Soil and Land use change

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Land use change has a huge influence on various ecosystem services. While improper land use leads to a reduction in ecosystem services and results in soil degradation (Hatano et al. 2015), optimal land use can maintain or increase ecosystem services. In this fact sheet, the focus is on ecosystem services related to soil functions.

The provisioning of goods is one of the prime ecosystem services. Agricultural land uses rely on the provisioning services of soil to produce food, feed, fibre and fuel. Agricultural land use alters these services by cultivating the soil, controlling the vegetation and adding various amendments. Forestry provides not only timber and biomass, but also various foods such as fungi and understory vegetation. The provision of clean water is getting more and more important under the climate change.

The regulating services of soil are found in the remediation of waste, toxics and other nuisances. Absorption and adsorption of cations and particles on the aggregate surfaces is especially important when it comes to providing clean water. These physicochemical soil functions are hardly influenced by artificial management, while some soil amendments have been found to be effective such as zeolite amendments to immobilize radioactive Cs in soil.

The mediation of flows is also an important regulating service of soil. Material and water flows are hugely influenced by land use. Changes in land use can release or sequestrate carbon till the equilibrium specific to the soil and environmental condition is reached. Soil microbes play a key role in the regulation of nitrogen flows. It is important to connect different spatial and temporal scale to capture the whole flow from regional to global scale (Kimura et al. 2009). Symbiotic nitrogen fixation by rhizobium as well as other plant growth promoting rhizobacteria can be used to enhance nutrient availability. The use of the microbial activities is still difficult to manage since spatial and temporal variability in the field often masks the effect.

Maintaining the physical, chemical and biological conditions of a given environment is also an important regulating service of soil. For example, land use type and soil management methods influence water storage and this function is crucial to prevent soil erosion or to provide water for drinking or succeeding crops.

Cultural services are of importance at landscape scale. Scenic landscape patterns formed by traditional land use attract tourists. Even if there is no economic benefit at field level, there are many areas that maintain special land use systems to boost tourism and, thus, benefit at regional level. Payment for ecosystem services is considered a governance tool to enhance ecosystem services of soil and land use systems (Uthes and Matzdorf 2016).

Hatano R. Suwardi, Bellingrath-Kimura S.D. 2015: Key processes and factors to mitigate land degradation. Catena 133. 453–454

Kimura S.D., Hatano R. and Okazaki M. 2009: Characteristics and issues related to regional-scale modeling of nitrogen flows Soil Sci. Plant Nutr. 55,1-12

Uthes, S., Matzdorf, B. (2016): Budgeting for government-financed PES: Does ecosystem service demand equal ecosystem service supply? Ecosystem Services 17, 255-264.