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How far can we prevent further physical soil degradation in the future?

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Arable as well as forest soils are exposed to increasing external stresses, which coincide with a further and deeper reaching soil degradation, which may result in an aggravation of hydraulic, gaseous, thermal but also physicochemical and chemical soil functions. The decline coincides with a simultaneous reduction in useable land areas and worsens food production amongst others. Therefore, it is mandatory, that stable soil structure from the surface down to depth prevents soil compaction, sustains water infiltration, reduces rates of soil erosion by water and wind in each case to the minimum possible under the soil, terrain, land use, and climatic conditions in which the soils occur. It improves organic carbon storage in soils and optimizes microbial activity and functions. These benefits coincide with sustainable soil properties and soil management systems, which prevent
- deep mechanical stress propagation which can cause irreversible soil deformation,
- loss of surface soil layers with coinciding organic and mineral nutrient pool available for microbial processing and plant uptake,
- Truncation of soil horizons, or damage on private and public infrastructures (roads, houses) and downstream fields.
In order to prevent negative impacts on soils, it is recommended, that
A) concerning prevention of soil compaction
- stresses applied to soils shall not exceed the mechanical soil stability to maintain the actual functioning of chemical, physical and biological processes and to utilize their resilience (i.e. the elasticity),
- land use management strategies have to be related to the actual soil properties in order to optimize plant growth, yield, filtering and buffering of infiltrating water, and carbon sequestration.
B) soil erosion by
- water, wind, and tillage is counteracted by an adequate surface soil stability including a site specific residue management (e.g. conservation tillage), controlled traffic and harvesting, ecological grassland use strategies (e.g. fodder production and harvesting, adequate animal grazing),
- wind is furthermore minimized by adequate hedgerow plantations, continuous cover crop growth, optimized particle bindings by water, infiltrating organic acids, appropriate grazing intensity. Agroforestry can be considered as an additional positive measure to reduce soil erosion risks generally and to ameliorate degraded sites.

C) -plant cover on slopes remains untouched, overgrazing and consecutive soil homogenization especially under moist climatic conditions must be prevented but adjusted to the actual structure stability of the hillsides.
The communication of these findings followed by application of such measures can help farmers and foresters as well as landowners to prevent (further) physical soil degradation in the future.