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Geoinformational modelling of the land use of Polesye and Opolje landscapes in Bryansk region (Russia) under conditions of 137Cs radionuclides contamination

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Significant part of Russian Federation was contaminated by 137Cs radionuclides due to Chernobyl disaster in 1986. South-western part of Bryansk region has suffered the most. Study area (the central part of Bryansk region, Polesye and high plains landscapes) is situated outside the officially specified zone of contamination with contamination levels under 1 Ci / km2. Nevertheless, such contamination levels (which are 20 times greater than levels of global fallout) require particular attention as it may contain a threat of the land use and the health of population, living within the territory.

Radioactive contamination within the model area was formed as a result of a “dry” deposition from the atmosphere. Consequently, the initial contamination of soil by isotopes 137Cs, unlike the western part of the Bryansk region, was spread relatively equally. The main part of 137Cs (up to 90%) in natural landscapes is contained in the top 5 cm of soil, which itself creates danger of biogeochemical migration from soil to plants. In agricultural landscapes under cultivation 137Cs is uniformly spread within a 20 cm layer of soil and can also come from soil to plants grown in the fields.

The area of radioactive contamination that was formed during the period of deposition (late April – early May 1986), is exposed to the processes of secondary redistribution. It is influenced by several factors as topography, vegetation type, proportion of arable soils, soil humidity, soil texture etc. In the presented study there was evaluated the impact of these factors on the secondary redistribution of 137Cs.

Sustainable development of agricultural production in the contaminated territories requires managing a number of measures to reduce radiation risks to the population. Regarding this point the greatest threat may be represented by milk production, as well as picking berries and mushrooms. Planning of the sustainable use of the territory requires an evaluation of contamination levels within the existing agricultural lands.

For this purpose, geographic information system (GIS) of the territory was created. It contains following layers: aero-gamma spectrometry data with interval of 100 m; soil types (scale 1: 50,000); relief (SRTM data); schematic map of agricultural lands and forests.

The analysis of the secondary redistribution of radionuclides was conducted for the radio-ecological zoning of the territory, as well as the stock of 137Cs was calculated according to types of land use. It made it possible to evaluate the contamination of milk (using transfer coefficients "soil-plant-milk") for different natural landscapes.

Evaluation of factors of radionuclides’ migration in landscape also allows to predict possible trends in distribution of contamination and to develop recommendations regarding the future use of the territory.