Soil and Water Quality

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The term ‘soil quality’ indicates to what extent the soils of the world are able to provide ecosystem and societal services through several different functions. The production of food (and energy) is the most important function of soils from an anthropogenic perspective. Maintaining biodiversity is a likewise crucial soil function in the ecosystem context. Furthermore, the resilient reaction of landscapes upon weather extremes such as heavy rainfall is fundamentally linked to the water storage function of soils. Fully functional deep soils lower the flooding risk and provide water to plants during dry conditions because of the soils’ water storage capacity. Closely related to water retention is the ability of soils to cleanup the percolating rainwater.

Water quality is characterized by means of physical, chemical and biological parameters, in general, with respect to a certain purpose such as drinking or maintaining biodiversity. Soil quality and water quality very much depend on each other since soils form an important stage in the water cycle by temporally retaining water. The filter and buffer function of soils directly improve (ground)water quality as estimated on the basis of chemical indicators. Soils store nutrients and thereby protect water resources against eutrophication. Water purification through soils is achieved by mechanical filtration, adsorption of compounds and transformation of pollutants into non-toxic degradation products. Soil protection is, thus, a prime measure of water conservation because of the close interlinkages of soil and water processes. After decades of loading land surfaces with nutrients and pollutants, soils may also become a source of water contamination. Even after rethinking and reversing fertilization strategies and use of pesticides, nutrients and pollutants are leached from soils.

Soil quality and productivity of farmland as core elements of food and nutritional security can be rated based on how operational soil functions are. Soil physical properties including rooting depth or water holding capacity along with substrate composition and organic matter content are key parameters to be determined in soil quality assessments. Site specific conditions including drought/flooding and salinization risks have to be taken into account in order to fully understand soil quality at a given site.

Protection and maintenance of soil functions in landscapes under agriculture or forest use are the basis of a sustainable land management. Processes such as soil erosion, compaction, contamination, and loss of fertility compromise soil quality, eventually causing land degradation. Water quality is, likewise, at risk if soils are not carefully managed and protected. Historical and current examples of an unsustainable land management demonstrate the clear connection between loss of soil quality and hunger and/or poverty often at large scales.