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Intensive Tillage Result on Soil Degradation

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Description

Soil erosion may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing a serious loss of topsoil. The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damaged drainage networks. Soil erosion could also cause sinkholes. Human activities have increased by 10 times to 50 times the rate at which erosion is occurring world-wide. Excessive or accelerated erosion causes both "on-site" and "off-site" problems. On-site impacts include decreases in agricultural productivity and on natural landscapes ecological collapse, both because of loss of the nutrient-rich upper soil layers. In some cases, the eventual end result is desertification. Off-site effects include sedimentation of waterways and eutrophication of water bodies, as well as sediment-related damage to roads and houses.

Water and wind erosion are the two primary causes of land degradation; combined, they are responsible for about 84% of the global extent of degraded land, making excessive erosion one of the most significant environmental problems worldwide. Intensive agriculture, deforestation, roads, acid rains, anthropogenic climate change and urban sprawl are amongst the most significant human activities in regard to their effect on stimulating erosion. However, there are many prevention and remediation practices that can curtail or limit erosion of vulnerable soils. Soil retrogression and degradation are two regressive evolution processes associated with the loss of equilibrium of a stable soil. Retrogression is primarily due to soil erosion and corresponds to a phenomenon where succession revert the land to its natural physical state. Degradation is an evolution, different from natural evolution, related to the local climate and vegetation. It is due to the replacement of primary plant communities known as climax vegetation by the secondary communities. This replacement modifies the humus composition and amount, and affects the formation of the soil. It is directly related to human activity.

Soil Degradation

Soil degradation may also be viewed as any change or ecological disturbance to the soil perceived to be deleterious or undesirable at the beginning of soil formation, the bare rock outcrops are gradually colonized by pioneer species. They are succeeded by herbaceous vegetation, shrubs, and finally forest.

In parallel, the first humus-bearing horizon is formed, followed by some mineral horizons. Each successive stage is characterized by a certain association of soil/vegetation and environment, which defines an ecosystem. Willow hedge strengthened with fascines for the limitation of runoff, after a certain time of parallel evolution between the ground and the vegetation, a state of steady balance is reached. This stage of development is called climax by some ecologists and "natural potential" by others. Succession is the evolution towards climax.

Regardless of its name, the equilibrium stage of primary succession is the highest natural form of development that the environmental factors are capable of producing. The cycles of evolution of soils have very variable durations, between tens, hundreds, or thousands of years for quickly evolving soils to more than a million years for slowly developing soils.

The same soil may achieve several successive steady state conditions during its existence. Soils naturally reach a state of high productivity, from which they naturally degrade as mineral nutrients are removed from the soil system. Thus older soils are more vulnerable to the effects of induced retrogression and degradation. When the state of balance, characterized by the ecosystem climax is reached, it tends to be maintained stable in the course of time. The vegetation installed on the ground provides the humus and ensures the ascending circulation of the matters. It protects the ground from erosion by playing the role of barrier for example, protection from water and wind.

Retrogression

Plants can also reduce erosion by binding the particles of the ground to their roots. A disturbance of climax will cause retrogression, but often, secondary succession will start to guide the evolution of the system after that disturbance. Secondary succession is much faster than primary because the soil is already formed, although deteriorated and needing restoration as well. However, when a significant destruction of the vegetation takes place of natural origin such as an avalanche or human origin, the disturbance undergone by the ecosystem is too important.

In this latter case, erosion is responsible for the destruction of the upper horizons of the ground, and is at the origin of a phenomenon of reversion to pioneer conditions. The phenomenon is called retrogression and can be partial or total in this case, nothing remains beside bare rock. For example, the clearing of an inclined ground, subjected to violent rains, can lead to the complete destruction of the soil. Man can deeply modify the evolution of the soils by direct and brutal action, such as clearing, abusive cuts, forest pasture, litters raking. The climax vegetation is gradually replaced and the soil modified.

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