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Soil and vegetation cover spatial-temporal dynamics of the river basin landscapes according to the remote sensing data

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The Klyazma river catchment basin is located in the center of the East European plain. It is characterized by a diverse landscape structure but at the same time represents a single ecosystem possessing common functioning features and similar features of dynamic processes.

The biological indicators dynamics of the Klyazma river basin landscape functioning has been analyzed. These indicators included: phytoproductivity, photosynthetic activity, soil cover carbon accumulation, as well as the analysis of land use structure changes over the past 20 years. The assessment was carried out for the entire basin, as well as for individual landscapes within the basin differing in structure and composition of the soil and vegetation cover.

The research was performed using geoinformation analysis of remote sensing data and cartographic information applying basin approach. The river network vectorization and the watershed boundaries definition were carried out basing on digital terrain model (DEM). The input data comprised radar topographic survey of the Earth-SRTM 90. The productivity indicators calculation in carbon units, LAI (Leaf area index) and FPAR (Fraction of Absorbed Photosynthetically Active Radiation) indices are based on Modis data. Organic carbon stocks in soil are determined using the "Trends. Earth " GIS package QGIS 2.18.

The land use structure analysis shows that the trend for forest vegetation increase and arable land and pastures reduction is common to all landscapes, but different in changes speed and scale. The most stable is the land structure in Meshchera province, where almost 90% is occupied by forests and their area has not changed significantly.

Over the period of 2000 - 2019, the Klyazma river basin ecosystem was characterized by the annual value fluctuations of gross primary GPP production, net primary NPP production, and MP respiration costs up and down in comparison with the average values. There is no stable tendency in productivity growth or decline.

The maximum annual changes in productivity indicators are observed for the landscape of the Klin-Dmitrov ridge. The analysis showed that various landscapes differ in their biological parameters varying within different limits.

The agricultural land overgrowing with forest vegetation is accompanied by the increase in carbon

deposition in the soil. Landscapes of the stable land use structure are characterized with zero carbon balance, while landscapes with forest vegetation with slightly negative carbon balance in the soil. However, the average biological indicators of the entire river basin ecosystem remain relatively stable. It testifies of the compensating biological mechanisms maintaining the ecosystem stability within a large ecosystem. That is, changes in some landscapes are compensated by changes in others according to the feedback principle.

The analysis of productivity features, land use structure, and carbon deposition in the soil in the Klyazma basin and certain key sites associated with different landscapes allowed us to determine a representative key site, located within Klin-Dmitrov ridge for the environmental monitoring of the entire basin.

The research allowed determining a representative area within the basin for environmental monitoring of the entire basin ecosystem.

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