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APPLICATION OF GIS SYSTEMS FOR DELIMITATION OF DEGRADED AREAS OF SMALL CITIES AND RURAL AREAS

12.1 INTRODUCTION

Taking an effective and efficient action in the area of regeneration requires precise diagnosis of situation and concentration of areas, where socio-economic, environmental and infrastructural problems exceed given levels. These levels should be determined individually for each municipality, as taking general values from the EUROSTAT or national Statistical Offices is very likely to not recognize the real problems of the local community. In the previous research the author identified particular criteria for delimitation of degraded areas in the largest cities in Poland [9, 10]. The set of criteria taken into account when deciding about the borders of the areas considered as degraded comprises both qualitative and quantitative ones. Legal framework for regeneration in Poland is still under development, as the Act of Revitalization was came into power in November 2015. In article 4 it indicates only, that the diagnosis oriented on delimitation of degraded areas and regeneration areas must be based on objective and verifiable indicators and research methods appropriate for local conditions.[1] In fact, the legislation does not indicate clearly, how this research should be conducted, which creates the possibility to include in the regeneration programmer the areas not having real problems. The only limitation for this results from two conditions set by the legislator, namely: the total area of regeneration areas within the municipality must not exceed 20% of its total area and the population of the area indicated for regeneration must not be higher than 30% of its total population. It should be clearly said, that the legislation differentiates the degraded areas and areas for regeneration. Articles 9 of the aforementioned act states that the area may be considered as degraded if there is a concentration of negative social phenomena like: unemployment, poverty, delinquency, low level of education or social capital and insufficient level of participation in social or cultural life and simultaneously there are negative phenomena in the following areas: local economy, environment, technical infrastructure and spatial solutions. Article 10 says that if there is particular concentration of the negative phenomena, the area may be considered as the regeneration area. Its borders, however, must be precisely defined, preferably on the cadastre map, on the external borders of plots of land.

The framework of the research was the urban audit method. Jarczewski in [4] indicates that the number of available data on the local level concerning intra municipal differentiation of social, economic and spatial phenomena is extremely low. Statistical Offices in the EU member states, as well as EUROSTAT, do not collect data on level lower than NUTS-5. It is a level of individual municipality. The main assumption of the research was to facilitate the presentation of intra municipal differences in the aforementioned areas, basing on the data possessed by them. Local governments collect and report various data, however, it is very difficult to give them spatial attribute. Jarczewski also emphasizes that the urban audit may be used as a tool of development and implementation of given municipal policies on social inclusion, employment, education, property management, etc. One of the key issue is how to divide the municipality into units, on the level of which the research may be done. So far GIS was widely used for performing spatial analyses of delinquency, for determining optimum location for solar power plants or windmills, as well as the negative phenomenon of urban sprawl or determinants of processes of creation of metropolis [2, 3, 5, 7, 8]. Potential use for urban regeneration was indicated in [4].

12.2 METHODOLOGY OF THE RESEARCH

The objective of the research is to determine the most usable and useful spatial unit for carrying out socio-economic analyses of smaller municipalities. Having the examples of four municipalities located in various regions of Poland, the author approaches the unit suitable enough and objective for making decisions and determining the borders of degraded and regeneration areas. These municipalities are: Lubin (Lower Silesia), Sułkowice (Lesser Poland), Brzeszcze (Lesser Poland) and Sońnicowice (Silesia). Their location in the southern part of Poland is presented below (Fig. 12.1).



Fig. 12.1 Dislocation of the researched municipalities

Source: own elaboration

The research in spatial factor is based on the maps from Polish National Register of Borders, local cadastre maps and the resources provided by OpenStreetMap community. The figures were elaborated in QGIS. Numerical data were delivered by appropriate municipalities. The qualitative factors were developed by the representatives of the municipalities during the expert sessions. The results are divided into four groups of representation:

- quantitative data related with the population,
- quantitative data related with the area of the land (not considered in the paper),
- spatially related qualitative data,
- synthesis of qualitative and quantitative data.

12.3 SPATIAL REPRESENTATION AND DISTRIBUTION OF SOCIO-ECONOMIC PHENOMENA IN SMALLER MUNICIPALITIES

This section is divided as stated above. Presenting spatial distribution of given phenomenon is crucial from the point of view of decision making process, since – in case of any misuse of spatial units, the results can be misleading, carrying the decision maker to wrong conclusions, and – as a final result – to inappropriate allocation of budgets and actions. From the research carried out for all aforementioned cases it was derived, that spatial distribution of social phenomena which are statistically presented for a given number of inhabitants (mainly 100 or 1000) must be developed with the use of homogeneous units, bearing in mind all social factors. Although the criteria of establishing spatial units comprise wider catalogue of factors (i.e. morphological homogeneity, functional unity, social cohesion) [6], in case of identification of social issues the factors of size and morphology should be rather skipped. The author made having an example of the municipality of Brzeszcze it can be confirmed that appropriate selection of social indicators facilitates indication of proper areas. For example in case of long-term unemployment or beneficiaries of social aid, in both cases the number of the inhabitants affected by this phenomena per 100 inhabitants delivered different results for larger and smaller units, as it is indicated on the maps. In the first case there were used pseudo natural units – localities, in the second case – for the same primary data – the artificial spatial units – voting districts to the municipal council. The goodness of voting districts results from its homogeneity, namely – each of them counts more or less equal number of inhabitants. It works perfectly well in case of smaller municipalities where single-mandate voting districts function. In larger cities, where the local elections are proportional, it does not function so well, as various number of mandates are allocated to various voting districts and the number of inhabitants in particular location may differ. The scale of difference may distort the final result of analysis of indicators.

As it is presented on the map, the highest concentration of people benefiting from the social aid per 100 inhabitants is in the neighborhood located in the easternmost part of the municipality. It is partially true, as this very location has the fewest inhabitants, some of whom naturally benefiting from this type of aid (Fig. 12.2).

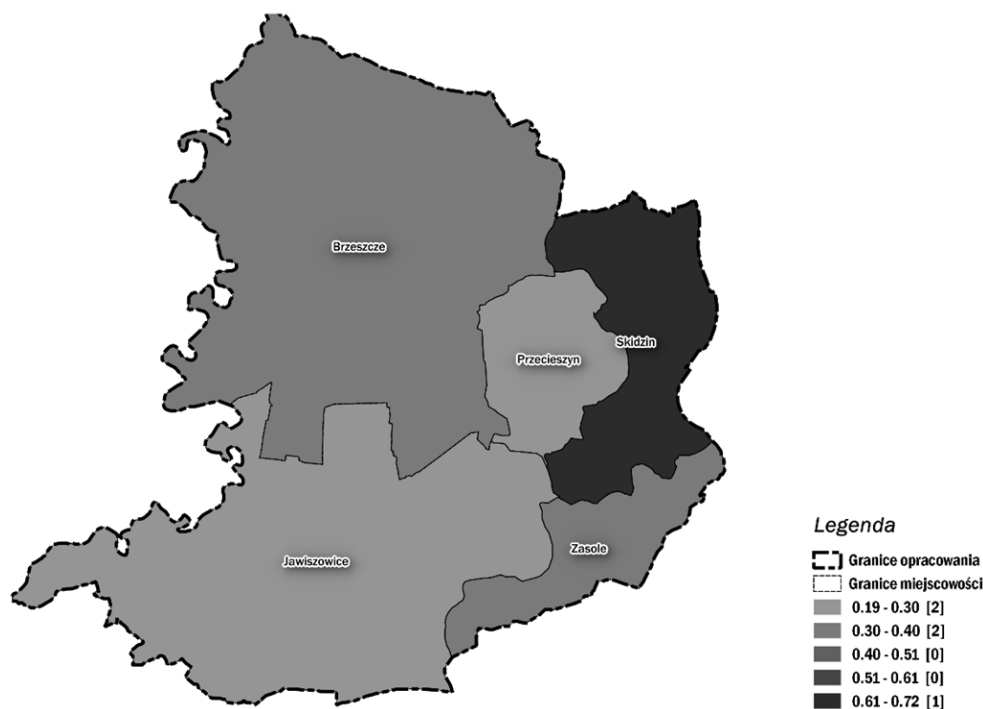


Fig. 12.2 Dislocation of the beneficiaries of social aid in the municipality of Brzeszcze based on neighborhoods

Source: own elaboration

Comparable situation may be identified in case of long-term unemployment, where for this factor, figures say that the worst situation is in the central part of the municipality, as it was indicated on the map (Fig. 12.3).

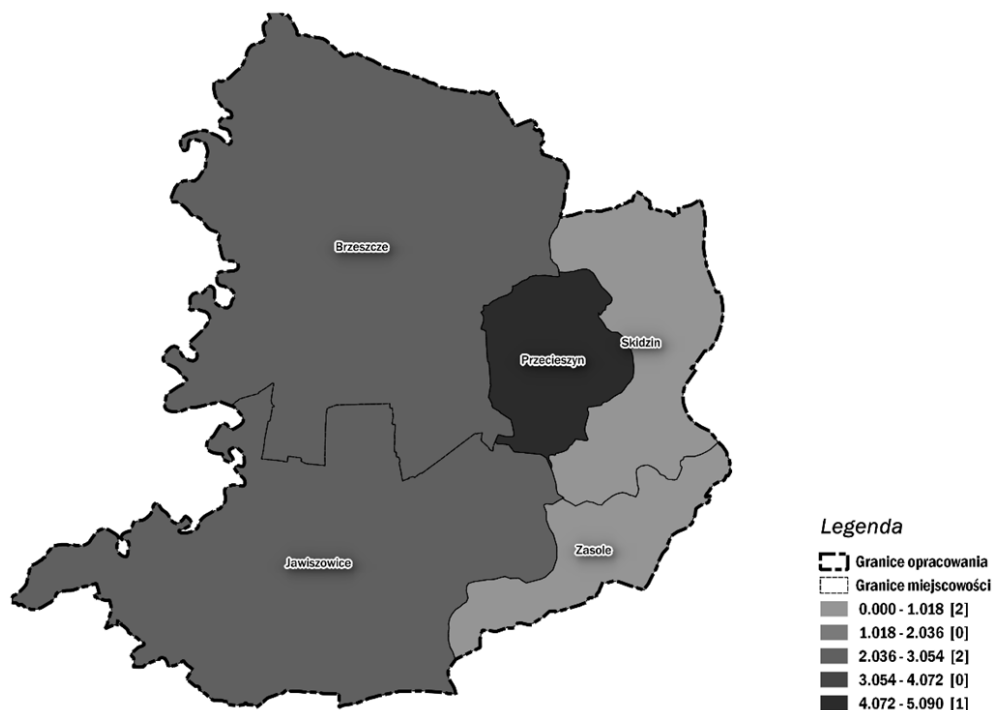


Fig. 12.3 Dislocation of long-term unemployment in the municipality of Brzeszcze based on neighborhoods

Source: own elaboration

It is worth mentioning, that the use of neighborhoods, although appealing to local decision makers, does not reflect the real situation due to disparities in number of inhabitants, population density and physical factors. In order to increase the precision of diagnosis, it was decided to introduce more homogenous spatial units – in this case the voting districts. The results of the spatial analysis of the aforementioned social phenomena are provided on the maps. Naturally, the primary data used in the first attempt were attributed to appropriate, smaller spatial units.

Some of the data were unavailable for some locations, therefore they were marked white. As it can be seen, on the contrary to previously indicated results, the highest concentration of the long-term unemployed is in district 10, whereas the highest number of inhabitants supported by social aid may be identified in districts 1 and 4. All of them are not located in the neighborhoods that initially were identified as potentially problematic. The results of the analysis on higher level of accuracy, performed for smaller spatial units, are provided in the pictures below (Fig. 12.4).

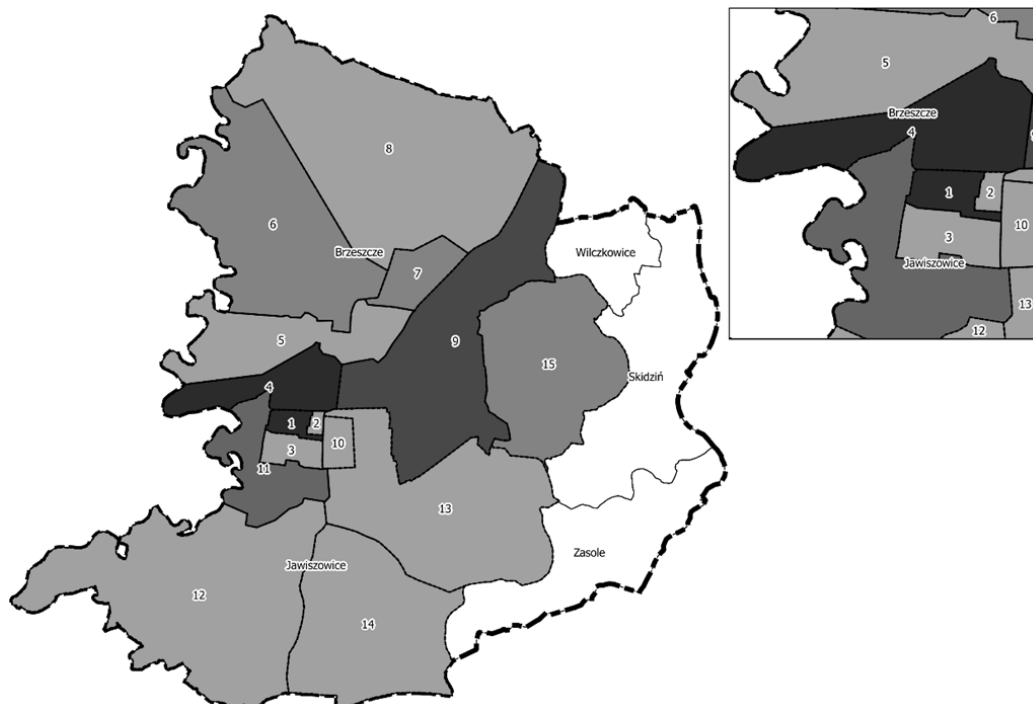


Fig. 12.4 Dislocation of the beneficiaries of social aid in the municipality of Brzeszcze based on the voting districts

Source: own elaboration

The frame in the upper right hand corner presents details of the analysis, indicating the districts with the highest ratio of population supported by social aid per 100 inhabitants. High concentration of this problem is identified also in district 9, what previously was not so obvious. It is worth mentioning, that these artificial spatial units were created according to their population, regardless of their area. As stated previously, they are suitable for analyzing phenomena for which one can calculate the ratio indicators. Otherwise the results of analysis are likely to be misleading. An exemplification of the long-term unemployment ratio per 100 inhabitants is provided below (Fig. 12.5).

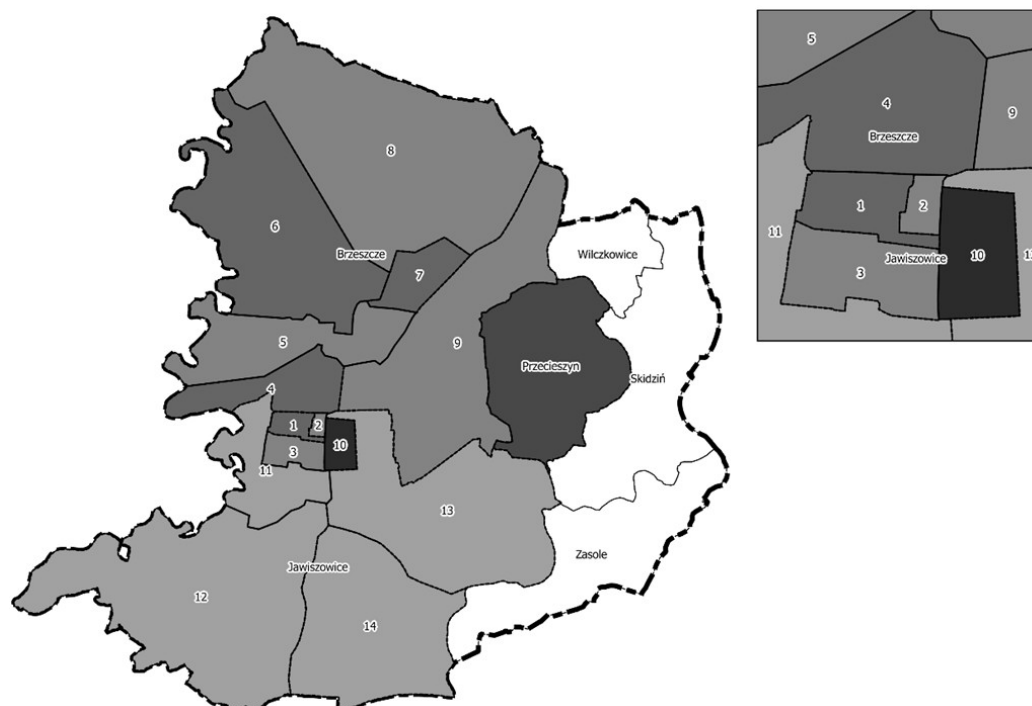


Fig. 12.5 Dislocation of long-term unemployment in the municipality of Brzeszcze based on the voting districts

Source: own elaboration

As far as spatially related qualitative data is concerned, division of the municipality into natural, pseudo natural or artificial measurable units is not so important. Bearing in mind the necessity to aggregate the quantitative and qualitative data in spatial manner in order to indicate degraded and regeneration areas, it is suitable to have a „common denominator”, which can be the smallest unit used for qualitative analyses. If each phenomenon has a dedicated layer, it is easy then, with the use of any currently available GIS environment, to sort and overlap the layers, in order to delimitate the area of the highest concentration of problems, both of qualitative and quantitative nature.

An example of the qualitative spatial analysis performed for the municipality of Lubin is provided below. Basing on the interview, local government of Lubin acquired the qualitative data on the condition of the roads in 31 neighborhoods. The primary information was collected from the sample of the inhabitants who had 3 options to choose: good, moderate and bad. Spatial attribution to given units was done on a very general level, basing on the majority of opinions. Objectivity of this approach may be controversial, still it leads to some conclusions that facilitate decision making and match non-measurable problems to spatial units (Fig. 12.6).

Another example of use of qualitative data both on more general and particular level was observed in the municipality of Sułkowice in Lesser Poland. The phenomenon which was spatially analyzed was potential for development of businesses. This analysis was done by the experts who indicated particular neighborhoods and voting districts where there is surplus or deficit of this type of potential. Due to lack of objective indicators for analysis on this level, the assessment was qualitative only. The results are provided on the maps (Fig. 12.7).



Fig. 12.6 Qualitative assessment of condition of the roads in the municipality of Lubin
Source: own elaboration



Fig. 12.7 Qualitative assessment of business development potential in the municipality of Sułkowice on the level of neighborhoods

Source: own elaboration

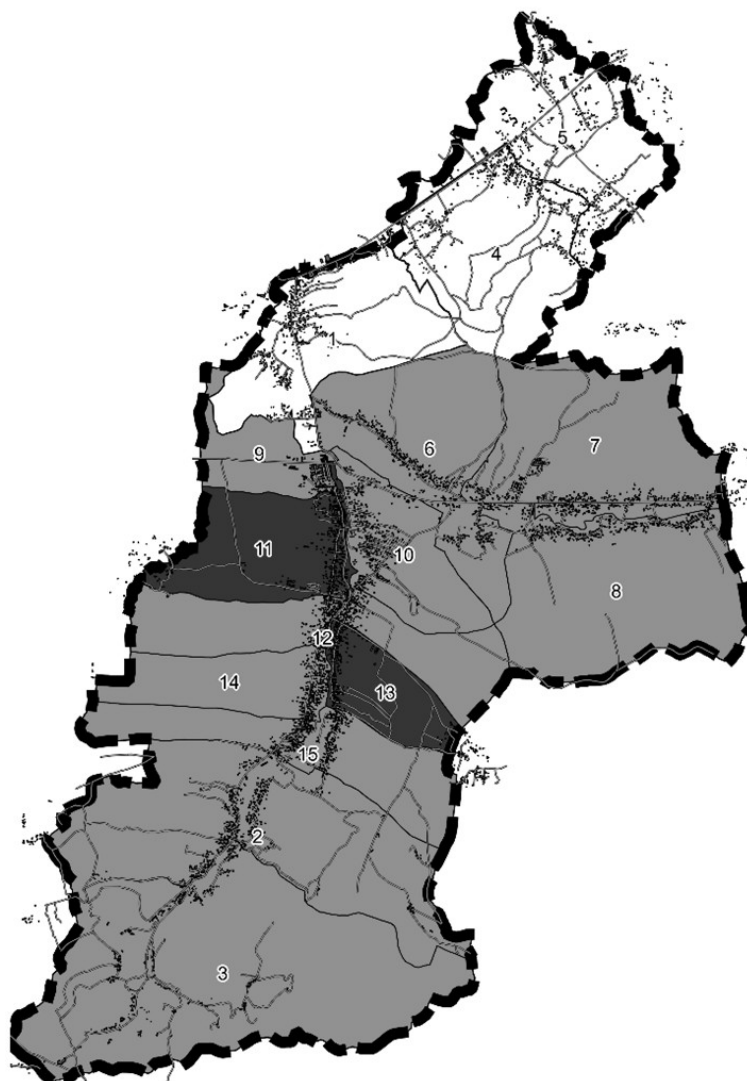


Fig. 12.8 Qualitative assessment of business development potential in the municipality of Sułkowie on the level of voting districts

Source: own elaboration

It should be underlined, that the neighborhoods located in the upper part of the second map were not considered in the further analyses, as they were not identified as the deficit ones. It is noticeable, that the general results of the analysis presented on the first map have a tendency to overgeneralization, as they indicate two neighborhoods as the problematic ones, whereas after more insight it was found out that only two voting districts located in the centrally located neighborhood have low potential for business development and the actions should be generally concentrated on them (Fig. 12.8).

Concluding part of the spatial analysis is synthesizing the results of qualitative and quantitative research. As indicated earlier, the most suitable spatial unit for this activity is the smallest possible one used in the quantitative part of the research. Synthetic maps indicate the scale of concentration of problems identified on given areas. Due to its hybrid character, they have to be prepared as if they presented qualitative phenomenon. The example of such map prepared for the municipality of Brzeszcze, is provided below (Fig. 12.9).



Fig. 12.9 Synthetic map of problems for the municipality of Brzeszcze

Source: own elaboration

The detailed views of the areas of concentration of problems are provided in the frames. The spatial units, basing on which the analysis was performed, are the smallest possible ones, in order to facilitate focused approach of local government to solution of identified problems. Using other spatial units blurs the image and significantly limits the ability to undertake actions oriented on particular districts of the municipality, where gravity of the problems interferes the quality of life.

CONCLUSIONS

Latest approaches towards public sector, for instance New Public Management, require the use of managerial thinking when delivering services aimed at satisfying the needs of the local community. Revitalization is oriented on solving serious and concentrated problems identified on homogenous and rather smaller areas of the municipality. Objective assessment of the regeneration needs with the use of GIS environment requires delimitation of spatial units suitable for the analysis, where the primary data has both qualitative and quantitative nature. In The findings presented above indicate that the use of natural or pseudo natural units may lead to ambiguous results due to inequalities of distribution of the inhabitants. Using the voting districts improves accuracy of analyses, as each natural or pseudo natural spatial unit is divided artificially into smaller parts, having similar number of inhabitants. There are, however, unsolved problems in this field, for the units whose population is lower than 100 and social phenomena represent given values. In such case the results of the analysis may also be ambiguous and difficult to interpret. Further research of the author will concentrate on this issue.

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Abstract: *The paper presents the results of research on application of GIS systems for delimitation of degraded areas in smaller municipalities. During the analyses it was found out, that the distribution of population of smaller municipalities is uneven as most of the areas are covered by forests or cornfield. This increases population on smaller housing areas. From the point of view of socio-economic indicators related to the unit of area of the land, it interferes the measurements. On the other hand, due to lower number of inhabitants comparing to larger cities, taking some of the indicators that are standardised to „per 100 persons” as they are, may also interfere the results and distort the real situation. This paper is an attempt to handle these dilemmas.*

Key words: *small cities, delimitation, degraded areas, revitalisation*

WYKORZYSTANIE SYSTEMÓW GIS DLA DELIMITACJI ZDEGRADOWANYCH OBSZARÓW MAŁYCH MIAST I TERENÓW WIEJSKICH

Streszczenie: *W artykule zaprezentowano wyniki badań nad wykorzystaniem systemów GIS dla delimitacji obszarów zdegradowanych w mniejszych gminach. Podczas analiz autor stwierdził, iż rozmieszczenie populacji mniejszych gmin jest nierównomierne, gdyż większość ich obszarów zajmują lasy lub pola uprawne. To z kolei naturalnie zwiększa populację na obszarach mieszkalnych. Z punktu widzenia wskaźników społeczno-ekonomicznych odnoszonych do jednostki powierzchni gruntu, fakt ten powoduje zaburzenie wyników. Z drugiej strony, z uwagi na mniejszą liczbę mieszkańców, porównując z większymi miastami, przyjęcie wskaźników odnoszonych „do 100 mieszkańców” w sposób bezpośredni, również zaburza i zniekształca wyniku. Niniejszy tekst stanowi próbę odpowiedzi na te dylematy.*

Słowa kluczowe: *małe miasta, delimitacja, obszary zdegradowane, rewitalizacja*

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