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Spatial analysis of the landscape structure of the river basin on the basis of remote sensing data

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The aim of the study is the spatial analysis of the structure of the river basin in identifying anthropogenic-transformed landscapes. The object of the study is the water catchment basin of the «Yayva» river, which is a left, mountain-taiga tributary of the «Kama» river and flows in the Perm region, in the Russian Federation. The river basin covers an area of 6502 km^2 , long main river, 304 km, the average slope of the basin $1,85^0$, height difference is significant and is 687 meters. The Catchment has a high degree of ruggedness of 0.91 km/km^2 . The sharp asymmetry of the catchment basin is expressed, so the left part of the basin is more pronounced.

With the use of remote sensing satellite images with high spatial resolution Landsat – 8 and Sentinel – 2, based on digital elevation model and GIS tools identify the types of land cover of the basin. In the ArcGis 10.4 software environment, morphometric indicators of the river basin at the level of small rivers are determined. The map of the basin territorial structure is developed on the basis of a vector relief model with a section height of 25 meters. The areas of morphological elements of river basins are unevenly distributed over the absolute height and slope of the terrain, causing spatial heterogeneity of landscape structures.

In the zones of the sources of watercourses, water-collecting funnels of a rounded shape are formed, the boundaries of which are clearly deciphered from space images. In the direction from the mouth to the source along the main river, the average absolute height of the terrain increases from 170 to 540 meters, the height differences also increase, while the area of the catchment funnels increases from 0.04 km^2 to 13.4 km^2 .

On well-drained slopes with average humidity, fern spruce-fir forests are represented, and on wet slopes and areas with temporary watercourses, sparse high-forest taiga and raw horsetail spruce forests are developed. Also, waterlogging is manifested in flat areas with poorly developed river network, where drainage is insufficient, so in the lower reaches of the basin, the wide valley of the river is swamped.

For each morphological element of the catchment area, a characteristic type of vegetation is determined. The most common wetland landscapes are confined to catchment funnels (37%), which is especially pronounced in mountainous conditions (upper reaches of the basin at an altitude of 500 meters or more); less wetlands (17%) occur in inland river valleys.

Transformed landscapes (cuttings and secondary forests) are confined to the upper parts of the slopes of the catchment surface (14%) and arcs of the watershed system (10%). The largest share of urbanized areas corresponds to inland river valleys (3%). Areal dynamics of anthropogenically transformed landscapes is determined. As a result of the analysis of the dynamics of vegetation cover, the growth of the area of cuttings, secondary forests and anthropogenic objects that form the basins of river systems was established.

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