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Soil Structure – the elusive and fragile scaffolding for soil ecological functioning

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Soil biological activity often imparts structural signatures such as biopore networks and aggregation of soil particles resulting in a nonrandom spatial arrangement of soil constituents reflecting complex ecological and hydrological feedbacks. A simple and intuitive definition of soil structure is the binding and spatial arrangement of soil constituents that support physical and biological traits not found in a disturbed soil with the same constituents (i.e. texture, organic matter). As a fragile product of soil biological activity, it encompasses traits invisible to the eye (mechanical and ecological) that contribute to the already difficult task of defining soil structure rigorously. The picture is further complicated by “managed” soil structure via tillage that does not rely heavily on biological activity. We examine similarities and differences between natural and managed soil structure in terms of ecological and agronomic “goals”, the value of desired soil structure (contrasting tilled, no-till and natural land) and consequences for eco-hydrological soil processes. We evaluate the consequences of projected increase in food production for world population on soil structure and its management considering glaring gaps in knowledge and limited scientific basis for what is arguably the largest geo-engineering operation on Earth – the annual tillage of arable lands.