

The dissertation addresses the development of a modern, integrated methodology for the inventory of inland surface waters in Poland, utilizing GIS tools and low-altitude remote sensing technologies (UAVs, LiDAR, multispectral imaging). The research was conducted within the framework of the “Implementation Doctorate” program in cooperation with the Polish State Water Holding Regional Water Management Authority in Gliwice, (PGW Wody Polskie Regionalny Zarząd Gospodarki Wodnej w Gliwicach). The main objective was to create a methodology that enables precise, up-to-date, and legally compliant mapping of the hydrographic network, along with the development of a structured surface water database. The research was carried out in three stages:

- (1) verification of errors and discrepancies in existing databases,
- (2) testing and comparison of remote water detection methods,
- (3) implementation of the methodology at the Regional Water Management Authority in Gliwice.

The study utilized data collected through UAV flights, processed into multispectral orthophotos (NDWI index) and terrain models. Statistical analyses, spatial analyses, and surveys among employees of PGW Wody Polskie were conducted. The results revealed significant geometric and attribute discrepancies between databases, as well as ownership inconsistencies regarding land with water. Particularly critical were the data from the cadastral database (EGiB), which cannot be considered a reliable reference source. In contrast, NDWI and LiDAR point cloud classification proved effective for remote and automated water detection.

The outcome of the research is a ready-to-implement methodology for water inventory, including: a data processing workflow, an attribute structure for the database, algorithm selection recommendations, and a proposal for integration with legal and cadastral systems. An interactive hydrographic map was also developed using ArcGIS Online.

The dissertation makes a significant contribution to the development of water management tools in Poland, highlighting the need for spatial data harmonization and the use of modern technologies in public administration.