



The impact of peasant and industrialized agricultural systems on high productive loess soils in Central Europe

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The study analyzes the impact of a peasant and an industrialized agricultural land use system on soil degradation in two loess landscapes. The comparative method aims to test the hypothesis that different agricultural systems cause distinct differences in soil properties that can be documented by geo-chemical soil analysis.

The two loess landscapes under investigation show great similarities in natural geo-ecological properties. Nevertheless, the land use system makes a significant difference in both research areas. The Polish Proszowice Plateau is characterized by traditional small-scale peasant agriculture. Small plots and fragmented ownership make it difficult to conjointly manage soil erosion. However, the Middle Saxonian Loess Region in Germany represents loess landscapes whose ecological functions were shaped by land consolidation measures resulting in the large-scale, high-input farming system.

To identify representative small catchments for soil sampling relief heterogeneity analyses and a cluster analysis were performed to bridge scales between the landscape and the sub-catchment level. Geo-physical and geo-chemical laboratory techniques were used to analyze major soil properties. A total number of 346 sites were sampled and analyzed for geo-ecological, geomorphological, and pedological features.

The results show distinct differences in soil properties between the two loess landscapes strongly influenced by agricultural use. However, despite big differences in agricultural management great similarities can also be found especially for mean soil organic carbon contents and plant nutrient values. At the same time, the greater variability of the soil mosaic is depicted by a higher variance of almost all soil properties common to traditional land use systems. Topsoils on arable land at the Proszowice Plateau also show a wider C/N ratio. Therefore, the soils there are less prone to degradation through mineralization of humic substances. The wider ratio is mainly caused by lower inputs of N-fertilizers, at least since 1990. At the same time, soil cultivation techniques and atmospheric deposits are not likely to make a significant difference.

The topsoil horizons on arable lands at the Proszowice Plateau do not show significant differences in plant available nutrients like phosphorus, despite much lower P-inputs through mineral fertilizers since 1990. This is because of the high P-sorption capacity of the loess soils. Therefore, a long legacy effect of previous comparatively high mineral P-inputs between the 1960s and 80s can be observed. A similar effect occurs in the Middle Saxonian Loess Region. In contrast to the assumption of many scholars small-scale farming at the Proszowice Plateau has not lead to an under-supply of plant nutrients.

The study has shown that significant differences in major soil properties can be observed because of different fertilizer inputs and partly because of different cultivation techniques. Also the traditional system increases soil heterogeneity. Contrary to expectations the study has shown that the small-scale peasant farming system resulted in similar mean soil organic carbon and phosphorus contents like the industrialized high-input farming system.

A further study could include investigations of the effects of soil amendments like herbicides and pesticide on soil degradation.