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Point zero: the missing link in initial soil formation concepts

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Soils as important parts of ecosystems are characterized as complex systems with abiotic and biotic processes interacting between the various components. This complexity has evolved over long-term periods of decades to millennia. Most integrating studies have been carried out in ´climax´ ecosystems and only limited knowledge exists about the initial phase of ecosystem development although it is hypothesized that the conditions at ´point zero´ and the processes of the initial phase determine and control further development.
It is rarely possible to study the ´point zero´ of ecosystem development and primary ecosystem genesis under natural conditions. Examples are landscapes created by volcanic activity, glacier retreat areas, tectonic uplift zones, coastal and inland sand dunes or the newly exposed seashores of the Dead Sea and the Aral Sea. Also anthropogenic disturbances result in large-scale impact on landscapes creating new land surfaces and spatial patterns.
Therefore, concepts for the development of soils and other ecosystems compartments are often based on assumptions and extrapolations e.g. from chronosequence studies. Conceptual frameworks of pedogenesis are mainly based on changes in soil properties over time. Rate and direction of development are controlled by both exogenic and endogenic factors. During this course the soil system ´accumulates´ properties and reaches new stages by transgressing thresholds. In many studies chronofunctions are derived by inferring temporal patterns across soil chronosequences. Examples of these types of development are processes of mineral weathering, formation of soil horizons, leaching, decalcification, secondary mineral formation, the occurrence of buffering systems or the stability of solid phases.
But most of these studies lack defined characteristics of the starting conditions at ´point zero´. So there is a need to entangle the close interaction of spatial and temporal patterns with processes in order to better characterize the effect of this very initial phase of development on later stages of ecosystem structure and functioning. Moreover, the study of initial, probably less complex systems could help to better identify and characterize coupled patterns and processes compared to highly complex systems.