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WSA index as an indicator of soil degradation due to erosion

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Knowledge of spatial distribution of soil aggregate stability as an indicator of soil degradation vulnerability is required for many scientific and practical environmental studies. The goal of our study was to assess predisposition of different soil types to change aggregate stability due to erosion. Five agriculture arable lands with different soil types were chosen. The common feature of these sites is relatively large slope and thus soils are impacted by water erosion. The first studied area was in Brumovice. The original soil type was Haplic Chernozem on loess, which was due to erosion changed into Regosol (steep parts) and Colluvial soil (base slope and the tributary valley). A similar process has been described at other four locations Vidim, Sedlcany, Zelezna and Hostoun, where the original soil types were Haplic Luvisol on loess and Haplic Cambisol on gneiss, Haplic Cambisol on shales, and Calcaric Cambisol on marlstone, respectively. The regular and semi-regular soil sampling grids were set at all five sites. The basic soil properties were measured and stability of soil aggregates (WSA index) was evaluated.
In all cases, the higher aggregates stability was observed in soils, which were not (or only slightly) affected by water erosion and at base slope and the tributary valley (eroded soil particle accumulation). The lowest aggregate stability was measured at the steepest parts. When comparing individual sites, the highest WSA index, e.g. aggregate stability, was found in Sedlcany (Cambisol). Lower WSA indexes were measured on aggregates from Hostoun (Cambisol), Zelezna (Cambisol), Vidim (Luvisol) and the lowest values were obtained in Brumovice (Chernozem). The largest WSA indexes for Cambisols in comparison to Luvisols and Chernozem could be attributed to higher organic matter content and presence of iron oxides. Slightly higher aggregate stability of Luvisols in comparison to Chernozem, could be explained by the positive influence of clay (especially in form of clay coatings) and organic matter, and negative impact of pH. The largest range of WSA values were found for Sedlcany (WSA = 0.41 to 0.93), followed by Vidim (WSA = 0.32 to 0.78) and Brumovice (0.20 to 0.67), Zelezna (WSA = 0.35 to 0.78) and Hostoun (WSA = 0.53 to 0.85). This indicates that the largest impact of erosion on aggregate stability was measured for Cambisol in Sedlcany. Similar impact of soil erosion was observed for both soils on loess and Cambisol in Zelezna. The lowest impact of erosion on aggregate stability was measured for Cambisol in Hostoun.

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