INNOVATIVE METHODS OF LAND MANAGEMENT TASKS BASED ON GEOINFORMATION DATABASES

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Abstract. *This study explores innovative methods for managing land resources through the use of geospatial databases. It highlights the critical role of Geographic Information Systems (GIS) in analyzing, modeling, and visualizing spatial data, thereby facilitating well-informed decision-making in land use, agriculture, and environmental management. The primary objective of the research is to design a structured geodatabase encompassing administrative, hydrographic, agricultural, and transportation features. Publicly available datasets from platforms such as QGIS and OpenStreetMap (OSM) were integrated into vector-based models to enable in-depth analysis of land resources. As a result, a geospatial database for the East Kazakhstan region was developed, serving as a comprehensive tool for assessing land resources, promoting sustainable regional development, and optimizing land use practices. The authors underline the significance of employing advanced geospatial technologies—particularly ArcGIS and QGIS – to enhance data accuracy and reliability, thereby strengthening decision-making processes in land resource management.*

Keywords: *GIS, land resources, geospatial database, QGIS, East Kazakhstan region*

Introduction

The growing anthropogenic pressure on the environment and the need for sustainable territorial development have made effective land resource management increasingly important. Modern geospatial technologies provide unparalleled opportunities for analyzing, modeling, and visualizing spatial data, enabling informed decisions in land use, agriculture, and ecology. These technologies also integrate heterogeneous datasets and account for both natural and socio-economic factors, which is especially relevant for intensively used regions such as East Kazakhstan.

Methodology

To develop the geodatabase, data from open sources such as QGIS and OpenStreetMap were collected, processed, and integrated into vector models. The methodology included multilingual data preparation (Russian, Kazakh, English), data standardization (coordinate systems, scales, symbology), process automation, staff training, and workflow optimization. The final database structure consists of thematic layers covering administrative boundaries, hydrography, protected areas, agricultural land, and transportation infrastructure (Figure 1).

Figure 1. *Database of the East Kazakhstan Region in ArcGIS (Compiled by the authors)*

Results and Discussion

The developed geodatabase enables comprehensive analysis and efficient management of land resources. Its multi-level structure allows for the organization of spatial objects into thematic categories, facilitating targeted analysis in areas such as environmental protection, agricultural optimization, and infrastructure planning. Attribute information was created for each layer following a standardized workflow, ensuring high data reliability.

In creating the geospatial database (GIS) for the East Kazakhstan region, a multi-level structure of catalogs and classes of spatial objects was applied, which allowed for the effective organization of data for various thematic layers. The catalog structure includes numerous subsections, each corresponding to a specific type of spatial data, such as administrative objects, hydrography, protected areas, agricultural land, and transport networks. An extended database with subsections has been compiled (Figure 2).

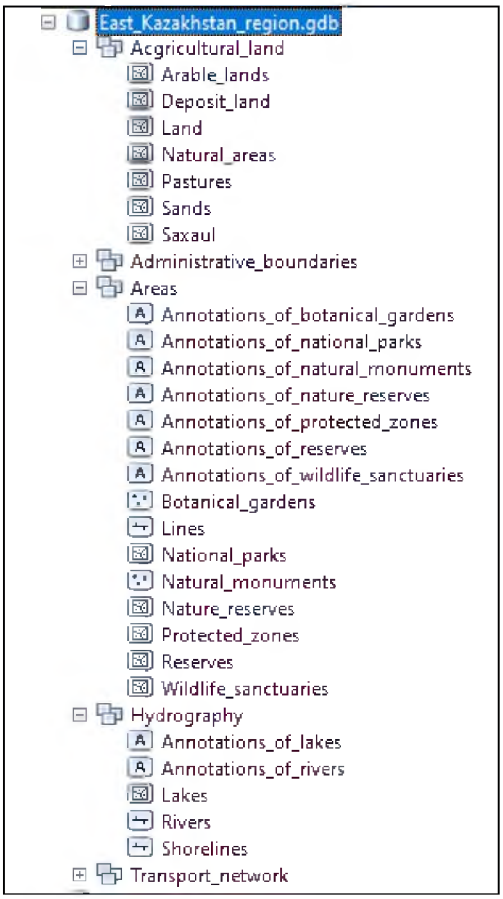

Figure 2. *Subsections of the Geospatial Database of the East Kazakhstan Region*

The subsections are classified into more detailed categories, ensuring convenient access and data management. For example, the "Administrative Objects" section includes classes such as regions, districts, and rural districts, organized hierarchically from larger to smaller units. The "Hydrography" section contains data on rivers, water bodies, and other aquatic features, enabling spatial analysis of the region's water resources. The "Protected Areas" category includes information on national parks, reserves, and recreational zones, which is crucial for managing environmental conservation activities.

Conclusions

The integration of QGIS and OSM data allowed for the creation of an up-to-date, accurate, and structured geodatabase for the East Kazakhstan region. The database supports sustainable land use planning, enables monitoring of land use changes, and provides a solid foundation for future regional development strategies.

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