

Characterization of the woody vegetation of the forest biogeocenosis using artificial intelligence based on remote sensing data

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Abstract. The purpose of the study is to rank woody areas of different lengths within the forest biogeocenosis based on remote sensing data and using artificial intelligence. Materials and methods. The object of the study is the “Bely Klyuch” natural landmark of the Tatishchevsky district of the Saratov region. The research materials are multichannel satellite images in the visible and near-infrared spectral ranges. The processing of materials and their mapping were completed using the cross-platform QGIS system (version 3.28.0). Recognition of biogeocenosis objects was carried out using the Mapflow plugin. Results. A multilevel structure of the biogeocenosis has been established. It was found that 60–65 % of woody areas belong to the high forest, and 30–35 % to the medium forest. Signs of sustainable development of the deciduous forest biogeocenosis have been established: indistinctness of the soil line in the coordinates of greenness vs brightness, NIR–RED tasseled cap transformations; high dispersion of dependencies wetness vs brightness; greenness vs wetness; the presence of a local area at the top of the principal component diagrams, in which their values vary over a wide range; asymmetry and skewness towards higher values of frequency diagrams of wetness and greenness, as well as the EVI index. Discussion. For forested areas, the structure of the tasseled cap diagrams is characterized by indistinct and blurred soil line, as well as by a concentration of maximum vegetation component in certain areas. The reason for this is that in forests, unlike agricultural lands, the soil is hidden under a layer of foliage, fallen leaves, and moss; therefore, the reflected signal from the soil mixes with the reflection from the vegetation. The predominance of high forest indicates that the upper layer of the biogeocenosis occupies a large part of the territory and is a determining factor in the structure and functioning of the ecosystem. Tall trees create shade, influence the microclimate, soil conditions, and light availability for the lower layers.

Keywords:

forest biogeocenosis, remote sensing, artificial intelligence, spectral transformation

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