

Soil degradation and desertification

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Based on the GLASOD map, which covers the earth's surface between 72°North and 57°South, a total land area of 13 bn ha is available, of which according to an evaluation of Blum and Eswaran (2004) only 13-18 % are very fertile soils, with more than 50 % being of the lowest fertility class. Since an area of 3-400 km² is irreversibly degraded per day we are not only faced with a shortage of productive soils; to make matters worse these productive soils are also more intensely used for food production. Overuse may result in a decline of soil properties and functions. At the same time the population increases and may reach approx. 9 bn people worldwide in the year 2050, which exacerbates the food production problems.

Soil degradation is defined as a change in the soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries. It is therefore one of the major threats to future life. Soil degradation comprises physical, chemical and biological processes. Rainfall, surface runoff, floods, wind erosion, tillage, mass movements and soil compaction/deformation, and prevented carbon sequestration are examples of physical processes, which lead to a loss of fertile soils and declining soil quality and functionality. The reduction of soil nutrients due to alkalinity and acidity, loss of organic matter or water logging can be regarded as chemical components of soil degradation. The loss of biodiversity due to non-site adjusted soil management results both in changes in microbial activity, which affects crop yield, and sustainability of soil productivity.

At present 15 % of the total area is degraded which equals 1.95 bn ha and affects 1.5 bn people or 74 % of the poor globally. Approx. 1.6 bn ha are affected by soil erosion, while the further physical degradation amounts to nearly 0.1 bn ha and the chemical degradation to 0.25 bn ha. It can be assumed that nearly half of the eroded land is caused by secondary effects of soil degradation due to compaction and deformation by non-site adjusted management. According to the European Soil Framework Directive (2006) soil compaction is besides water and wind erosion one of the main physical threats causing soil degradation. It is estimated that 32 % of the subsoils in Europe are highly degraded and 18 % moderately vulnerable to compaction. The problem is not limited to cropland or forest areas (especially because of non-site adjusted harvesting machines) but is also prevalent in rangelands and grassland, and even in so-called natural non-disturbed ecosystems. The main reasons for an intense increase in compacted agricultural or forested land are the still increasing weight of the machines as well the increased frequency of machine wheeling under non-favorable site conditions. The same holds true for animal trampling in combination with overgrazing of moist to wet pastures.

Desertification: Since the pressure is increasing on dryland ecosystems to provide services such as food, forage, fuel, building materials, and water needed for humans, livestock, irrigation and sanitation, soil loss due to desertification ranges worldwide at 6 to 12 million km². It defines (a) land degradation in dryland areas and/or (b) the irreversible change of the land to such a state that it can no longer be recovered for its original use. Desertification-related processes such as reduction of vegetation cover increase the formation of aerosols and dust. These, in turn, affect cloud formation and rainfall patterns, the global carbon cycle, and plant and animal biodiversity. Desertification occurs because of a long-term failure to balance human demand for ecosystem services and the amount the ecosystem can supply.