



Landscape assessment of spatial Cs-137 connectivity patterns in arable land with gray loamy soils in the Bryansk Region (landscapes of the Opolje)

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As a result of the Chernobyl accident in 1986 landscapes of the Bryansk Region (Russia) were contaminated by Cs-137. In 1993 air-gamma survey with 100 m resolution was done in contaminated areas of the region, which revealed significant spatial heterogeneity of Cs-137 contamination. The initial "spotting" of contamination Cs-137, which in the spring of 1986 represented multi-scale complex patterns of contamination, was substantially transformed by 1993 as a result of erosion processes of various intensity. The purpose of this research was to obtain estimates of the transformation of initial Cs-137 patterns as influenced by different landscape factors. The study is based on the concept of sediment and hydrological connectivity. We apply GIS-based models considering lateral soil migration to analyze sediment cascade system.

The study area is a test plot that has grey loamy soils (landscapes of the Opolje) with a size 10x16 km in the central part of the Bryansk Region, with more than 80% of the area under cultivation. Elevation levels are in the range of 140-210 m. Because of plowing, intense erosion processes have taken place. The slope angles in the lower parts of slopes reach 2-3 degrees. Maximum slopes in gullies reach 11,5 degrees. Cs-137 levels of contamination vary from 3,6 kBq/m² to 35 3,6 kBq/m².

Over the past few decades the Cs-137 technique has been applied to determine net soil redistribution rates. It is applicable for medium long term (30 to 40 years) soil redistribution estimates. In this technique, the anthropogenic radionuclide Cs-137 is used as a sediment tracer from upland erosion studies to catchment sediment budgets, as well as to depositional areas in colluvial positions, valleys, river terraces, floodplains. The soil movement is primarily driven by water flow due to the gravity. The effect of gravity can be easily approximated using DEM derivatives.

Cs-137 patterns have been investigated to estimate landscape connectivity and soil redistribution rates in different slope positions. In addition to the Cs-137 contamination, DEM parameters, such as slope angle, aspect, and different landscape indexes (wetness index etc.) have been estimated. Potential Cs-137 connectivity of hillslopes - floodplain or hillslopes -valley is characterized by lateral contributing area.

To assess the relationship of Cs-137 with various landscape factors we used different statistical models. Analysis of the lateral redistribution of Cs-137 in the landscape is based on the assumption of primordial density in nonuniformity of Cs-137 deposition in different landscape positions.

Relationship of Cs-137 connectivity for various landscape positions is presented. Fundamental differences of Cs-137 connectivity for slopes of southern and northern exposure are demonstrated.