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## PLANNING-RELATED FACTORS OF THE QUALITY OF THE RESIDENTIAL ENVIRONMENT IN THE MODELLING OF THE FUNCTIONAL SPATIAL STRUCTURE OF CRACOW

### PLANISTYCZNE CZYNNIKI JAKOŚCI ŚRODOWISKA ZAMIESZKANIA W MODELOWANIU STRUKTURY FUNKCJONALNO-PRZESTRZENNEJ KRAKOWA

#### Abstract

Models of functional spatial structures, thanks to information aggregation, facilitated the decision-making process in terms of the development of cities. Considering the quality of the residential environment in the planning-related approach, in the scale of the entire city, the Author investigates which elements should be presented in the analysed model. To this end, the Author undertakes an attempt at defining planning-related factors of the quality of the residential environment and at assigning relevant indicators to them. These reflections focus on the example of Cracow.

**Keywords:** quality of the residential environment, model of the functional spatial structure, spatial planning, development of Cracow

#### Streszczenie

Modele struktur funkcjonalno-przestrzennych, dzięki zagregowaniu informacji, ułatwiają proces decyzyjny w zakresie rozwoju miast. Rozpatrując jakość środowiska zamieszkania w ujęciu planistycznym, w skali całego miasta, a autorka rozważa, jakie elementy winny być przedstawiane w analizowanym modelu. W tym celu podejmuje próbę zdefiniowania planistycznych czynników jakości środowiska zamieszkania wraz z przypisaniem ich wskaźników. Rozważania prezentowane są na przykładzie Krakowa.

**Słowa kluczowe:** jakość środowiska zamieszkania, model struktury funkcjonalno-przestrzennej, planowanie przestrzenne, rozwój Krakowa

## 1. Modelling

Special place in the history of urban planning is occupied by models of an ideal city of the industrial era. Equal importance is attached to planning models of the transformations of functional spatial structures developed later, among which the model of functional Warsaw from 1934 was a truly remarkable achievement. Model interpretations of existing urban tissues, as well as simulations of their development, were still a real strength of Polish spatial planning in the 1980s; today, they are a rarity. Meanwhile, many European metropolises are still being developed consequently on the basis of urban models, frequently supported with computer tools. Leaving aside, however, complex mathematical models, requiring extended databases, in this paper, the Investigator's attention is focused around quality factors of the residential environment, as components of the planning model.

## 2. Environment quality factors

Research work on gauges of the quality of the residential environment of a macro- and micro-range of influence was carried out by G. Schneider-Skalska [13] and J. Kobylarczyk [10] at the Faculty of Architecture, Cracow University of Technology. This study develops this topic for the needs of spatial planning in the scale of a city or an urban functional area. Therefore, it is proposed to introduce a new group of indirect factors of a mezzo-range of influence and to relate them to the details of the study of spatial development conditions and directions or the plan of an urban functional area.

The quality of the residential environment is influenced by factors with the macro-range of influence, characteristic for a specific region, mezzo-factors, moulding the environment of a city or an agglomeration/urban functional area, and micro-factors, referring to conditions in the scale of local planning, urban projects, and revitalisation projects.

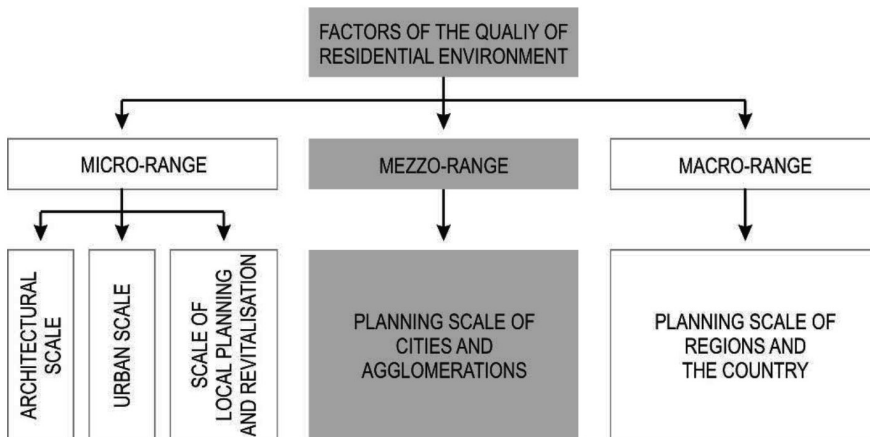


Fig. 1. Factors of the quality of the residential environment in the process of modelling the spatial structure of a city (by A. Ziobro)

The category of factors of the quality of the residential environment with the mezzo-range of influence covers: 1. Population density; 2. Accessibility to the public transport; 3. Accessibility to concentrations of primary services; 4. Accessibility to public spaces, greenery; 5. Morphogenetics of the layout.

#### 1. Population density

The number of residents per one hectare is a leading factor in studies devoted to the quality of the residential environment. The other four quality-related factors of the residential environment are provided with reference to population density. The foundation for such analyses is an assumption that as population density increases, the demand for access to effective public transport, easily accessible primary services, easily accessible public spaces, which, along with the morphogenetic quality of the tissues, strengthen the cultural identity of residents, increases, as well. Owing to the conditions of the natural and cultural environment, cities around the world have different development density, different concentration of city inhabitants. Therefore, density classes should be selected on the individual basis, addressing the specificity of a given city. In order to maintain the legibility of the presentation of the research effects, the Author limited the number of classes of population per hectare to four.

#### 2. Accessibility to public transport

One of the important aspects of the quality of the residential environment are comfortable transport options, which, in the case of big cities, are closely connected with the concept of TOD (Transit Oriented Development). As J. Gehl emphasised, “The concept of a sustainable city strengthens when most transport in the city is constituted by ‘green mobility’, that is pedestrian traffic, cycling, and public transport. (...) A good public space and a good public transport system are actually inseparably linked” [5, p. 7]. This means that the most densely populated areas are located within the distance of ca. 400–800 m from a highly efficient public transport stop, such as underground or rapid transit rail.

#### 3. Accessibility to concentrations of primary services

The proximity of the concentrations of primary services has a direct effect on the sense of comfort of residence, and at the same time, it is connected with sustainable mobility. Regular distribution of service centres and corridors adjusted to the distribution of inhabitants within the city limits the need to move around to satisfy primary needs.

#### 4. Accessibility to public spaces, greenery

The issue of public spaces and greenery calls for clarification. The typology of public spaces has been presented by, e.g. J.M. Chmielewski, who differentiated between the cultural and technical public space (Fig. 2). “Public spaces in the city are understood as generally accessible systems of passages and places, creating a rich mosaic of urban interiors, where cultural values or technical solutions prevail” [4, p. 429]. It should be pointed out that the division of streets into technical public spaces, dominated by car traffic, and cultural public spaces, where pedestrian traffic prevails, does not exhaust this topic, as the co-existence of space users: drivers

and pedestrians within the area of a street, is possible in the form of a shared zone, as well as a separate form (road and pavements), in a way allowing the pedestrian part to be also a cultural public space. It is possible by means of an appropriate design, by introducing elements enabling to use the pavement in a different way than only for moving from one point to the other.

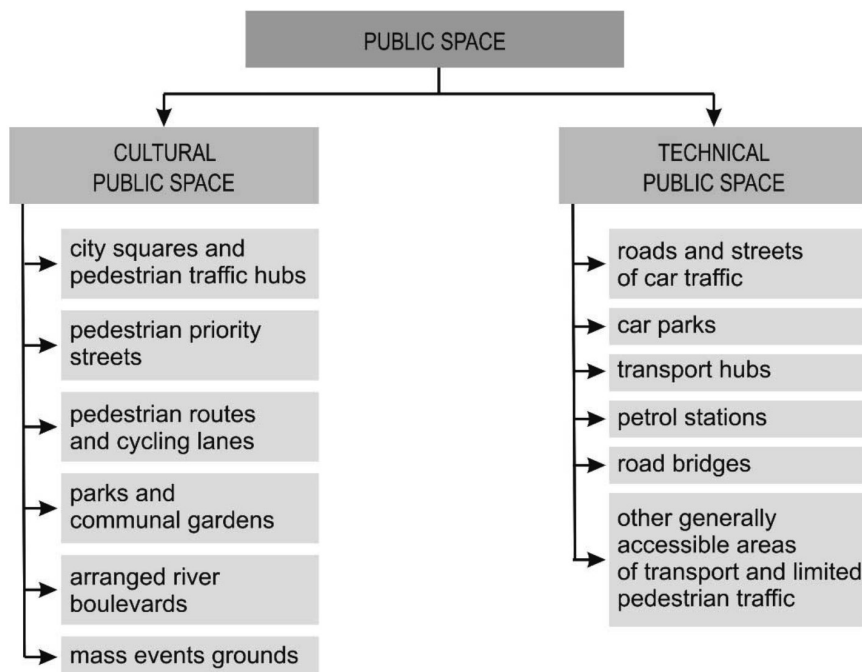


Fig. 2. Types of public spaces (source: [4, p. 429])

Linear public spaces should integrate point and area public spaces, creating a ‘white-green’<sup>1</sup> rhizome of public spaces. “The layouts constantly encourage to take a stroll, eliminate unnecessary driveways, integrate the community, consolidate the city, and in the social reception they demarcate a clear skeleton, which crystallises the structure of the city” [4, p. 436].

The density of the rhizome should take into account the population density of specific areas, so as to make sure that the priority of several-minute accessibility (below 1 km) for the biggest concentrations of residents is satisfied. The ‘white-green’ rhizome of public spaces covers:

<sup>1</sup> The term ‘white-green’ public spaces corresponds to the method of recording public spaces in the planning practice: green public spaces are marked as parks and arranged greenery, and white public spaces stand for piazzas, market squares, pedestrian routes, etc. Meanwhile, most publications are devoted to either greenery, or public spaces, whereas these two elements intermingle. According to the Author, the quality of residential environment is influenced by greenery accessible to residents, and therefore greenery in the form of a public space. Unarranged greenery inaccessible to the public has only minor importance for the residential environment model – comparable to a private garden, which has a positive effect on the microclimate, allows to be contemplated from a distance, but is not utilised by the community.

- ▶ 'green' public space: points (parks, communal gardens), lines (avenues, boulevards), areas (vast recreational grounds, lakes, forest parks);
- ▶ semi-private 'green' space (housing estates);
- ▶ 'white' public space: points (piazzas, market squares), lines (pedestrian routes or zones shared with transport), areas (historical city centres excluded from car traffic).

#### 5. Morphogenetics of the layout

A housing environment, where architecture is well composed and harmonious, is perceived as valuable. The period in which buildings were erected is important, too. The priority of the evaluation was the planning-related usefulness for the general scale of the city, i.e. defining whether a specific unit exhibits coherence of the general layout and is fully moulded, or whether it requires structural strengthening in the provisions of the study of spatial development conditions and directions.

### 3. Structural urban units

Four-degree scales were developed for all the factors, allowing for legible graphical representation, making use of structural urban units (SUU) defined in the study of spatial development conditions and directions. The decision to adopt such SUUs as research units was supported by:

- ▶ The accuracy of the image granulation – 63 units form an image general enough to be able to emphasise the development designing principles, and at the same time, they take into account the principal structural and spatial diversification of the city,
- ▶ The alignment of the research study with the study of development conditions in force, enabling to transfer the research conclusions onto further planning documents,
- ▶ The availability of statistical data for individual units.

### 4. Summary of the model of the residential environment in Cracow in 2016

The biggest concentrations of residents are located in the north parallel belt and in the historical centre of the city. In the southern belt, on the other hand, the highest densities of residents are observed only in two structural urban units: No. 32 Wola Duchacka and No. 52 Prokocim, located in the S/E part of Cracow. The distribution of residents within the city is not uniform. Despite the concentric layout of compact development areas towards the Old Town (except for the western greenery wedge and Rybitwy, which has an industrial character), the analysis of individual population density values in the SUUs demonstrated strong dominance of the belt located north of the Vistula (Fig. 3).

The geometry of effective public transport does not correspond to the geometry of population density. This means that the most densely populated northern belt only has very good accessibility via rail transport in selected locations, and in some cases, it does not have this type of accessibility at all. In the S/E part of the city, the accessibility of the rapid transit rail combined with tramway

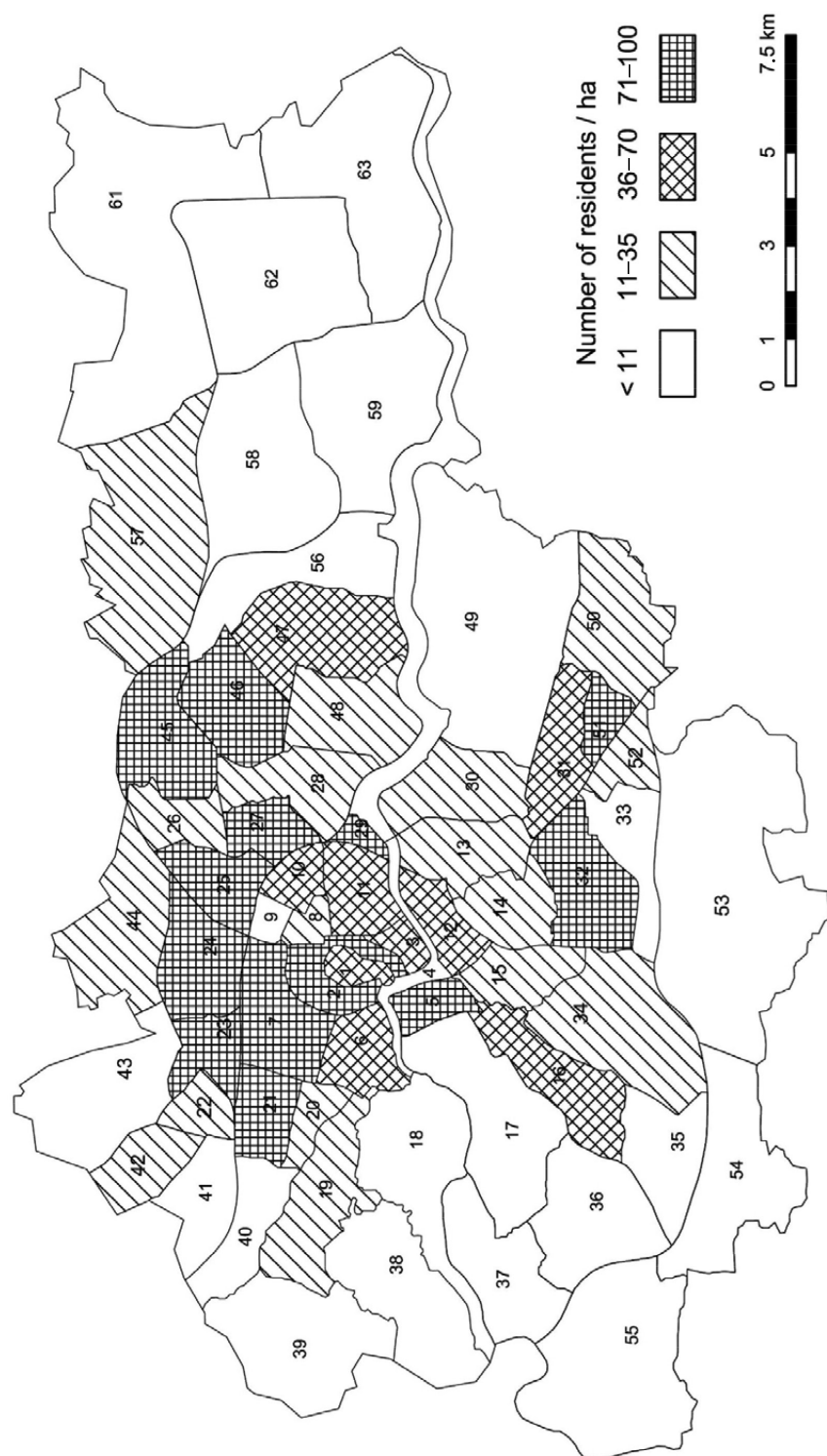


Fig. 3. Population per hectare in SUUs, 2016



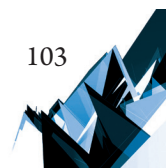
is the most beneficial, but it misses units with the highest number of residents per hectare that are located in this part of the city. The logic of the transport form is also contradicted by the good accessibility of peripheral units (N/S, E, and S/E), which do not provide the passenger potential necessary for the feasibility of frequent connections, encouraging to use public transport (Fig. 4).

Primary service clusters (service centres and corridors) in SUUs demonstrate a concentric layout towards the Old Town (except for the western greenery wedge). A big concentration of the services in question is located in the central zone of the city, in the northern belt, and in the south. Peripheral areas, including the territory of Nowa Huta-East, are deprived of any local centres and corridors, which generates travelling to better equipped units, located in the city centre. This situation is even strengthened by analogous patterns in the dysfunctional suburbs of Cracow.

The juxtaposition of primary services clusters to population density in SUU emphasises the problems in the area of Górka Narodowa (SUU 44a), where the average population density exhibits a growing tendency, and there is no local service centre or corridor there (Fig. 5).

White public spaces, especially the high-quality ones, concentrate in the area of the historical part of the city, forming a relatively continuous system, which could be even classified as an attractive public space area, whereas in other areas of Cracow, especially where the population density is high, deficits are observed in this respect. As far as the green public spaces are concerned, a relatively good situation is in Stara Nowa Huta, Bieńczyce, and Mistrzejowice, thanks to vast areas of semi-public greenery of housing estates and Bieńczycki Park. In other parts of the city, the arranged greenery is in the form of islands, and it is too scarce considering the number of residents. In general, 'white-green' spaces do not form a coherent system (Fig. 6).

The island-like character of greenery, and at the same time, the small area of most parks and squares in areas with the highest population density, hinders diversified forms of everyday recreation on short distances, which is particularly important for individuals with worse mobility (the elderly and young children). Reaching few green enclaves along uneven pavements, which are even made narrower by cars often parked on them, along streets deprived of any trees, which would offer some shade on hot days, is a big challenge for people with limited mobility, sometimes even too big. Securing equal opportunities in the everyday access to attractive green areas, creation of walking lanes encouraging to spend free time actively and do sports all year round, constitutes a foundation for a healthy society. Meanwhile, for the majority of SUUs from the N/W and S belt, reaching bigger recreation grounds where one can jog, roller blade, etc. is connected with using an expensive means of transport. The problem is additionally intensified by the lack of attractive recreational areas in the suburbs of Cracow and the resultant migrations of residents of the neighbouring communes, especially at weekends.



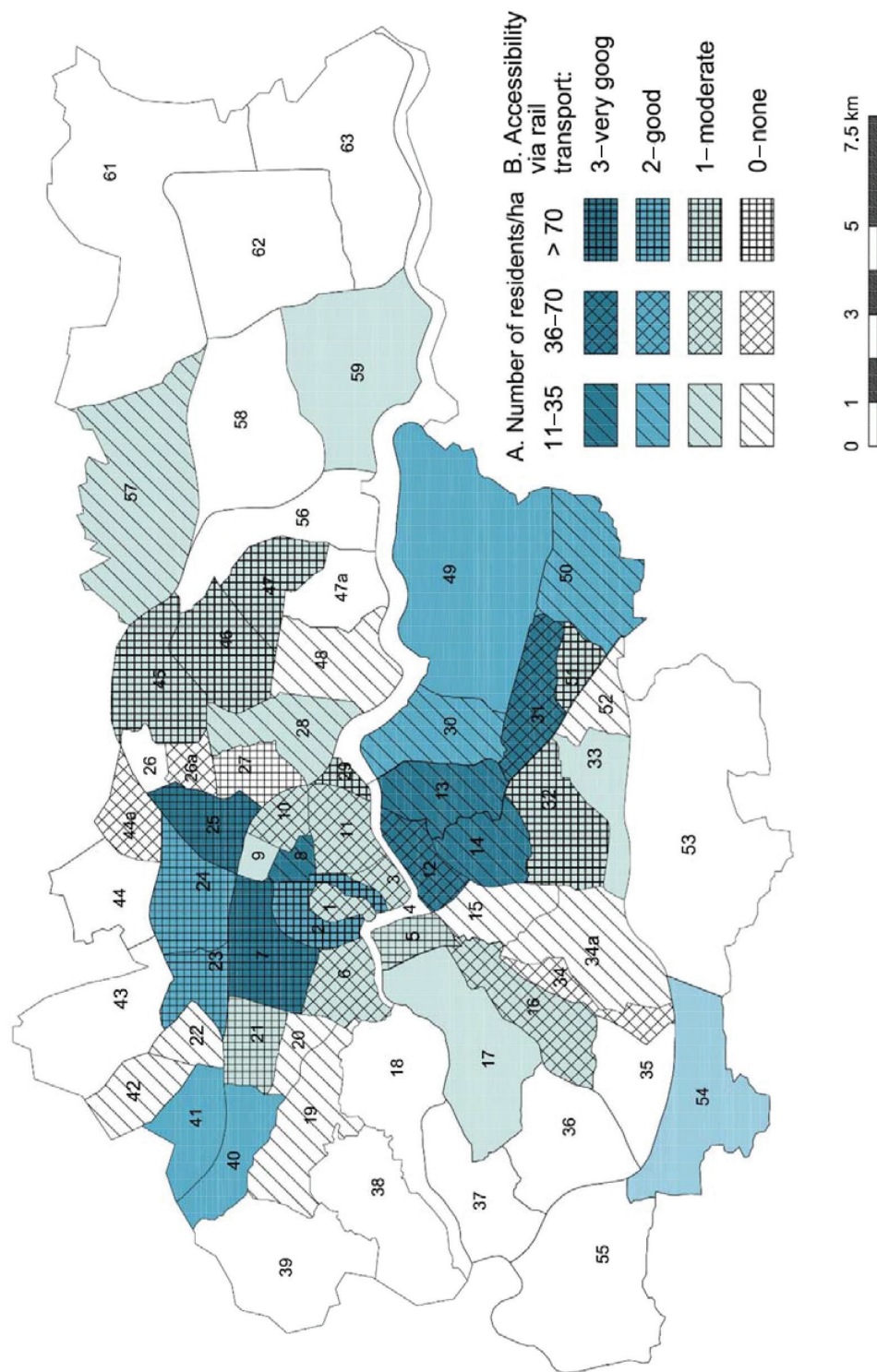


Fig. 4. Rail transport vs. population density in SUUs, 2016. Prepared by: A. Ziobro, in cooperation with: A. Derlatka, A. Matusik, D. Pokielski-Koziel, A. Sarga, F. Suchotni, P. Tota



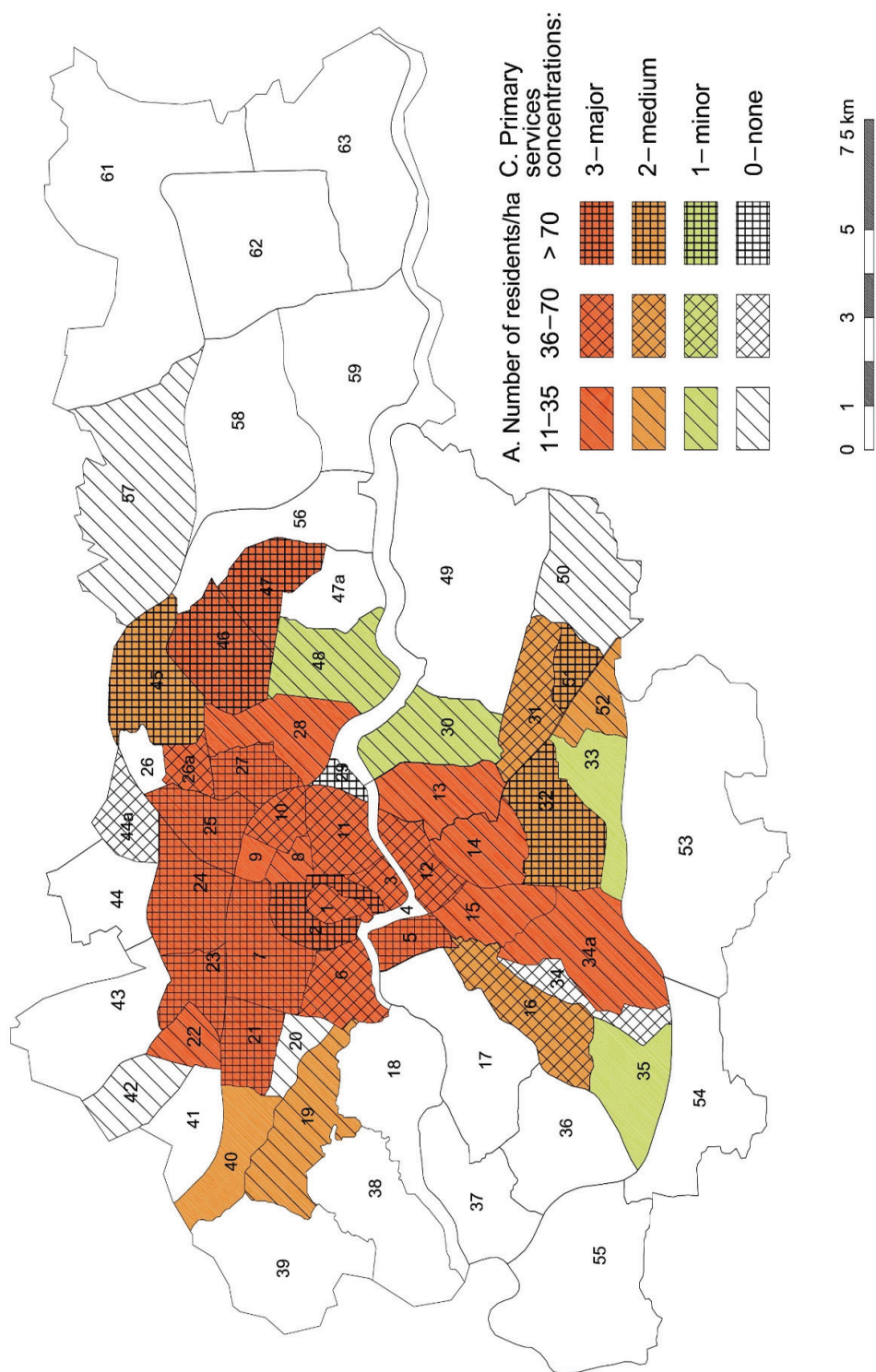


Fig. 5. Primary service concentrations vs. population density in SUUs, 2016. Prepared by: A. Ziobro on the basis of research by D. Ogrodnik; in cooperation with: A. Derlatka, A. Matusik, D. Pokielski-Koziele, A. Sarga, F. Suchon, P. Tota

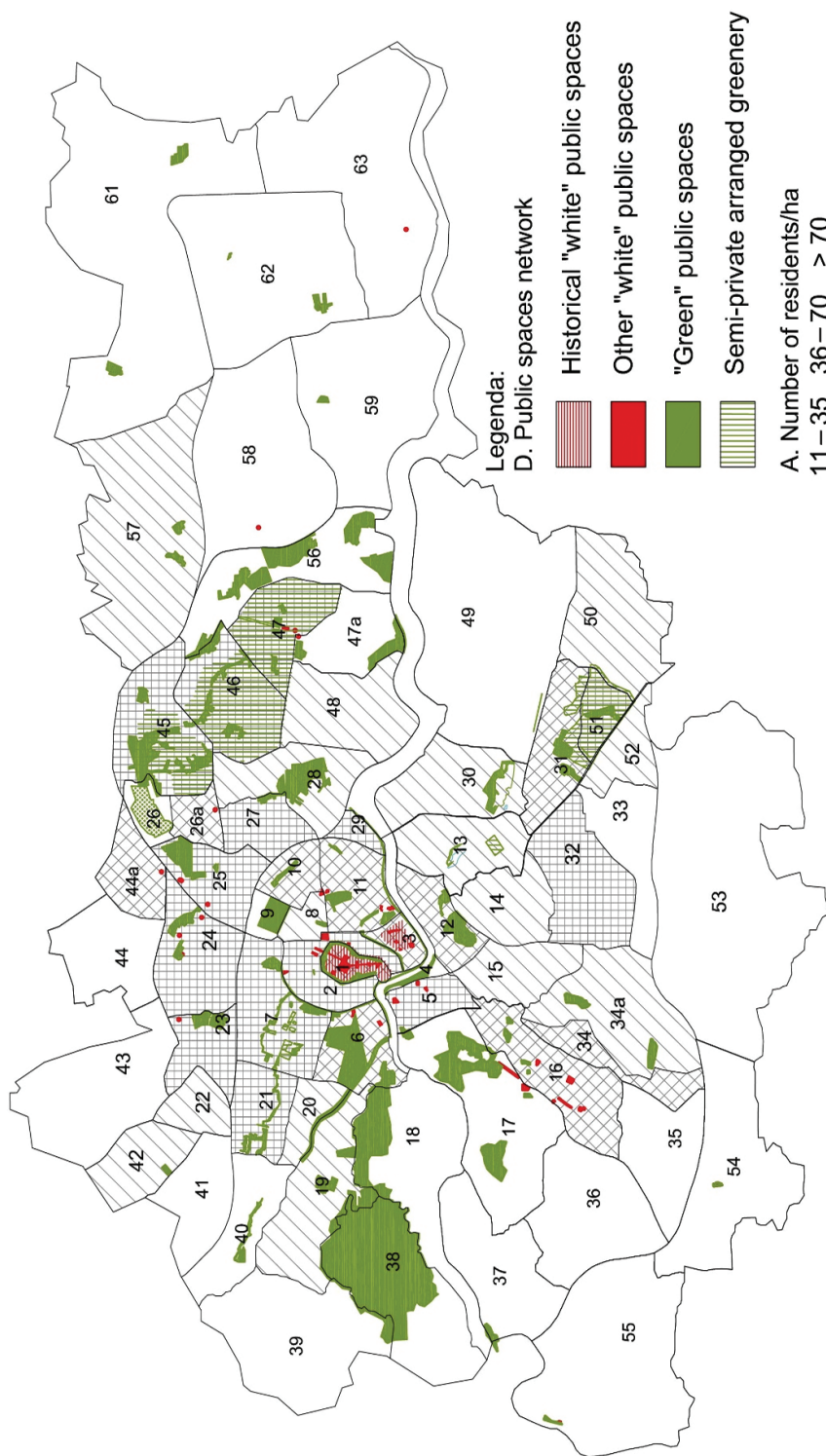


Fig. 6. 'White-green' public spaces vs. population density in SUUs, 2016. Prepared by: A. Ziobro, in cooperation with A. Derlatka, A. Matusik, D. Pokielski-Koziel, A. Sarga, F. Suchoń, P. Tota

## 5. Conclusions

The factors and indicators developed as components of the model of the quality of the residential environment allowed to illustrate the spatial dysfunctions of Cracow. A solution for many of the demonstrated problems is the implementation of investments already included in the study of spatial development conditions and directions. For other areas, recommendations for amending the aforementioned planning document were formulated. These experiences, as well as planning practices in such cities as Copenhagen or Stockholm, testify to the great usefulness of model interpretations.

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