil forming process is a time- taken process, it is measured that a soil loss of 1 t/ha/year is considered irreparable within 50–100 years of time span. Raindrop impact is the first stage of water erosion; it leads to sheet erosion. Sheet erosion removes upper fertile layer of soil. Sheet erosion develops into rill erosion, forming small channels. These channels become widen and lead to gully formation.

Wind Erosion

Erosion caused by wind is known as wind erosion. It is the severe problem of arid and semiarid regions but also observed in humid regions. Wind erosion transports very fine particles and

lowers soil fertility and thus degradation occurs. It is reported by Global Assessment of Soil degradation that 42 million hectare of European land is wind eroded.

There are three modes of soil movement, depending on particle size: • Creep ($>500\mu\text{m}$ along the surface) • Saltation ($70\text{-}500\mu\text{m}$) • Suspension (short-term suspension $20\text{-}70\mu\text{m}$; long term suspension $< 20\mu\text{m}$).

Causes of Erosion

Soil Structure: structure of the soil is an important factor in the soil erosion process. The soil with weak developed structure, medium to fine in texture and having low content of organic matter are most dominantly eroded in easy ways. Due to less water holding capacity and low water infiltration rates these soils are more favorable to be eroded by wind and water energy. Texture and organic matter content of soil provides ability to the soil to resist erosive conditions. They influence the water holding capacity of soil as well as make aggregates of soil particles.

The Role of Vegetative Cover

Coverage of plant biomass serves as a protective blanket over the topsoil to prevent it from erosion by means of wind and water energy. Coverage of plant biomass, dead or living dissipated the rain and wind energy and as a result protects the underlying soil layer from erosion. Soil particles remains in contact and are held firmly due to upper coverage. About 60 % of forest coverage is essential to prevent forested areas from land sliding and soil erosion. Extensive loss of forests now days for irrigation lands and pasture is followed by soil erosion

Land Topography: The vulnerability of land to water and wind forces depends on its surface exposure as well as on its topography. It is estimated in Philippines and Jamaica where 58 % and 52 % of land respectively have slopes, face 400 times per hectare more erosion rates. Steep and marginal lands which changed from forest to crop lands are more susceptible to soil erosion. Arid lands are susceptible to soil erosion as observed in India the erosion rates are 5600 times per hectares per year.

Disturbances: According to estimation about three-quarters of the world's soil erosion is due to depletion of soil biomass coverage. Along with anthropogenic activities natural processes also result in soil erosion especially along stream banks due to powerful action of flowing water. 30 % or more soil erosion is recorded on steep slopes while on flat surfaces with only 2 % of slope also faces the problem of soil erosion under powerful force of wind and water.

Soil Acidity

Acidic soils mostly have pH values less than 7 on the pH scale. Acidity of the soil mainly depends on the availability of exchangeable forms of hydrogen and aluminum ions. Higher the concentration of these exchangeable ions higher is the amount of acidity in the respective soil. Acidic soil is observed to have low fertility rates, poor in physical, biological and chemical properties. Poor management of such areas results in depressed crop yield to a significant level.

Causes of Soil Acidity

Both the natural and anthropogenic activities are responsible for soil erosion process. Natural processes happen gradually and affect the soil fertility in a gradual way but the anthropogenic effects are rapid. The causes of soil acidity include

- ✓ Weathering and Leaching
- ✓ Organic Matter Decomposition
- ✓ Acid Rain
- ✓ Crop Production and Removal
- ✓ Application of Acid Forming Fertilizers

Effects of Soil Acidity on Crop Production

Soil acidity significantly affects plants yield and productivity by decaling available nutrient contents. Two major factors associated with soil infertility are presence of phytotoxic substances like Al and Mn, and P, Ca, and Mg nutrient deficiency. Mostly plants uptake the nutrient in soluble form. Soil acidity cation cause profusion availability of elements such as Al and Mn and result in shortage of plant's essential nutrients such as P, Ca and Mg. it is noted previously that soil acidity is associated with H^+ and Al^{3+} . Surprisingly, there is no deleterious effect found on plants growth by H^+ .

Reference:

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