



Soils as records of past and present environments

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This contribution reflects selected pedological concepts that are helpful for interpreting soil properties related to past and present environments. These concepts are illustrated by examples from various landscapes, and their combination finally leads to some further conclusions. The concept of Targulian and Gerasimova (2009) distinguishes soil system and soil body. Soil system is defined as “open multiphase system functioning in any solid-phase substrate at its interface with the atmosphere, hydrosphere and biota”, and soil body as “solid-phase part of a soil system produced by its long-term functioning and composed of a vertical sequence of genetic horizons”. Soil system functioning corresponds to the recent environmental factors and includes heat and moisture dynamics, biomass production, biogeochemical cycles, and other processes. In contrast, a soil body is a record of the long-term functioning of a soil system. It thus provides a record not only of the functioning of the soil system under the present environmental conditions but also under past, possibly different, conditions. Hence, Targulian and Goryachkin (2004) called it the “memory” of the landscape. Richter and Yaalon (2012) argued that most soils comprise both, features that developed under the present environmental conditions and features that reflect different conditions that the soils experienced in the past; they concluded that most soils are polygenetic. Although the current functioning of the soil system in the concept of Targulian and Gerasimova (2009) is mainly controlled by the present-day combination of environmental factors, it should be added that past processes also influence the soil system, because past processes changed the soil properties in a way that also the present-day functioning of the soil system is affected by these changes.

Earlier, Yaalon (1971) had categorised soil properties according to the time-span required for their adjustment to the actual environment, distinguishing (i) rapidly adjusting soil properties (adjusting within some hundreds of years), (ii) slowly adjusting soil properties (adjusting within some thousands of years), and (iii) persistent soil properties (showing no changes over ten thousands to millions of years).

In a polygenetic soil, rapidly adjusting soil properties may already be in equilibrium with the present conditions, whereas slowly adjusting soil properties may still reflect past conditions. Thus, the lower the rate at which a certain soil property in a polygenetic soil adjusts, the larger is the extent to which this property is still determined by earlier environmental conditions. Knowledge on the rates at which soil properties adjust may hence be used to estimate the time at which a significant environmental change took place, based on the degree of overprinting of the different kinds of soil properties adjusting at different rates in a polygenetic soil.

References:

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