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IMPROVING THE RATIONAL USE OF LAND RESOURCES THROUGH THE INTEGRATION OF LAND MONITORING AND CADASTRE DATABASES

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Abstract: The rational and sustainable use of land resources is one of the important priorities of modern land management. Effective land management requires reliable, up-to-date, and comprehensive information on the condition, use, and legal status of land resources. In this regard, the integration of land monitoring data with cadastral databases creates new opportunities for improving the efficiency of land resource management. This article examines the theoretical and practical aspects of integrating land monitoring and cadastral information systems. Particular attention is paid to the use of geographic information systems, remote sensing technologies, digital cadastral systems, and spatial databases. The study analyzes the role of integrated information in identifying inefficient land use, monitoring land degradation, improving cadastral registration, and supporting management decisions. The results indicate that integration of monitoring and cadastral databases can improve the accuracy and timeliness of land information, increase transparency in land management, and contribute to the sustainable and rational use of land resources.

Keywords: land resources, land monitoring, land cadastre, cadastral database, geographic information system, remote sensing, digital land management.

Introduction

Land is one of the most important natural resources and serves as the foundation for agricultural production, economic development, infrastructure, and human settlement. The increasing pressure on land resources, urbanization, environmental degradation, soil erosion, and inefficient land use create the need for more effective land management mechanisms.

Modern land management increasingly depends on accurate spatial and legal information. Traditional cadastral systems mainly provide information about land parcels, their boundaries, ownership or use rights, area, and designated purpose. Land monitoring systems, on the other hand, provide information about changes in land conditions, land degradation, vegetation cover, soil characteristics, and actual land use. When these two information systems operate separately, it can be difficult to obtain a complete picture of the current state and use of land resources.

The integration of land monitoring and cadastral databases can provide a unified information environment for land management. Such integration allows cadastral information to be supplemented with current information obtained through field surveys, satellite imagery, remote sensing, and geographic information systems (GIS). The purpose of this article is to examine the possibilities of integrating land monitoring and cadastral databases and to identify ways to improve the rational use of land resources on the basis of integrated spatial information.

Main Part

1. The importance of land monitoring and cadastral information

Land monitoring is a systematic process of observing, assessing, and analyzing changes in the condition and use of land resources. Monitoring makes it possible to identify negative

processes such as soil degradation, erosion, salinization, desertification, and changes in land use.

The land cadastre contains important legal, spatial, and economic information about land parcels. It generally includes parcel boundaries, area, location, designated use, rights, restrictions, and other relevant characteristics.

Although land monitoring and cadastral systems have different functions, they are closely interconnected. Cadastral data answers the question of who uses or owns the land and where the land parcel is located, while monitoring data provides information about how the land is being used and what condition it is in.

Therefore, integrating these datasets can significantly improve the quality of land management.

2. Integration of land monitoring and cadastral databases

Database integration involves combining information from different sources into a common information environment. In the context of land management, cadastral databases can be integrated with monitoring data, satellite imagery, GIS layers, field survey results, and other spatial information.

A modern integrated land information system can include:

- cadastral parcel boundaries;
- land ownership and use rights;
- land-use categories;
- soil and ecological characteristics;
- satellite and aerial imagery;
- information on land degradation;
- agricultural land productivity indicators;
- information on land-use changes;
- restrictions and protection zones;
- results of field inspections.

The integration of these datasets allows specialists to compare the legally registered status of land with its actual use. For example, satellite imagery can identify cases where agricultural land is not being cultivated, where construction is taking place outside the permitted land-use category, or where signs of degradation are developing.

3. The role of GIS and remote sensing technologies

Geographic Information Systems are one of the main technological tools for integrating land monitoring and cadastral information. GIS makes it possible to collect, store, process, analyze, and visualize spatial data.

Remote sensing technologies are also increasingly important for land monitoring. Satellite images provide information about large areas at relatively short intervals. By comparing satellite images from different periods, specialists can identify changes in vegetation, land cover, agricultural activity, and signs of degradation.

The integration of GIS, remote sensing, and cadastral information provides an opportunity to create dynamic digital land maps. Such maps can be regularly updated and used by government agencies, land users, researchers, and other stakeholders.

4. Improving the rational use of land resources

The integration of land monitoring and cadastral databases can contribute to rational land use in several ways.

First, it improves the **accuracy of land information**. When cadastral records are regularly compared with monitoring data, discrepancies can be identified more quickly.

Second, integration improves the **efficiency of land-use control**. Instead of relying exclusively on physical inspections, specialists can use remote sensing and GIS technologies to identify areas requiring additional investigation.

Third, integrated databases can help identify **unused and inefficiently used land**. This information can support decisions concerning land redistribution, agricultural development, infrastructure planning, and environmental protection.

Fourth, integrated monitoring can contribute to the prevention of **land degradation**. Early identification of salinization, erosion, loss of vegetation, or other negative processes allows preventive measures to be taken.

Fifth, digital integration can improve **transparency and decision-making**. A unified database provides decision-makers with more complete and reliable information about land resources.

5. Organizational and technological challenges

Despite its advantages, the integration of land monitoring and cadastral databases faces several challenges. One of the major problems is the lack of interoperability between information systems. Different organizations may use different data formats, coordinate systems, classification systems, and database structures. Another challenge is the regular updating of information. Land resources and land use are constantly changing, therefore cadastral and monitoring databases must be updated systematically. Data quality and accuracy are also important. Errors in cadastral boundaries, outdated information, or insufficiently accurate satellite interpretation can negatively affect management decisions.

In addition, successful integration requires qualified specialists who possess knowledge of land management, GIS, remote sensing, database administration, and spatial analysis.

6. Prospects for digital land management

The development of digital technologies creates new opportunities for improving land resource management. Cloud-based databases, artificial intelligence, automated image classification, mobile GIS applications, and digital platforms can increase the efficiency of monitoring and cadastral operations.

In the future, artificial intelligence can be used to automatically identify changes in land use, detect unauthorized construction, assess vegetation conditions, and predict land degradation risks. Mobile applications can also enable field specialists to update cadastral and monitoring information directly from the location of the land parcel.

The development of a unified digital land information environment can therefore become an important element of sustainable land management.

Conclusion

The integration of land monitoring and cadastral databases is an important direction for improving the rational and sustainable use of land resources. Combining cadastral, spatial, environmental, and monitoring information makes it possible to obtain a more comprehensive understanding of the actual condition and use of land. The application of GIS, remote sensing, digital cadastral systems, and modern database technologies can improve the accuracy and timeliness of land information. Integrated databases can help identify inefficient land use, monitor land degradation, strengthen land-use control, and improve management decisions.

For effective implementation, it is necessary to develop common data standards, ensure interoperability between information systems, regularly update cadastral and monitoring data, and improve the professional skills of specialists. The wider use of digital technologies and automated monitoring systems will further increase the effectiveness of land management.

Thus, the integration of land monitoring and cadastral databases should be considered not only as a technological task but also as an important component of sustainable development, environmental protection, and rational management of land resources.

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