Soil Degradation

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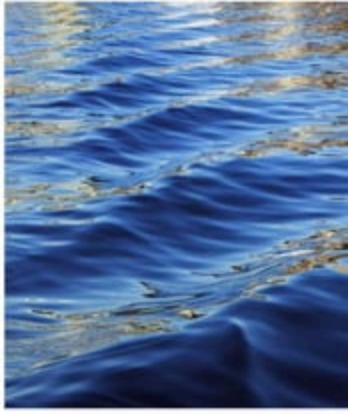

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What is soil?

- The upper layer of earth in which plants grow, a black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles.
- Soil is one of the three major natural resources, alongside air and water. It is one of the marvellous products of nature and without which there would be no life.

Soil Degradation

- Soil degradation is the inability of soil to support the growth of crops.
- Soil degradation is the decline in soil quality caused by its improper use, usually for agricultural, industrial or urban purposes.
- It is a serious environmental problem.
- Avoiding soil degradation is crucial to our well-being.

(FAO, 2015)

Types of Soil Degradation

- Following are the Main types of Soil Degradation:

- Chemical Degradation
- Physical Degradation
- Biological Degradation

Chemical Degradation

- Loss of nutrient or organic matter
- Acidification.
- Salinization.
- Acid Sulphate Soil.
- Soil Pollution

Loss of Nutrients

- The removal of nutrients reduces the capacity of soils to support plant growth.
- Decrease the Soil Fertility.
- Decrease the crop Yield.
- Hardening of iron and aluminum rich clay soils into hardpans.
- The reduction of soil nutrients may be due to acidity or water logging.

Salinization

- Soil salinity is the salt content in the soil; the process of increasing the salt content is known as salinization.
- Salts occur naturally within soils and water.
- Salinization can be caused by processes such as mineral weathering or irrigation.

(Wikipedia)

- Acid sulphate soils are naturally occurring soils, sediments or organic substrates that are formed under waterlogged conditions.
- Release of this sulfuric acid from the soil can in turn release iron, aluminium, and other heavy metals (particularly arsenic) within the soil.
- killing vegetation, seeping into and acidifying groundwater.

Acid Sulphate Soil.

Soil Pollution

- Soil pollution as part of land degradation.
- Caused by the presence of human-made chemicals or other alteration in the natural soil environment.
- It is typically caused by industrial activity, agricultural chemicals, or improper disposal of waste.

Physical Degradation

- Water Lodging.
- Compacting, Sealing and Crusting.
- Lowering of water table.
- Mining and Urbanization.

Water Lodging

- Excessive irrigation on poorly drained soils is waterlogging.
- This occurs (as is common for salinization) in poorly drained soils where water can't penetrate deeply.
- For example, there may be an impermeable clay layer below the soil.
- The raised water table results in the soils becoming waterlogged.

(European Environment Agency, 2000)

Compacting, Sealing and Crusting

- **Soil compaction** decrease in space between soil particles due to externally or internally applied loads.
- **Soil sealing** is the covering of the ground by an impassable material is one of the main causes of soil degradation.
- **Soil crusting** is a thin layer of dense and tough material. Soil crusting is considerably more compacted and packed than the underlying material.
- Increase runoff, decrease infiltration of water.

(European Environment Agency, 2000)

Mining and Urbanization

- Surface mining requires the removal of topsoil to get at the valuable rocks below which cause soil degradation.
- Increased urbanization due to population growth reduces the agricultural land.
- Therefore, urbanization leads to deforestation which in-turn affects millions of plant and animal species.

(European Environment Agency, 2000)

Biological Degradation

- Affect soil micro flora and fauna also reduce the biological or microbial activity of soil adversely.
- Reduce the yield.
- Applications of some pesticide chemicals which inhibit nitrification.
- Disposal of oil shales, heavy metal contamination of soil and spillage of crude oils adversely affect soil micro flora.

(Land and Environmental degradation, M. Sharif Zia, 2004, Lahore)

Causes of Soil Degradation

i. Immediate Causes.

- Biophysical factors

• Topography (determines soil erosion)

• Climatic Conditions

i. Temperature

ii. Rainfall

iii. Wind.

Causes of Soil Degradation

- Unsustainable Land management Practices

i. Deforestation.

ii. Soil Nutrient Mining

iii. Cultivation in Steep Slopes

Impacts of Soil Degradation

- The effect of soil degradation is not detected as serious global problem up to 2020. But, its localized effect is serious affecting food supply and production in poor and marginal areas with low income.

- Cumulative effect of soil degradation is a serious problem.

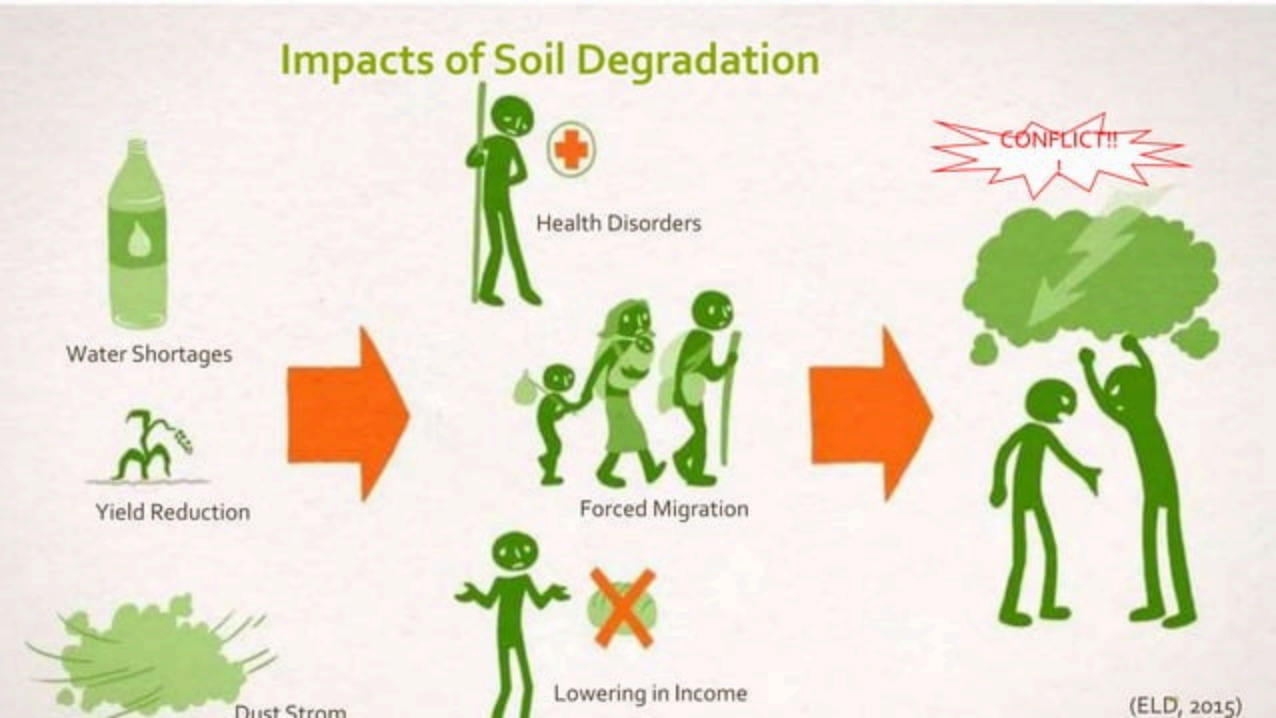
- Cost of degradation :
  - 5-10% production loss (light degradation)
  - 20% production loss (moderate degradation).
  - 75% Production(severe degradation).
  - Even 100% in severe condition.

Impacts of Soil Degradation

- Effect of soil degradation in food production system combines with the land management techniques, use of fertilizers, irrigation and machinery uses.

- Degradation makes Soil irresponsive to inputs, reduce alternative use of land, failure of irrigation scheme, and reduce water use efficiency.

Impacts of Soil Degradation



(ELD, 2015)

Sustainable Soil Management: Principles

Five Basic Principles:

- Maintain Soil Livestock: They recycle nutrients and many other benefits!
- Organic matter (OM) is food for the soil microbes.
- Cover the soil (Mulching): You may loose nutrients due to erosion and temperature extremes.
- Minimum or No Tillage: It speeds the organic matter decomposition.

Sustainable Soil Management: Principles

- Maintain Nitrogen in Soil: Higher nitrogen (N) in soil means higher decomposition of organic matters and vice versa. Also, Low N starves plant.

- OM degradation should be less than its addition to maintain the soil fertility. Soil Fertility should be in acceptable level before doing agriculture.

Soil Degradation in Pakistan

- In Pakistan soil degradation include:
- Water erosion
- Wind erosion
- Deforestation
- Water logging
- Salinity
- Flooding and drought

Soil Degradation in Pakistan

- Total geographical area of Pakistan is 79.6 mha (Million Hectares).
- About 11 million hectares are affected by water erosion.
- About 3-5 million hectares by wind erosion.
- The amount of soil removed by wind is about 28% of total soil loss.
- About 15.5 million ha are affected by water-logging.
- About 5.0 million ha affected by salinity.

(Land and Environmental degradation, M. Sharif Zia, Tariq, 2004, Lahore)

References

- Land and Environmental degradation, M. Sharif Zia, Tariq Mahmood, Mirza B. Baig, and M. Aslam, 2004, Lahore
- European Environment Agency, 2000.
- Soil Degradation by erosion, R.LAL, 2001, USA.
- Viewed, 31 July 2017, Land Degradation, http://www.sgppakistan.org/landdeg.html

Last but not the Least:

"RESPECT THE SOIL"

Thank You!!!

Now the flour is open for queries!!!