

GE 2211 Environmental Science and Engineering

Unit – I

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Land Resources

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Contents

- land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification

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Introduction

- The most important natural resource, upon which all human activity is based since time immemorial, is land
- Man's relentless progress towards development has, however, considerably damaged our land resource base
- Further, land also suffers from various kinds of soil erosion, degradation and deforestation
- Unprecedented population pressures and demands of society on scarce land, water and biological resources and the increasing degradation of these resources is affecting the stability and resilience of our ecosystems and the environment as a whole

Land Degradation

- *Land degradation* is a concept in which the value of the biophysical environment is affected by one or more combination of human-induced processes acting upon the land
- It is estimated that up to 40% of the world's agricultural land is seriously degraded
- Land degradation is a global problem, mainly related to agricultural

Causes of Land Degradation

- Land clearance, such as clearcutting and deforestation
- Agricultural depletion of soil nutrients through poor farming practices
- Overgrazing
- Urban conversion
- Irrigation
- Land pollution including industrial waste
- Weeds
- Walking tracks

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Soil Erosion

- **Soil erosion** is one form of soil degradation along with soil compaction, low organic matter, loss of soil structure, poor internal drainage, salinisation, and soil acidity problems
- Soil erosion is a naturally occurring process on all land. The agents of soil erosion are water and wind, each contributing a significant amount of soil loss
- The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damaged drainage networks



Soil Erosion by Water

- The rate and magnitude of soil erosion by water is controlled by the following factors:
 - Rainfall Intensity and Runoff
 - Soil Erodibility - is an estimate of the ability of soils to resist erosion, based on the physical characteristics of each soil. Generally, soils with faster infiltration rates, higher levels of organic matter and improved soil structure have a greater resistance to erosion.
 - Slope Gradient
 - Vegetation

Soil Erosion by Wind

- The rate and magnitude of soil erosion by wind is controlled by the following factors:
 - Erodibility of Soil - Very fine particles can be suspended by the wind and then transported great distances.
 - Soil Surface Roughness
 - Climate - Soil moisture levels can be very low at the surface of excessively drained soils or during periods of drought, thus releasing the particles for transport by wind
 - Unsheltered Distance – lack of wind breaks
 - Lack of vegetative Cover

Onsite Effects of Soil Erosion

- The main on-site impact is the reduction in soil quality which results from the loss of the nutrient-rich upper layers of the soil, and the reduced water-holding capacity of many eroded soils.
- A diminution of the soil's suitability for agriculture or other vegetation



The on-site impact of erosion: severe rilling on a hillslope at Rottingdean on the UK South Downs in 1987

Off-site Effects of Soil Erosion

- Main off-site effect is the movement of sediment and agricultural pollutants into watercourses. This can lead to the silting-up of dams, disruption of the ecosystems of lakes, and contamination of drinking water.
- In some cases, increased downstream flooding may also occur due to the reduced capacity of eroded soil to absorb water



China's Yangtze River at the Three Gorges,
in Hubei province