

Angelika Jasion-Krzysztofik

The summary of the PhD dissertation:

“Geoinformation analysis of the settlement network on the example of Opoczno district”

Keywords: GIS, geoinformation, settlement network, spatial data, research methods, Opoczno district, village, settlement geography

The dissertation is related to geoinformation analysis, in which data and spatial analysis made on the basis of specific research methods are crucial. Testing of data sources and research methods was conducted on the settlement network of The Opoczno district. The Opoczno district is a typically rural region, located peripherally, on the border of three provinces, far from major cities and major transportation routes. This leads to many demographic, economic or social problems. The settlement network of the area consists mainly of villages, understood in administrative terms. Studies of the settlement network were carried out on the basis of various theories and models of settlement development, the most important of which are Christaller's theory of central places, the theory of the economic base and also more contemporary network models.

The work is generally a combination of the topics of settlement network and settlement (mainly rural) with the application of geographic information systems. The course of work and activities and the structure of the dissertation were based on the holistic model of Geographic Information System proposed by R. Tomlinson (2008), which presents the various components of GIS. According to the discussed model, a scheme was developed on the basis of which the research proceeding was carried out. In accordance with the title of the paper, a geoinformation analysis of the settlement network was conducted on the example of The Opoczno district. It was assumed that geoinformation analysis is the study of a phenomenon based on the elements of geographic information systems in the context of new possibilities of interpretation. The research proceeding was divided into 3 main groups of activities. The first part relates to the discussion and comparison of spatial data needed for settlement network analysis. An attempt was made to select spatial data from various sources, discuss them, compare them and propose the data most useful for this type of work.

Then, with accordance to the second group of activities, a proposal for research methods important for settlement network analysis were presented. They were characterized and then used in settlement network studies and evaluated their usefulness in this type of

research, the possibility of implementation into geographic information systems, and their advantages and disadvantages were presented. According to the third group of activities, the characterization of the settlement network of the selected district, which is the final product of the research proceedings, was carried out. Two main research objectives were adopted in the study:

1. Implementation of spatial data and settlement network research methods into Geographic Information Systems.
2. Creation of a proposal for a settlement network research model using Geographic Information Systems.

Several specific objectives were also identified:

- comparison and evaluation of various data sources,
- comparison and evaluation of settlement network research methods based on the literature,
- implementation of selected settlement network research methods into GIS,
- characterization of the settlement network of the Opoczno district using selected methods,
- recommendation of spatial data and research methods useful for settlement network research.

Among the data sources used were the Database of Topographic Objects, the Database of General Geographic Objects, the State Register of Geographic Names, as well as Openstreetmap and the PESEL database and population registers in municipalities. Data were analyzed and compared regarding: localities, buildings, road network, habitats and population. The data were compared in both the geometric and attribute parts. The principles of geometric representation of data, their scale, timeliness and sources of information acquisition were delved into, and the number and quality of descriptive data were compared. Among the research methods included were concentration methods such as the nearest neighbor method, Lorenz concentration, the C-index, as well as graph methods, including the Wroclaw dendrite and methods for determining the hierarchy of a settlement network such as Zipf's rule. Each of these methods was characterized and attempted to be implemented into a geographic information system. With new GIS capabilities and available tools and modeling, new research approaches have been proposed, such as calculating the shortest connections along a road network or creating computational tools in Model Builder, such as for Shannon entropy. The spatial concentration formula C was also discussed, and various methods of approximating points under the size-order rule of Zipf were tested. After the methodological discussion, the

results obtained for the settlement network of the Opoczno district were analyzed. Concentration studies show dispersion of settlements, mainly in the context of studies of settlements represented by points. A greater concentration is shown by the research in relation to residential buildings, where the towns and communal localities particularly stand out, and an even greater concentration can be seen for the number of population, where the town of Opoczno definitely stands out. The greatest influence on the formation of settlements is exerted by forests and protected areas. Settlement development is also visible in relation to some major roads. The diversity of settlements within the district is also influenced by historical conditions. Due to the typically rural settlement network, most of the settlements of The Opoczno district act as secondary, peripheral settlements, subordinate to larger settlements with different functions. The main administrative, commercial, service and cultural center is the town of Opoczno, which has a district-level administration. The places that play the role of central places are mainly communal settlements, which develop further functions due to their administrative function. Some types of surveyed facilities are more common and found in more settlements, while some provide more specialized services, which is associated with their rarer occurrence. Volunteer firefighting units are the most numerous in the district. The network of elementary school is also well distributed, with the availability of kindergartens in rural areas significantly worse. Access to primary health care (PHC) centers in many localities is limited, especially considering accessibility on foot. A large role in the study area is played by churches and parishes of the Roman Catholic Church and their division, often different from the administrative division.

The final result of the dissertation is a created model of rural settlement network research including a proposal for analysis using specific data and research methods. All the established objectives of the work in accordance with the topic of the dissertation were realized, including an attempt to implement the methods into geographic information systems with a detailed description of the obtained results. The dissertation has the character of interdisciplinary research at the intersection of settlement geography and geoinformation, which can bring new insights into the complex issues related to rural settlement networks. The dissertation, by its subject matter, fits into the research scope of the scientific discipline of socio-economic geography and spatial management.