UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN

BALTIC SURVEYING

GIS tools for green infrastructure – a case study of the Pojezierze estate in Olsztyn
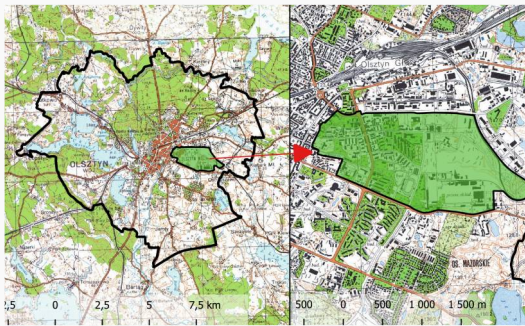
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Abstract

🔑 **Key words:** local governance, spatial decision-making, public spaces, green infrastructure

Green infrastructure is becoming an increasingly important element of urban environmental policies. Its significance grows alongside rising public awareness of climate change and the broader societal trend toward undertaking pro-environmental actions. Consequently, municipal authorities, partly under pressure from residents, are engaging in efforts aimed at more effective management of green spaces. However, when addressing the issue at a central level, small spaces located at the points of greatest interaction with users are often overlooked. Therefore, managing green infrastructure at the neighborhood or district level becomes crucial. It enables the effective implementation of green space policies and better alignment with residents' expectations. To efficiently undertake actions related to green infrastructure, it is advisable to use GIS tools, which provide strong support for decision-making, research, analysis, and local-level management activities. Among other capabilities, they facilitate the rapid identification of problems, the mapping of functions, and the monitoring of environmental conditions within a given administrative unit.

### Location of the Pojezierze estate within the city of Olsztyn

The Pojezierze housing estate, located in the city of Olsztyn within the Warmian-Masurian Voivodeship, was selected as the subject of this study. It is situated in the central and eastern parts of the city and is well connected with other districts due to the presence of major transportation arteries. The estate is characterized by a diverse range of land uses within its boundaries. Its western part borders the city center and is predominantly occupied by multi-family residential buildings and a municipal park. The central area of the estate is also dominated by multi-family housing, whereas the eastern section consists of extensive industrial zones, representing one of the largest concentrations of industrial activity in the city.
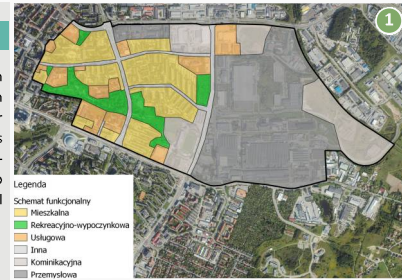
Possibilities of using GIS Tools in managing GI at the local level

Green infrastructure can be effectively managed at the local level through the use of GIS tools and other supporting software. The case study presented here identifies several fundamental ways in which such tools can be applied. While the scope of their use may vary, their diversity demonstrates the broad potential that GIS offers. Based on the study, nine main categories of application have been identified, each encompassing specific actions. Among these, the most important for the efficient functioning of a housing estate include the identification of potential problems, the collection and effective use of environmental data, and the mapping of green areas in response to the functional needs of residents.

Environmental Assessment and Monitoring
- Assessment of ecological value of spaces
- Evaluation of the distribution and fragmentation of green areas
- Identification of ecological corridors
- Integration of environmental data
- Support for stormwater management

Spatial Analysis and Planning
- Conducting diverse spatial analyses
- Support for effective spatial planning
- Identification of problematic areas requiring intervention
- Mapping and visualization of green infrastructure

Decision-Making and Policies
- Support for decision-making (at local and supra-local levels)
- Support for sustainable development policies
- Analysis of socio-economic factors

Education and Public Participation
- Raising public awareness
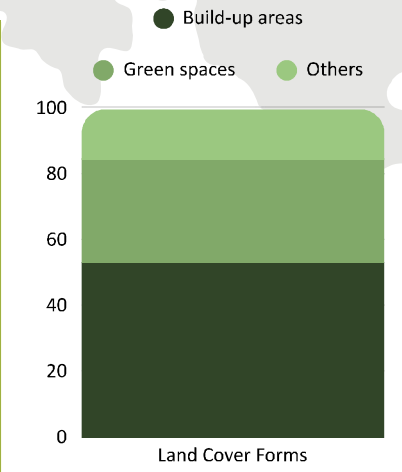- Opportunities for public participation in the implementation of solutions
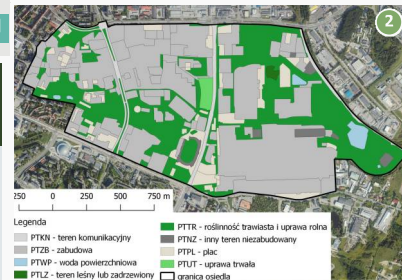
Possibilities of using GIS Tools: the case study of the Pojezierze housing estate

Environmental data management	Conducting Green Infrastructure Inventories	Planning Green Infrastructure Investments
Determining the Impact Range of Investments	Stormwater Management	Mapping Green Areas
Creating a Functional Scheme	Identifying the Scope of Phenomena Occurrence	Calculating Environmental Indicators

① **Functional and spatial structure of the Pojezierze estate**
② **Land Cover Forms within the estate area according to BDOT**
③ **Location of green open spaces within the estate**

Managing green infrastructure in urban areas requires both technical and substantive preparation. Centralized management systems do not always yield effective results due to their general approach and the large number of overlapping tasks. Therefore, it is crucial to undertake actions also at the local level, and, if necessary, to decentralize certain responsibilities. GIS tools can significantly facilitate green infrastructure management processes both at the local and central levels. They offer a wide range of capabilities, including the collection, processing, and visualization of data, which can support the identification of issues and threats related to green spaces. Moreover, they can substantially assist in decision-making processes and in the allocation of resources.

The combination of GIS functionalities with software such as Excel enables the calculation of environmental indicators and the creation of databases concerning infrastructure under the supervision of a given administrative unit. At the initial stage of implementing GIS tools, it is particularly important to collect as much spatial data as possible, which will enable efficient future analysis, actions, and decision-making. To achieve this, a detailed inventory of the area must be carried out, with special attention paid to green infrastructure elements and their immediate surroundings. Although this stage is time-consuming, it will reduce the risk of errors and increase the reliability of the analyses and obtained results.

Land Cover Forms

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