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Soil erosion threatens food production.

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Erosion removes soil from land surfaces, reducing the productivity of all natural ecosystems, including agricultural, forest, and pasture ecosystems [1]. Soil erosion, water availability, climate change due to fossil fuel usage, eutrophication of inland and coastal marine bodies of water, and biodiversity loss are among the world's most pressing environmental issues.

Malnutrition affects about 66 percent of the world's population [2], the highest proportion of malnourished people ever (malnutrition: defective nutrition caused by insufficient or unbalanced nutritional intake or poor digestion or use of nutrients) [3]. More food will be required as the global population exceeds seven billion people and is anticipated to reach 9.3 billion by 2050 [4]. Consider that more than 99.7% of human food (calories) is produced on land [5], while less than 0.3 percent is produced in marine and aquatic ecosystems. The productivity and quality of all agricultural soils are essential for maintaining and growing the world's food supply.

Over many years, human-induced soil erosion and accompanying damage to all agricultural land has resulted in the abandonment of important agricultural land and a reduction in productivity of the remaining land, which is somewhat compensated by the injection of nitrogen and phosphate fertilisers [6]. The loss of agriculture due to soil erosion frequently necessitates the development of new cropland from forestland and pastureland, as well as the application of nitrogen and phosphate fertilisers to these new croplands [7]. Soil erosion also reduces the diversity of plants, animals, and soil microorganisms, which is important.

Erosion's causes

When soil is exposed to raindrops or wind energy, erosion happens. With around 1000 mm of rainfall, raindrops hitting a hectare of land in the New York State region of the United States give the energy equivalent of 60,000 kcal (250 106 joules) per year [8]. The energy in eight litres of gasoline is around 60,000 kcal. Raindrops hitting soil loosen the soil particles, and even a 2% slope causes the earth to start moving downward. The most common type of erosion is sheet erosion [9]. The impact of soil erosion is amplified on any sloping land, because as the water travels downhill into valleys and streams, more of the surface soil is swept away with each degree of slope.

Wind energy has the ability to dislodge and move surface soil particles over large distances. Wind erosion in Kansas during the winter of 1995–1996 was a striking illustration of this, as it was relatively dry and windy. Around 65 t/ha of soil was lost from this productive cropland at the time. The wind is powerful enough to push dirt particles thousands of kilometres. This is demonstrated by NASA's photograph of a sand storm being blown from Africa to South and North America.

Soil structure

The ease with which soil can be eroded is influenced by its structure. The most easily eroded soils have a medium to fine texture, low organic matter concentration, and poor structural development [10]. These soils typically have low water infiltration rates, resulting in high rates of water erosion and being easily displaced by wind energy.

The function of vegetative cover

Because rain drop and wind energy are dispersed by the biomass layer and the topsoil is held together by the biomass, land areas covered by plant biomass, living or dead, are more resistant to wind and water soil erosion and experience comparatively less erosion [11]. In Utah and Montana, for example, erosion rates increased 200-fold when the amount of ground cover plummeted from 100 percent to less than 1% [12]. To prevent major soil erosion and landslides in wooded areas, a minimum of 60% forest cover is required. Soil erosion is a result of the vast clearing of forests for crops and grazing.

Land topography

The topography of a landscape, as well as the amount of rainfall and/or wind exposure, all affect the land's susceptibility to soil erosion. Soil erosion rates as high as 400 t/ha/year have been observed in the Philippines, where more than 58 percent of the land has a slope greater than 11 percent, and in Jamaica, where 52 percent of the land has a slope greater than 20 percent [13]. The rate of erosion is particularly high on marginal and hilly lands that have been converted from woods to agriculture. Furthermore, in a desert part of India, soil erosion rates as high as 5600 t/ha/year have been documented under arid conditions with moderately strong winds. Even in a developed country like the United States, where there is less of a need to use croplands with steeper slopes, erosion losses averaged 13 tonnes per hectare per year in 2007. Individual storm losses of 20–40 tons/ha, which may occur every two or three years, are measured regularly in Europe, with losses of more than 100 tons/ha in extreme events, in a developed region such as Europe.

Other soil disturbances

Despite the fact that agriculture is responsible for almost three-quarters of global soil erosion, erosion happens whenever humans remove the vegetative cover. This difficulty can be seen in the development of roadways, parking lots, and buildings. Although the pace of soil erosion at building sites might be extremely high, the erosion only lasts a short time. Erosion decreases as the land surface is sown with grass or covered with other vegetation.

Natural habitats are also affected by erosion. This is particularly noticeable along stream banks, where erosion happens naturally

as a result of the forceful action of the nearby rushing water. When a stream cuts through adjacent land, increased soil losses (30 percent or more) occur on steep surfaces. Stream banks erode even on relatively flat soil with only a 2% slope after severe rains and flooding.

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