

## **Solid-phase material connectivity in the soil catenas in the arable landscapes**

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Transport of soil solid-phase material at the arable slopes lead to connectivity between different landscape positions. But there is lack of knowledge about distance and real extent of connectivity of soils within catenas. The aim of this research was - the large-scale estimation of connectivity within arable part of catenas by applying soil solid-phase marker of material movement.

The studied catchment is located in the forest-steppe zone (near Plavsk city, Tula region, Russia), and had an area of 0.96 sq.km. Lengths of slopes were 300 - 700 meters; steepness of slopes was from 1 to 7 degrees in arable part and exceeded 18 degrees in the grass part. Nine catenas were studied within the catchment; they had dispersed form near outfall and converge form near valley head. Soil samples were taken along catenas with step 100-25 m from the depths 0-25 and 25-50 cm. The quantitative analysis of the content of spherical magnetic particles (SMPs) was conducted in soil samples. SMPs were used for estimation the soil solid-phase material transport during 100-120 year, as these particles were falling out from the atmosphere on the soil surface since 1860 after burning of coal in steam locomotives.

Present-day uneven distribution of SMPs in the catchment is a result of soil erosion and deposition processes. The comparison of SMPs storage in non-eroded sites with slopes allowed estimating the mid-year displacement of solid-phase material mass in each sample point. Multiplying the soil erosion rate by the area of soil erosion gave the idea of the total removal of material from catena's part. In this research studied only arable part of the watershed. The volume of material transported through the plot was calculated for each catena's position.

The following results were obtained. The extent and structure of the connectivity differed in the studied catenas within the same catchment area. On the wellhead slopes of southern exposition, the soil solid phase material, eroded from the upper part of the catena, accumulated after 150 m (shoulder position). The soil material, washed off from the middle part of these slopes, accumulated in the lower part. Catenas with southern exposition in the middle part of the catchment area had a similar structure. All soil material, washed out from the top positions, accumulated in 200 m (middle part of the slope).

Arable slopes in the upper part of the catchment (eastern exposure) did not have significantly accumulation zones in shoulder position or middle part of catena. Part of sediments deposited on the footslope. Despite of high length of these slopes, estimated high rates of sediment delivery ratios (more than 40%). The slopes of northern exposition in the middle part of the catchment area had a very low outwash rates and sediment delivery ratios (less than 10%). Based on the studies, revealed the main sources of soil solid phase material, accumulated in the lower no arable part of watershed (grassy valley slopes and bottom). The long gentle slopes of the eastern exposure gave the main contribution of sediments. At the southern slopes the erosion was intensive, but the sediment delivery ratios was low. The northern slopes had relatively low rates of erosion and high percent of inside slope accumulation.