



Principal factors of soil spatial heterogeneity and ecosystem services at the Central Chernozemic Region of Russia

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The essential spatial heterogeneity is mutual feature for most natural and man-changed soils at the Central Chernozemic Region of Russia which is not only one of the biggest «food baskets» in RF but very important regulator of ecosystem principal services at the European territory of Russia. The original spatial heterogeneity of dominated here forest-steppe and steppe Chernozems and the other soils has been further complicated by a specific land-use history and different-direction soil successions due to environmental changes and more than 1000-year history of human impacts.

The carried out long-term researches of representative natural, rural and urban landscapes in Kursk, Orel, Tambov and Voronezh oblasts give us the regional multi-factorial matrix of elementary soil cover patterns (ESCP) with different land-use practices and history, soil-geomorphologic features, environmental and microclimate conditions. The validation and ranging of the limiting factors of ESCP regulation and development, ecosystem principal services, land functional qualities and agroecological state have been done for dominating and most dynamical components of ESCP regional-typological forms – with application of regional and local GIS, soil spatial patterns mapping, traditional regression kriging, correlation tree models.

The outcomes of statistical modeling show the essential amplification of erosion, dehumification and CO₂ emission, acidification and alkalization, disaggregation and overcompaction processes due to violation of agroecologically sound land-use systems and traditional balances of organic matter, nutrients, Ca and Na in agrolandscapes.

Due to long-term intensive and out-of-balance land-use practices the famous Russian Chernozems begin to lose not only their unique natural features of (around 1 m of humus horizon, 4-6% of Corg and favorable agrophysical features), but traditional soil cover patterns, ecosystem services and agroecological functions.

Key-site monitoring results and regional generalized data showed 1-1.5 % Corg lost during last 50 years period and active processes of CO₂ emission and humus profile eluvial-illuvial redistribution too. Forest-steppe Chernozems are usually characterized by higher stability than steppe ones. The ratio between erosive and biological losses in humus supplies can be tentatively estimated as fifty-fifty with strong spatial variability due to slope and land-use parameters. These processes have essentially different sets of environmental consequences and ecosystem services that we need to understand in frame of agroecological problems development prediction.

A drop of Corg content below threshold “humus limiting content” values (3-4% of Corg) considerably reduces effectiveness of used fertilizers and possibility of sustainable agronomy here. This problem environmental and agroecological situation can be essentially improved by new federal law on environmentally friendly agriculture but it's draft is still in the process of deliberation.

Quantitative analysis of principal ecosystem services, soil cover patterns and degradation processes in parameters of land qualities help us in developing different-scale projects for agricultural and urban land-use, taking into attention not only economical benefits but environmental functions too. The conceptions of ecosystem services and local land resource management are becoming more and more popular at the Central Chernozemic Region of Russia due to innovation application of basic agroecology, ecological monitoring and soil science achievements.