

**ANALYSIS OF SOIL EROSION IN THE MINSK REGION OF  
BELARUS BASED ON THE RUSLE MODEL**

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**Summary.** *In this study, the RUSLE model was used in conjunction with remote sensing image information such as Sentinel 2 and field mapping data. A model of soil water erosion in the Minsk Region of Belarus was constructed and based on it a spatial analysis of soil erosion was carried out.*

Soil erosion is a major environmental issue, threatening agricultural sustainability and ecosystem health worldwide. In Belarus, the Minsk Region faces significant erosion risks due to its diverse topography, rainfall patterns, and intensive land use. This study applies the Revised Universal Soil Loss Equation (RUSLE) model integrated with GIS technology to quantify soil erosion rates, map spatial distribution, and identify high-risk areas in the region.

The Minsk Region, located in central Belarus, spans approximately 40,800 square kilometers and includes agricultural land, forests, grasslands, and urban areas. Its varied topography and land use make it an ideal area for studying soil erosion dynamics. The RUSLE model incorporates five factors: rainfall erosivity (R), soil erodibility (K), slope length and steepness (LS), cover management (C), and conservation practices (P). High-resolution spatial datasets, including rainfall data, digital elevation models (DEM), soil characteristics, and land use maps, were utilized to generate erosion risk maps using GIS.

The results indicate an average annual soil loss of X t/ha/year, with notable spatial variability. Low-risk areas (light green in figure 1) are concentrated in flat terrains and regions with dense vegetation, such as forests. Conversely, high-risk zones (orange) are predominantly located in steep agricultural lands with insufficient vegetation cover, particularly in the southern and western parts of the region. The map highlights that rainfall erosivity and topographic factors are the primary drivers of soil erosion, while dense vegetation and conservation practices significantly mitigate risks.

Figure 1 visually illustrates the spatial distribution of water erosion across the region. It highlights the areas requiring immediate soil conservation efforts, providing a practical tool for policymakers to prioritize interventions. High-risk areas underscore the importance of sustainable land management practices to reduce erosion.

This study recommends targeted conservation strategies, including conservation agriculture (e.g., no-till farming and cover crops), reforestation, and terracing to mitigate soil erosion in vulnerable areas. Integrating erosion risk maps into regional land use planning can further support sustainable development.

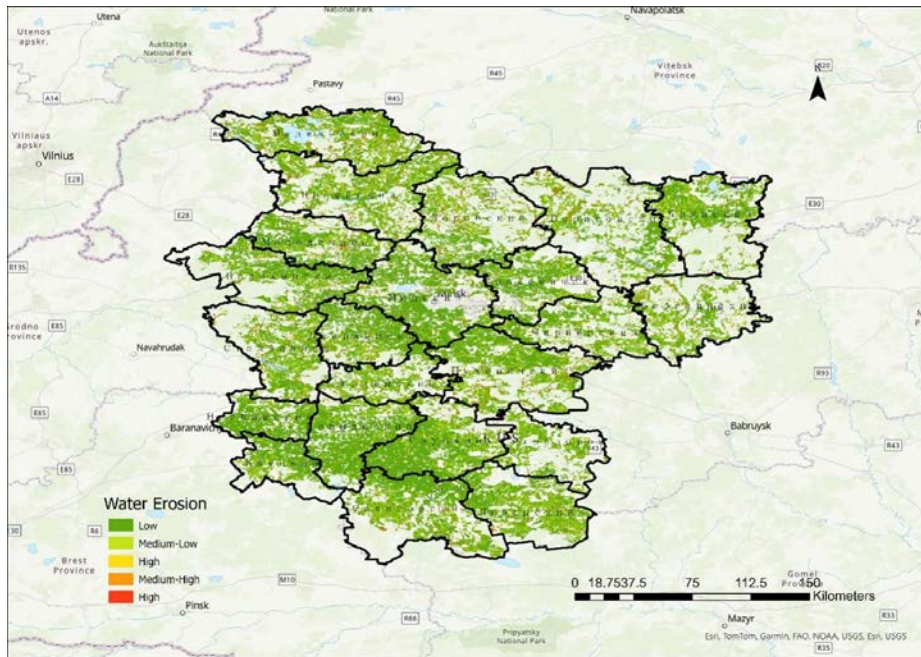


Figure 1 – Soil erosion map of Minsk oblast based on the RUSLE model

The application of the RUSLE model, combined with GIS, demonstrates its effectiveness in analyzing soil erosion patterns and informing soil conservation strategies. These findings offer valuable insights for policymakers and land managers to combat soil erosion and promote sustainable resource use. Future studies could incorporate high-resolution data and dynamic modeling to account for seasonal variability and the impacts of climate change.