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Changes in soil properties and soil cover structure due to intensive erosion and accumulation processes in loess soils

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Intensive water and tillage erosion and consequent accumulation are the most important processes affecting the agroecosystems in loess regions and changing soil properties, e.g. organic carbon content, carbonate content or structure stability, and general distribution of soil units in the landscape. South Moravian loess belt, formerly covered mostly by Haplic Chernozem, is now formed by a highly diversified soil mosaic.
At a morphologically heterogenous study plot (6 ha), a study on relationship between soil properties and terrain characteristics was held. DTM analysis, detailed terrain survey and laboratory analysis were the main methods adopted in the study.
Three main soil units were identified: Haplic Chernozem, calcareous Regosol and Colluvial soil. The distribution of each soil unit correlates with different terrain attributes. Regosols are significatly connected to the steep slope, while their correlation with the curvature or hydrological indexes is lower. On the contrary, the Colluvial soils distribution depends mainly on values of curvature and topographical wetness index and is independent on the slope. Chernozem is related to a specific terrain position more than to any of the terrain attributes.
Soil depth and humus horizon thickness vary extremelly – from 0.2 m at the erosionally exposed slopes to more than 2.5 m at the concave parts and the toeslope. Soil depth is significantly correlated with all of the tested terrain attributes except of the slope – the strongest correlation was proved in case of mean curvature, topographical wetness index and catchment area.
Different degree of changes in particular soil properties results from the specificity of both erosion process and parent material character. Organic carbon content in the topsoil varies significantly. Humus is practically absent in the steepest parts of the slope where the loess is exposed. High amounts of Corg were identified in the undisturbed A horizons of the Chernozem unit. In the concave parts of the slope and at the toeslope, the Corg content in the plough layer is lower due to an admixture of non-humus material transported from the steep parts of the plot. Nevertheless, the deeper (0.7 – 2 m), buried parts of the colluvial profiles are very rich in organic carbon (up to 4 %). These horizons may represent fossil chernic horizons of former Chernozems, buried by intensive sedimentation of humic material. Similar variability was found in carbonate content values, always due to amount of loess admixture in the plough horizon. While the soil structure stability, depending strongly on humus content, was the highest in the Chernozem unit, in the eroded parts it was highly unstable. Changes in the cation exchange capacity and pH are less distinctive. CEC slightly increases in humus-rich soils and pH is higher in the eroded parts of the plot due to the loess exposition.

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