



Linking soil systems to societal value systems

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Sustainable management of soils is needed to avoid soil degradation and to maintain soil functions. This requires the assessment of how human activities drive soil management, how soil management affect soil functions and soil degradation, which trade-offs occur and how they compromise sustainable development targets. In the frame of the German research programme “Soils as a sustainable resource for the bio-economy - BonaRes”, we developed an enhanced approach of the DPSIR (driver-pressure-state-impact-response) cycle which helps to assess these interrelations. Because not all soil functions can be maximized simultaneously in space and time and trade-offs are inevitable, it depends on the societal value system to decide which management practices and respective soil functional performances are valued sustainably. We analysed the applicability of three valuation concepts being prominent in research about social-ecological systems, namely resource efficiency, ecosystem services, and ethics and equity. The concept of resource efficiency is based in the life-cycle thinking and is often applied at the level of the farming systems and in the context of bio-economy strategies. It covers the use of natural (water, energy, nutrients, land) and economic resources. At the landscape level, the concept of ecosystem services is prominent. Here, the contribution of soils to the provisioning, regulating and cultural services of the natural ecosystems is considered. Ethical considerations include the intrinsic values of nature as well as issues of local and global equity between different societal groups, generations, and localities. The three concepts cover different problem dimensions and complexity levels of soil management and decision making. Alone, none of them are capable to discover complex questions of sustainable soil management and development. Rather, the exact spatial and temporal framing of the sustainability problem at stake determines which combination of the value system is appropriate. Exemplified by some studies on soil management, we conclude with an outlook on criteria for selecting and combining value systems to assess the involvement of soil functions to specific Sustainable Development Goals at different spatial, temporal and decision making scales.