Soil erosion

Soil erosion in sloping agricultural land in Tunisia. Photolibrary on soil erosion processes.

The most serious form of soil degradation is from accelerated erosion. Erosion is the washing or blowing away of surface soil, sometimes down to the bedrock. While some erosion takes place without the influence of man, the soil is lost so slowly that it is usually replaced through natural processes of decay and regeneration so soil loss and creation of new soil are balanced.

What keeps soil in a natural state from eroding is vegetation. Undisturbed by man, soil is usually covered by a canopy of shrubs and trees, by dead and decaying leaves or by a thick mat of grass. Whatever the vegetation, it protects the soil when the rain falls or the wind blows. The leaves and branches of trees and the cushion of grass absorb the force of raindrops, and root systems of plants hold the soil together. Even in drought, the roots of native grasses, which extend several metres into the ground, help tie down the soil and keep it from blowing away.

With its covering of vegetation stripped away, however, soil is as vulnerable to damage as a tortoise without its shell. Whether the plant cover is disturbed by cultivation, grazing, burning, or bulldozing, once the soil is laid bare to the erosive action of wind and water, the slow rate of natural erosion is greatly accelerated. Losses of soil take place much faster than new soil can be created, and a kind of deficit spending begins with the topsoil.

The mechanics of soil erosion are fairly well understood today by conservationists and by many farmers.

Erosion from water proceeds in three steps: (1) soil particles are loosened by the bomb-like impact of raindrops or the scouring action of runoff water; (2) the detached particles are moved down the slopes by flowing water; and (3) the soil particles are deposited at new locations, either on top of other soil at the bottom of the slope or in ponds or waterways. The soil washed downhill

is usually the most fertile, containing most of the nutrients and organic matter required for normal plant growth.

All other things being equal, the steeper the slope, the greater the soil erosion. Erosion is also more severe on long slopes than on short ones; the velocity of the water flow increases on long, unobstructed downhill stretches. Soil loss may be half again as great when the slope length is doubled.

Also significant is the shape of the slope. A convex or bulging slope loses more soil than a uniform slope. A concave or dish-shaped slope loses less. Many erodible soils also seal off the surface pores of the soil as they travel downhill with the runoff water. This action further decreases the amount of water that can be absorbed by the soil and increases the water's velocity, causing even more erosion.

For the farmer and for the consumer as well, the worst thing about soil erosion is that it reduces crop yields and increases the costs of growing food and fibre.

Firstly, erosion reduces the capacity of the soil to hold water and make that water available to plants. This subjects crops to more frequent and severe water stress.

Secondly, erosion contributes to losses of plant nutrients, which wash away with the soil particles. Because subsoils generally contain fewer nutrients than topsoils, more fertilizer is needed to maintain crop yields. This, in turn, increases production costs. Moreover, the addition of fertilizer alone cannot compensate for all the nutrients lost when topsoil erodes.

Thirdly, erosion reduces yields by degrading soil structure, increasing soil erodibility, surface sealing and crusting. Water infiltration is reduced, and seedlings have a harder time breaking through the soil crust.

Fourthly, erosion reduces productivity because it does not remove topsoil uniformly over the surface of a field. Typically, parts of an eroded field still have several inches of topsoil left; other parts may be eroded down to the subsoil. This makes it practically impossible for a farmer to manage the field properly, to apply fertilizers and chemicals uniformly and obtain uniform results. He is also unable to time his planting, since an eroded part of the field may be too wet when the rest of the field is dry and ready.

Source: Kelley, H.W. (1990). Keeping the land alive: Soil erosion: its causes and cures. FAO soils bulletin, 50. FAO, Rome.

Other resources on erosion:

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Website of the Joint FAO/IAEA Program on Nuclear Techniques in Food and Agriculture- Soil and Water Management & Crop Nutrition.