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Soil Erosion a Contemporary Challenge and it's Prevention

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Abstract: ***The soil is the top layer of the earth's surface. It is made up of dirt and rock. It is filled with air and life. A variety of organisms, like insects, earthworm, live in soil. For plants, soil serves as a storehouse of water and minerals needed for their growth. It also provides shelter to many animals that live on or in the soil. Without soil, there would be no grass, no crops, no trees, no food for us and other animals. It is a process in which the top fertile layer of soil is lost. Due to soil erosion, the soil becomes less fertile. The top layer of soil is very light which is easily carried away by wind and water. The removal of topsoil by the natural forces is known as soil erosion.***

Keywords: Soil erosion, challenges, Prevention

1. Introduction

Soil erosion is a gradual process that occurs when the impact of water[1] or wind detaches and removes soil particles, causing the soil to deteriorate. Soil deterioration and low water quality due to erosion and surface runoff have become severe problems worldwide. The problem may become so severe that the land can no longer be cultivated and must be abandoned. Many agricultural civilizations have declined due to land and natural resource mismanagement, and the history of such civilizations is a good reminder to protect our natural resources. Erosion is a serious problem for productive agricultural land[2] and for water quality concerns. Controlling the sediment must be an integral part of any soil management system to improve water and soil quality. Eroded topsoil can be transported by wind or water into streams and other waterways. Sediment is a product of land erosion and derives largely from sheet and rill erosion from upland areas, and to a lesser degree, from cyclic erosion activity in gullies and drainage ways.

The impact of soil erosion[3] on water quality becomes significant, particularly as soil surface runoff[4]. Sediment production and soil erosion are closely related. Therefore, the most effective way to minimize sediment production is the stabilization of the sediment source by controlling erosion. Several conservation practices can be used to control erosion but first you need to understand the factors affecting soil erosion. Soil erosion is the detachment and movement of soil particles from the point of origination through the action of water or wind. Thus, minimizing the impact of water or wind forces is the main objective for erosion control. Water erosion is the most pertinent erosion problem in Iowa. Soil erosion by water occurs when bare - sloped soil surface is exposed to rainfall[5], and the rainfall intensity exceeds the rate of soil intake, or infiltration rate, leading to soil - surface runoff. Soil erosion can occur in two stages: 1) detachment of soil particles by raindrop impact, splash, or flowing water; and 2) transport of detached particles by splash or flowing water. Therefore, soil erosion is a physical process requiring energy, and its control requires certain measures to dissipate this energy.

The hydrologic processes of rainfall and runoff play an essential role in water erosion[6]. The amount and rate of surface runoff can affect erosion and sediment transport. Thus, soil conservation practices are important in reducing soil erosion. Improving the soil infiltration rate, resulting in less surface runoff, can lead to reduction of soil erosion. Agronomic, cultural, or structural practices are available for controlling soil erosion. Structural practices involve physical changes in the shape and topography of the land. All these practices are not mutually exclusive. Some situations may require both management and structural changes, where the topography is highly complex. In other situations, erosion control can be achieved by implementing a single practice, where the erosion is minimum, such as the establishment of grassed waterways.

Causes of Soil Erosion

Various agents, like wind, water, deforestation[7], overgrazing[8] by cattle, etc., cause soil erosion. The various factors of soil erosion are:

1) **Wind**

When strong winds blow, the topsoil along with the organic matter is carried away by the wind. This happens more often when the land is not covered with grass or plants. Such conditions are very common in desert and semi - desert regions where strong winds blow very frequently.

2) **Water**

When it rains in the hilly areas, the soil gets washed away towards the plains. The running water deposits the mineral - rich soil in the riverbed and over the years this deposition of soil can change the course of the river. This can lead to floods which cause the destruction of life and property. Water erosion leads to loss of agriculture potential.

3) **Overgrazing**

When cattle are allowed to graze on the same field repeatedly, all the available grass, including the roots are eaten by them. This makes the topsoil vulnerable to wind and flowing water, leading to soil erosion.

4) **Deforestation**
Humans have taken land from the forest to cultivate in order to feed the ever - increasing population and to build houses, industries, etc. Cutting down trees on a large scale for these purposes is deforestation. The roots of trees hold the soil together, thus preventing the soil from getting uprooted. When large areas of the forest are cleared, the topsoil gets eroded by wind and flowing water.

Types of Erosion -
1) Erosion caused by water
Soil erosion is caused by a variety of factors, including running water. Water erosion can be caused by raindrops, waves, or ice. The severity and kind of soil erosion caused by water are classified differently.

2) Erosion by the wind
Soil erosion caused by the wind is especially prevalent in locations where natural vegetation is scarce. It's mainly found near the sandy coasts of seas, lakes, and rivers in dry and arid places. After becoming loose, the soil particles are blown and transported away by the wind through:

Suspension - Smaller dirt particles are suspended in the air and drift with the wind like a thin crust, allowing them to be carried across vast distances.

Surface Creep - The wind just pushes or spreads the heavier soil particles that aren't easily tossed up by the wind along the surface.

Impacts Of Soil Erosion
- Soil erosion destroys the most fertile section of the soil, which contains the majority of the nutrients and organic matter required by plants, leaving behind the less fertile subsoil.
- As a result of the removal of seeds or seedlings, the soil becomes bare, making it more susceptible to erosion.
- It also decreases the soil's ability to hold water.

The Importance of Soil, Especially Topsoil

Insects and earthworms are among the species that dwell in soil. Soil acts as a reservoir for water and nutrients that plants require for growth. It also serves as a home for a variety of creatures that dwell on or in the soil.

Why Preventing and Stopping Soil Erosion is so Important"

Air and vitality abound in the earth. There would be no grass, no crops, no trees, and no sustenance for humans and other animals without dirt.

Soil Conservation
Prevention of soil erosion is also called conservation of soil. Soil erosion can be prevented in the following ways:

1) **Afforestation**
Planting new trees and plants is afforestation[9]. We live because plants live. If the plants die, all living things will also die. Thus, whenever trees are cut down new trees should be planted. Planting trees in hilly areas are most effective for conservation.

2) **Crop Rotation**
Between harvesting one crop and planting the next crop, the fields lie bare; there is a time period when the farmland does not have any crops. During this period, the farmer either grows grass or grows other crops to prevent soil from erosion. This helps the soil to regain the lost minerals[10].

3) **Terrace Farming**
In hilly areas, farming is done by cutting steps on the slopes of the hills. This slows down the flow of water and soil removed from one step is deposited on the next step. Thus, the soil is never completely lost. This is terrace farming[11].

4) **Building Dams**
Dams are built to prevent floods, which not only damage the crops but also wash away the topsoil[12].

5) **Shelterbelts**
The cover of plants and trees around the field also breaks the speed of strong winds and protects the soil from being blown away[13].

6) Embankments
Bib strong structure called embankments along the banks of the river can protect fields from the floods. These embankments prevent the fast overflowing rivers and rainwater from washing away a huge amount of rich fertile soil[14].

2. Soil erosion in India

Excessive soil erosion in India combined with consequent high rate of sedimentation in reservoirs and decreased soil fertility has led to grave environmental problems. Soil erosion mostly affects practically all kinds of lands such as the forest lands, agricultural lands, arid and semi - arid lands, surface mines, roads, construction sites, coastal areas etc. Further, since soil formation is a very slow process, the erosion of the upper layer of the soil leaves it barren for a long time, causing grave problems to the agricultural sector. According to areport of the Indian Institute of Remote Sensing (IIRS), the estimated amount of soil erosion that occurred in India was 147 million hectares. Under this broad figure, 94 million hectares were claimed by water erosion, 16 million hectares by acidification, 14 Million hectares by flooding and 9 million hectares from wind erosion.29 percent of the soil that is eroded is lost in the sea while 61 percent is just relocated. India predominantly witnesses water erosion. The rate of soil erosion by moving water is directly proportional to the intensity and duration of the downpour. In coastal areas the intensity of the erosion is decided by the velocity of the waves, volume of water, extension of vegetation cover, nature of rocks, etc. The southern coasts of India, like the coasts of Kerala are most prone to such kind of aggressive form of Soil erosion. While in the high altitudes of the country glacial, snow and wind action control the nature and intensity of soil erosion. Intense erosion happens in the arid and semi - arid areas where the vegetation cover is scarce. On the other hand, in the northern parts of India, the states of Rajasthan, Haryana, Punjab and Gujarat face the problem of wind erosion. Wind

erosion depends on the velocity of the wind, the dryness and the particle size of the surface soil.

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