

Summary

The thesis is devoted to the occurrence of dispersed and concentrated built-up area patterns in the Warsaw urban agglomeration. The subject of research is the state and transformation of settlement in relation to the observed suburbanization processes and the urban sprawl. The problem is being analyzed in particular relation to the period after 1989, when the political and economic system transformation in Poland was initiated. In the empirical part of the research, taking a static approach, the spatial concentration of all buildings in the Warsaw metropolitan area has been examined, and taking a dynamic approach, transformations of urbanized areas have been investigated. The methodological dimension of the work is related to the determination of the usefulness of various indicator methods, source data in several scales, and various divisions of basic areal units – in order to investigate the spatial concentration of buildings and built-up areas in a possibly full and multidimensional way.

Chapter I of the thesis introduces and justifies the research problem. The research objectives, questions and hypotheses, study area, data sources, methods and techniques of analysis are presented. Chapter II provides an overview of major concepts and theories regarding the transformation of the suburban areas and related to suburbanization. Numerous examples of contemporary settlement phenomena occurring in these areas are also given. Chapter III is a review of indicator methods for studying the spatial concentration of settlement. Indicators intended for the analysis of point pattern systems, as well as landscape metrics, enabling the analysis of land use forms, are discussed. The computational assumptions of the measures and methods for presentation of the results of analysis are given, as well as examples of applications. The use of selected indicators in the empirical part of the study is also justified. Chapter IV describes the conditions and determinants of the examined processes, referring to the historical processes of the formation of the Warsaw agglomeration, and then analyzes the phenomena associated with demography and migration, housing, morphological transformations of the suburban zone, relocation of industry, trade and services, transport infrastructure, social changes, the impact of suburbanization on natural environment and landscape. The consequences of chaotic development of buildings in the suburban zone, often resulting from faulty spatial planning, are also discussed.

Chapters V and VI discuss the results of analyses from the empirical part of the research. Chapter V describes the results of analyses regarding settlement points representing buildings. The data was obtained from the Topographic Object Data Bank (up-to-date as of 2013). Selected building categories were: single-family and multi-family housing, industrial and service objects. The analyses were carried out in a division of communes (gminas) and urban districts and in other systems of basic units (hexagon grids, buffer and sectoral zones). Four selected methods were used for this purpose: the ratio of the building density, the Gini index, the minimum spanning tree (the shortest dendrite) and the average nearest neighbor method (Clark index). On this basis, cognitive conclusions for the research area have been drawn. The issue of the modifiable areal unit problem (MAUP) is also discussed for each of the indicators. The chapter ends with a presentation of a typology of administrative units in terms of spatial concentration characteristics of buildings. The extended typology also takes into account the intensity of built-up development related to the heights of buildings. Next, in chapter VI, the results of analyses of spatial concentration of urbanized areas as forms of land cover and land use are presented, based on data obtained from the CORINE Land Cover (CLC, 1990-2012, in three subperiods) and Urban Atlas (2006-2012) databases. In this dynamic analysis, changes of selected landscape metrics for settlement areas in the communes and urban districts in several time periods were calculated, as

well as statistics based on them for the entire study area. For the same time intervals, the places where new building development appeared in agricultural and forest areas, wastelands, or where the density of buildings increased, were identified in detail.

Chapter VII summarizes and synthesizes the results of analyzes carried out in the empirical part of the research. Answers to research questions are given and the hypotheses, put forward at the beginning, are verified. In reference to the 1. research question, it has been confirmed that the Warsaw agglomeration is still at the stage of spatial development associated with the well-developed concentric-star pattern, related i.a. to the arrangement of transportation routes, although this pattern is partly modified due to the significant share of dispersed buildings. Question 2. referred to the typology of units in terms of spatial concentration of buildings. Such typology was constructed for communes (gminas) and urban districts and it is based on several selected indicators related to building density, their spatial dispersion and the dominating types of housing buildings. It may be useful for research in other areas. However, most although not all, theoretically possible types of spatial concentration of buildings were identified in the Warsaw agglomeration.

In the scope of question 3., the subject of interest was the dynamics of changes in the arrangement of areas of concentrated and dispersed building patterns. It has been confirmed that in the Warsaw metropolitan area in the period 1990-2012 there was a dispersion (scattering) of urbanized areas taking place across the entire urban agglomeration. The results of the analyses based on medium-scale CLC data for the years 1990–2006 confirm overall the expansion and spreading of building development, while they confirm indirectly scattering and fragmentation taking place. Dispersion is revealed in the most reliable way based on large-scale Urban Atlas data for the 2006-2012 subperiod. Among the distinguishing directions of urbanization expansion in the last subperiod are in particular the further south-western direction (surroundings of Grodzisk Mazowiecki and Żyrardów; Bolimowski Forest) and the southern direction (surroundings of Piaseczno) have been noted, and in Warsaw itself – “inner suburbanization” processes, i.a. in the Białołęka district.

Question 4. concerned the assessment of complementarity of indicator methods in the study of the spatial concentration of settlement points. It has been confirmed that the selected methods complement each other because they relate to different types of spatial relations and their combined application aims to describe the phenomenon in a multidimensional way. The ratio of density allows for the identification of local densities of buildings and sparsely invested areas; the Gini index shows how evenly are the buildings distributed throughout the urban agglomeration; the minimal spanning tree (the shortest dendrite) indicates the cohesion of the settlement network, affecting, i.a. the efficiency of infrastructure; the Clark index illustrates whether the buildings appear in isolated clusters, whether they are randomly or regularly distributed.

In answer to the 5. question, it has been found that the combination of selected landscape metrics allows for a comprehensive description of the spatial concentration of urbanized areas. One indicator is not enough, however from the set of 13 metrics pre-selected for analysis, 4 indicators regarding area coverage, density and distances between the nearest neighboring built-up areas were selected as optimal. In reference to the question 6., it has been confirmed that the level of sensitivity of individual indicator methods to a change in the arrangement of basic areal units, affecting the results of the study of spatial concentration of buildings, depends on the types of spatial relationships studied and the dimensions of spatial concentration specific to those methods of measurement.

Recommendations are also given for the implementation of proper spatial policy in the communes of the Warsaw metropolitan area. This is important from the point of view of strengthening the arguments for improving spatial order in the agglomeration, as well as for the complementarity of the doctoral dissertation.