1.0 Concept of soil conservation

Soil and water conservation is necessary for sustained productivity of land. Soil erosion is prevented or reduced to a tolerable level, and water is conserved for judicious utilization. Sustainable production implies that agricultural practices would lead to economic gains without impairing environmental quality and the usefulness of the soil for future generation. Therefore, the objectives for soil and water conservation are:

- promotion of proper land use
- prevention of soil erosion
- restoration of the productivity of eroded land
- maintenance of soil productivity
- control of runoff, and regulation of water resource through irrigation and drainage
- maintenance of environmental quality by preventing land and water pollution

2.0 Land degradation (soil degradation)

Land degradation results in a reduced productive potential and a diminished capacity of land to produce benefits for humanity. Or, it can be described as process by which one or more of the potential ecological functions of the soil are harmed. The causative factors of land degradation are:

(i) Improper land clearing methods, non use of conservation agriculture

(ii) Soil compaction from mechanization,

(iii) Organic matter and soil biota depletion-Improper land clearing methods; Cropping intensification, non-return of residues, non practice of conservation or organic agriculture, acidification

(iv) Salinization-common in arid areas, arises from inherent soil properties during irrigation,

(v) Desertification

3.0 SOIL EROSION

The two main agents of soil erosion are water and wind. Soil erosion in the field can be assessed at the scale of a watershed. A watershed refers to a delineated area with a well-defined topographic boundary and a water outlet. It contains a complex of soils, landforms, land uses, and vegetation. A watershed is a hydrologic unit in which all hydrological processes are related. The terms watershed, catchments and basin are used interchangeably.

3.1 Broad classification of soil erosion

Geological or natural or normal erosion:

Erosion can occur naturally, transforming soil into sediment. This naturally occurring erosion devoid of man's influence is called **geological or natural or norm**al erosion. Under this erosion type, the process of soil erosion is balanced by the process of soil formation, creating a state of equilibrium.

Accelerated erosion:

When the process of soil erosion is influenced by human activities, it is **accelerated**. Such accelerated erosion is caused by removal of vegetation, and improper land use and management.

4.0 SOIL EROSION BY WATER

Soil erosion occurs through a 3-stage process, namely,

- detachment
- transportation
- deposition

Soil erosion by water can be primarily linked to rainfall, although water in motion erodes soil, rivers scour soil away, and waves erode shores. Therefore, soil erosion can be defined as the detachment and movement of soil particles by the erosive forces of wind or water. Soil detached and transported away from one location is often deposited at some other place. While soil erosion can be controlled, it is almost impossible to completely stop.

Detachment process

When a raindrop falls, it accelerates until it reaches a terminal velocity, capable of following processes -

- it detaches the soil
- it destroys granulation or aggregation
- it splashes particles

Loosening of soil particles and their suspension in a water film by raindrops constitute detachment of soil.

Transportation

As precipitation progresses, water film on the soil surface thickens particularly when the infiltration capacity of the soil has been exceeded. This water film slides down slope, and as it moves it carries with it soil particles. The water moving the soil from place to place is called runoff.

Deposition

When runoff reaches flat lowland, the current slows down depositing its content. This is the last stage of accelerated erosion. Deposition usually occurs in depressions or at the foot slope. The amount of soil delivered into a stream divided by the amount eroded is termed the delivery ratio.

4.1 Types of Water Erosion

Splash erosion: Raindrops hitting soil aggregates tear it apart by its kinetic energy. The soil particles are splashed as a consequence of this action

Sheet erosion: When precipitation exceeds soil permeability, excessive water will form a thin sheet or film. This film of water or film current moves over the soil, sometimes with small ripples. In the process, splashed soil is removed more or less uniformly. This is termed sheet erosion. Sheet erosion removes fine particles and organic matter without any easily detectable trace.

Rill and Interill erosion: Rills are channel which could be obliterated easily by normal tillage operations. A rill is always no more than 30 cm depth and 100 cm in width. They are formed when water has accumulated on the ground, and the film of water becomes streamlets which have greater scouring action than sheet flow. Rills can easily be formed along furrows planted along slopes.

Interrill (between rills) erosion is sometimes referred to as sheet erosion; but technically, interill erosion is the detachment and transport of particles by rain impact and shallow overland flow.

Gully erosion: When rills advance, gullies are formed. These are erosion channels too large to be obliterated by ordinary tillage. In gullies, runoff develops as powerful torrents with enhanced capability of erosion

4.2 Factors influencing soil erosion by water

The following are the factors which influence soil erosion by water

- Climate; rainfall
- Soil: its characteristics
- Topography: slope length, slope steepness and slope shape
- Vegetation: presence of crop, forest, and vegetation management
- Human behavior; land exploitation and management

Rainfall

The potential ability of rainfall to cause soil erosion is called erosivity. In evaluating rainfall erosivity, rainfall should first be perceived as an aggregation of different drops of water. Then it can further be perceived in amount as the summation of the amount of individual drops. Individual drops play a significant role in detaching the soil, and the cumulative drops as runoff transport and deposit detached soil. Therefore rainfall characteristics which influence it erosivity are:

- Amount, duration and intensity
- Drop size and drop size distribution
- Terminal velocity
- Kinetic energy

Soil

The vulnerability of the soil to erosion is called soil erodibility. Erodibility of the soil can be influenced by the inherent characteristics of the soil, the topographic features- slope, and the management of the soil.

Soil texture and particle size distribution are important in sediment detachment, dispersion and transportation. The bigger the particle the more the force required for its transportation