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MEANS OF ASSESSMENT OF THE ENVIRONMENTAL QUALITY OF THE RURAL AREAS IN POLAND ON THE BASIS OF STATE ENVIRONMENTAL MONITORING DATA (2000–2009)*

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Abstract. This article presents the results of an analysis of the 16 environmental monitoring networks in Poland, which were operating during the years 2000–2009 within communes with a particular focus on the rural areas. The original data completeness indices were calculated for each network and in total. The results show that the development of environmental monitoring in rural communes is much weaker than in cities, especially in the scope of air quality and traffic noise. Outside the cities, the monitoring of waters, as well as the health condition of forests is being realized most fully. Considering the spatial distribution, the environmental monitoring of rural areas is run the most successfully in Pomerania, Lower Silesia and Łódź voivodeships, while it is the least successful in eastern Poland, especially in the Masovia voivodeship. Environmental monitoring was particularly applied in the areas endangered by industry, the national border areas and those with especially valuable natural values.

Key words: environmental quality, environmental monitoring networks, rural areas, Poland

INTRODUCTION

The sustainable spatial management of the rural areas requires taking into consideration a number of factors, including environmental factors and within their scope, information on the quality (the degree of the anthropogenic transformation) of the natural environment. The realization of many socio-economic functions, whose

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development is based on the exploitation of natural resources and environmental amenities (e.g. agriculture, tourism, water management), depends not only on the their quantity but also on their quality. That is why this data is applied in the processes of strategic, socio-economic and spatial planning, among others, in the process of preparing eco-physiographical evaluations or environmental impact assessments.

The main source of information about the environmental quality in Poland is the state environmental monitoring system (SEM), which has been in operation according to the Act on the Inspectorate for Environmental Protection since 20th June 1991. This institution, operating through the Chief Inspectorate of Environmental Protection (GIOŚ) and 16 Voivodeship Inspectorates for Environmental Protection (WIOŚ), is the main coordinator of environmental monitoring. However, the data on environmental quality is also being gathered by many other institutions, such as: The Sanitary Inspectorate (until 2009, data on the quality of air and soils of the selected areas), The Polish Geological Institute (underground waters, water sediments), The Forest Research Institute (forests), The Institute of Soil Science and Plant Cultivation (soils) and The Institute of Meteorology and Water Management (monitoring the elements of surface waters). This information is gathered within the subsystems of the national environmental monitoring system covering the entire nation, which includes issues of the quality of air, water, soil and lands, nature (biotic elements) and the levels of noise, electromagnetic fields and ionising radiation in the environment. The monitoring of the condition of the above-mentioned elements is carried out in networks including points and areas where the measurements are taken.

The aim of this study, whose results are presented in the article, is to recognize the spatial scope of the measures carried out in the framework of the majority of environmental monitoring networks in Poland in years 2000–2009 with a special focus on rural areas. To date, a comprehensive analysis and evaluation of all the environmental monitoring networks has not been carried out in Poland. There are available studies on the monitoring network of the individual components, mainly air, water or forests, in the scope of evaluation of their functioning [e.g. Skotak 2002, Kobus et al. 2007] and location optimization proposals [e.g. Czyżkowski 2009]. In addition, this matter is most often raised in relation to the water [Strobl and Robillard 2008] and air [Sarigiannis and Saigana 2008] monitoring networks in international literature. Complex network analysis, similar to those presented in this article, for example, was conducted for the area of Estonia [Roose et al. 2007].

For the sake of this research, information on the distribution, within the analysed period, of 16 networks was gathered and they refer to the areas of communes in three main types which take into consideration the administrative-council criteria. These were the following types of communes: rural, urban-rural and urban. The analysis and comparisons presented in this article compare the data for rural communes to the other two types, which describe the characteristics of the first type and simultaneously analyses the differences between all three types.

STUDY METHODS

This research is part of a broader study by the author which deals with the diagnosis and sociological regionalization of Poland. The goals of the studies, as well as the initial results, have been presented in other publications [Kistowski 2010, 2011, 2012]. One of the stages of this study refers to the selection of the material for analysis. Assessment of spatial and time completeness of information on the environmental quality was the main criteria for this selection. Its significance is due to the fact of the uneven distribution of the elements in each of the monitoring networks as well as the applied changes, which were carried out due to modification of the measuring methodology and state ecological policy. Sixteen monitoring networks were analysed on the basis of publications of the Inspectorate of Environmental Protection (in the publication "Library of Environmental Monitoring"), especially using reports on environmental conditions in the voivodeships issued in 2001–2010, as well as information gathered directly from GIOŚ and WIOŚ which referred to: average annual concentration of NO_2, SO_2 and suspended particulate matter (BS, TSP or PM10, benzene and benzo-á-pyrene) and heavy metals (including lead separately); cleanliness class (2000–2003), quality class (2004–2007) and the assessment of the ecological state/potential (2008–2009) of the rivers; quality class of underground waters; cleanliness class of water sediments on the basis of geochemical criteria; degree of pollution of soils of arable lands with trace elements (2000 and 2005); traffic noise level; class of damage of forest stands, estimated on the basis of defoliation assessment; general assessment of the state of the selected habitats and plants/animals species listed in the appendixes to the EU "Habitat" and "Birds" directives (2006–2009).

In order to analyse the distribution of networks in the whole country, individual indices of data completeness were calculated for each of the networks (1) and the complex (total) index of completeness (2) was calculated, which takes into consideration the spatial and time density of data in each administrative unit, using the following formulas:

$$K_i = \frac{nL}{10} \tag{1}$$

where:
n – the total number of measure points of particular network in years 2000–2009,
L – the number of years when the measurements of the environmental quality were taken (2000–2009).

$$K_k = \frac{\frac{\Sigma n}{S}\frac{\Sigma L}{S}}{10} \tag{2}$$

where:
Σn – the total number of measure points in years 2000–2009 in all the networks,
ΣL – the total number of years when the measures of the environmental quality were taken (2000–2009) in all the networks.
S – the total number of monitoring networks taken into consideration in the study.

Divisor 10 results from the maximum possible number of measurement years during study time. Both indices were also referred to the area of the communes (per 100 km^2) and the average number of their population in 2000–2009 (per 1000 persons). The database of the monitoring networks was created in MS Excel and then – in order to acquire the spatial references – converted into GIS MapInfo software, which helped to carry out the data analysis and to make the illustrations for this paper.

STUDY RESULTS

As mentioned earlier, the study results refer to three groups of communes, whose general characteristics are shown in Table 1. Compared to the remaining communes, the rural communes cover an average area (much smaller than that for the urban-rural communes) as well as a small average population – 9 times smaller than in the urban communes and half as much as the urban-rural ones. They cover almost 2/3 of the country's total area. However, together with the rural areas of the urban-rural communes, the areas which are outside the cities cover 90% of the area of Poland.

Table 1. The general characteristics of the types of communes studied
Tabela 1. Ogólna charakterystyka trzech typów badanych gmin

Types of communes Typy gmin	Number of communes [% of total] Liczba gmin [% ogółu]	Area of communes 2009 [km^2] Powierzchnia gmin 2009 [km^2]			Average year population 2000–2009 Średnia roczna liczba ludności 2000–2009		
		total łączna	% of Poland % pow Polski	average per commune średnio w jednej gminie	total łączna	% of Poland % ludn. Polski	average per commune średnio w jednej gminie
Rural Wiejskie	1 591 (64,2)	200 153,6	64,01	125,8	10 980 851	28,76	6 902
Urban-rural Miejsko-wiejskie	580 (23,41)	97 931,6	31,32	168,85	8 412 281	22,04	14 504
Urban Miejskie	307 (12,39)	14 594,2	4,67	47,54	18 784 918	49,2	61 189

Source: Local Databank of The Central Statistical Office
Źródło: Bank Danych Lokalnych Głównego Urzędu Statystycznego

Among the monitoring networks selected for the study, the network of concentration of air pollution in the rural areas is the most poorly represented (Fig. 1). Taking into consideration the monitoring of NO_2 and SO_2, it is carried out in only 18–20% of those communes, while in the urban communes this percentage reaches 80%. These disproportions are even greater in the case of other air pollutants, which are monitored only in 0.3–3.3% of the rural communes, while in the cities it reaches 28–70%.

The greatest disproportions refer to the concentration of suspended particulate matter, which is monitored in only 3.3% of the rural communes, 23.4% of the urban-rural communes and up to 69.4% of the urban communes. It is a result of the concentration of the air pollution sources, especially from traffic in the cities. However, this makes it difficult to monitor the air quality in the particular points of its concentration (e.g. motorway nods) in the rural areas. The same situation can be observed for the monitoring of traffic noise; the number of monitored rural communes (21%) is almost four times smaller than urban ones (73.6%).

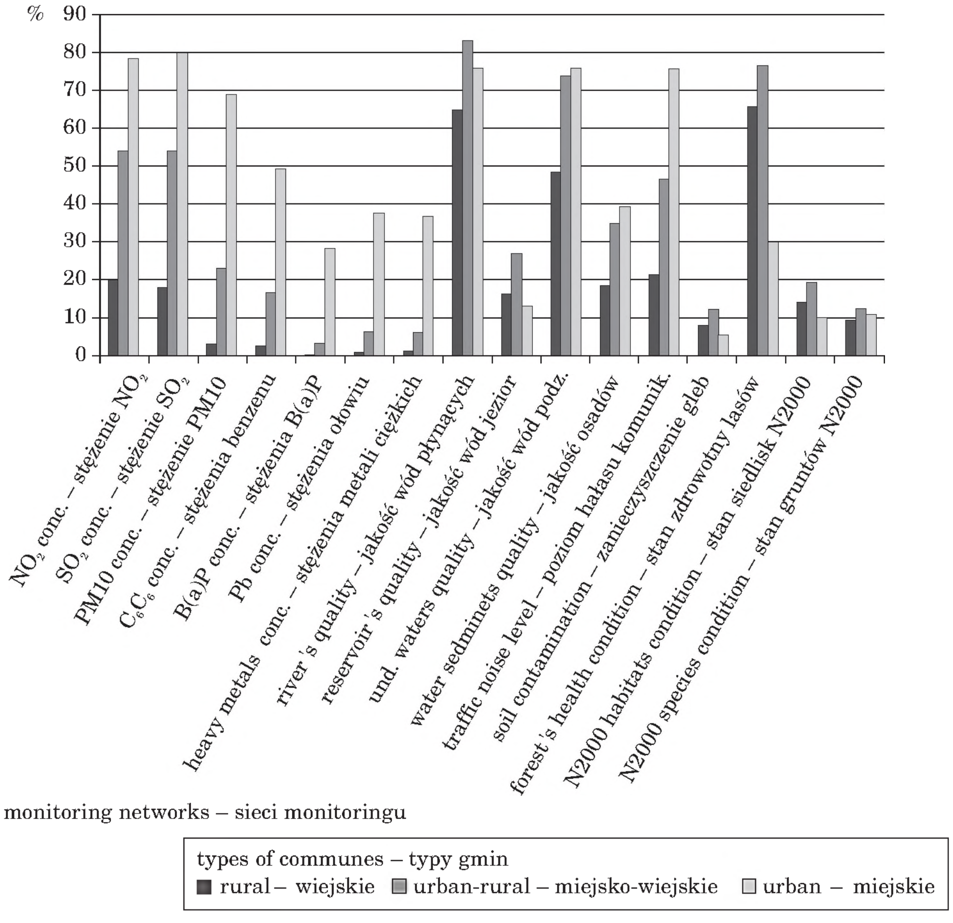


Fig. 1. The share of environmental monitoring networks in three types of Polish communes [%]

Rys. 1. Zasięg sieci monitoringu środowiska w trzech typach gmin Polski [%]

Source: Author's own study based on SEM data

Źródło: Opracowanie własne na podstawie danych PMŚ

The situation is much better in the case of the monitoring networks of waters and water sediments. This monitoring covers 63% of rivers as well as underground waters in almost half of the rural communes, while in the other two types of communes the share is 71–83%. These disproportions are much smaller. The monitoring of reservoirs covers 16% of rural communes, which is the average value against the background of urban communes (12.7%) and urban-rural communes (26.4%). However, the share of rural communes, where the quality of water sediments is monitored, is twice smaller (18.3%) than in the two other types of communes. Given the poorly-developed monitoring network of soil contamination, it is surprising that the number of monitored rural communes (7.8%) is not much different from urban ones (5.5%) and lower than in the urban-rural communes.

The monitoring network in rural communes is the best-developed for the monitoring of forest health conditions (63.8%), while it is developed in only 30% of urban communes. However, in the light of distribution of biological resources of the state – it is surprising that the percentage of the monitoring networks of habitats and Nature 2000 species are similar in all three types of communes (9–19%) and the highest percentage, in both cases, is the participation of urban-rural communes (19% and 12.2% respectively), while for rural communes it is 14% and 9.4%. This situation may be due to the relatively short period of development of monitoring networks for the natural environment which, in this case, amounts to 5 years. The number of operating monitoring nets also explains the poorest development of monitoring networks in rural communes within the studied types. In up to 103 (6.5%) of such communes there is no single monitoring network operating, while this percentage for the two other types of communes is 0.8–2.9% (Fig. 2).

Taking into consideration the number of monitoring points in particular networks, there are three main tendencies of their distribution in each of the three types of communes (Fig. 3). Referring to the monitoring points of condensation of air pollution and traffic noise, the smallest number of points was observed in rural communes (depending on the network, from 1.5% to 17.6% of the total points), on average in rural-urban communes (12–24%) and the highest number in the urban ones (58–85%). In this group of networks in rural communes, the monitoring net of NO_2 and SO_2 air concentration was relatively the densest. However, 0.5 measuring points fell on one rural commune under annual monitoring, while in the case of urban communes it was 2.2 points. In the other 8 analysed monitoring networks, the points and monitoring areas located in rural communes were in the majority. The points of monitoring nets of rivers, underground waters and water sediments located in these communes constituted about half of all the points of those networks; while the in case of the monitoring of reservoirs, soil contamination, forest health conditions and preservation of Nature 2000 habitats and species – ca. 60%.

The networks with the highest number of points in rural communes refer to the monitoring of: quality of rivers (10,400 points in years 2000–2009, which gives, on average, 1 point annually in each monitored commune), forest health conditions (over 9,600 points – on average 0.95 in a commune annually) and the quality of underground waters (almost 6,000 points – on average 0.78 annually in each monitored commune).

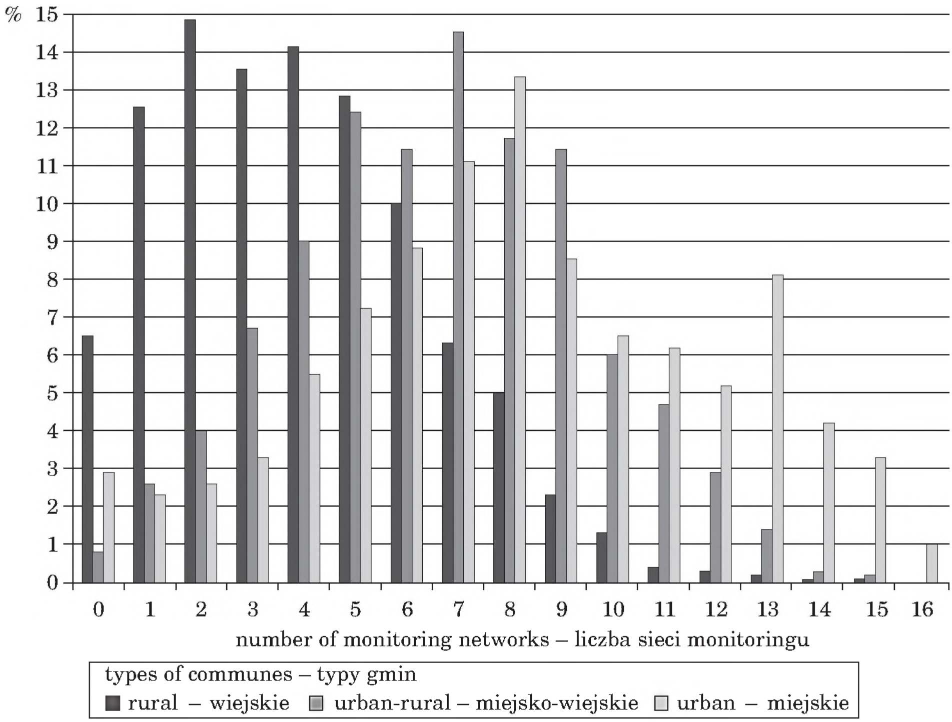


Fig. 2. The number of monitoring networks functioning in three types of communes [%] (2000–2009)
Rys. 2. Liczba sieci monitoringu działających w trzech typach gmin [%] w latach 2000–2009
Source: Author's own study based on SEM data
Źródło: Opracowanie własne na podstawie danych PMŚ

The detailed spatial characteristics of the distribution of monitoring networks in the rural areas shall be presented in three aspects:
- distribution of the number of networks and their points in rural and urban-rural communes;
- distribution of points in the selected environmental monitoring networks in those areas;
- general assessment of the completeness of environmental monitoring nets in the rural areas in view of the absolute magnitudes of the total index and the populations of the communes.

It should be emphasized that in reference to the localization of monitoring points in the city-village pattern in urban-rural communes, there is a certain degree of uncertainty. However, it is highly probable that the majority of monitoring points of air pollution and traffic noise in these communes were located in cities; the monitoring points of waters and water sediments, in similar proportions, were located in the cities and rural areas; while the areas for the monitoring of soils and the biotic elements were mainly located in rural areas.

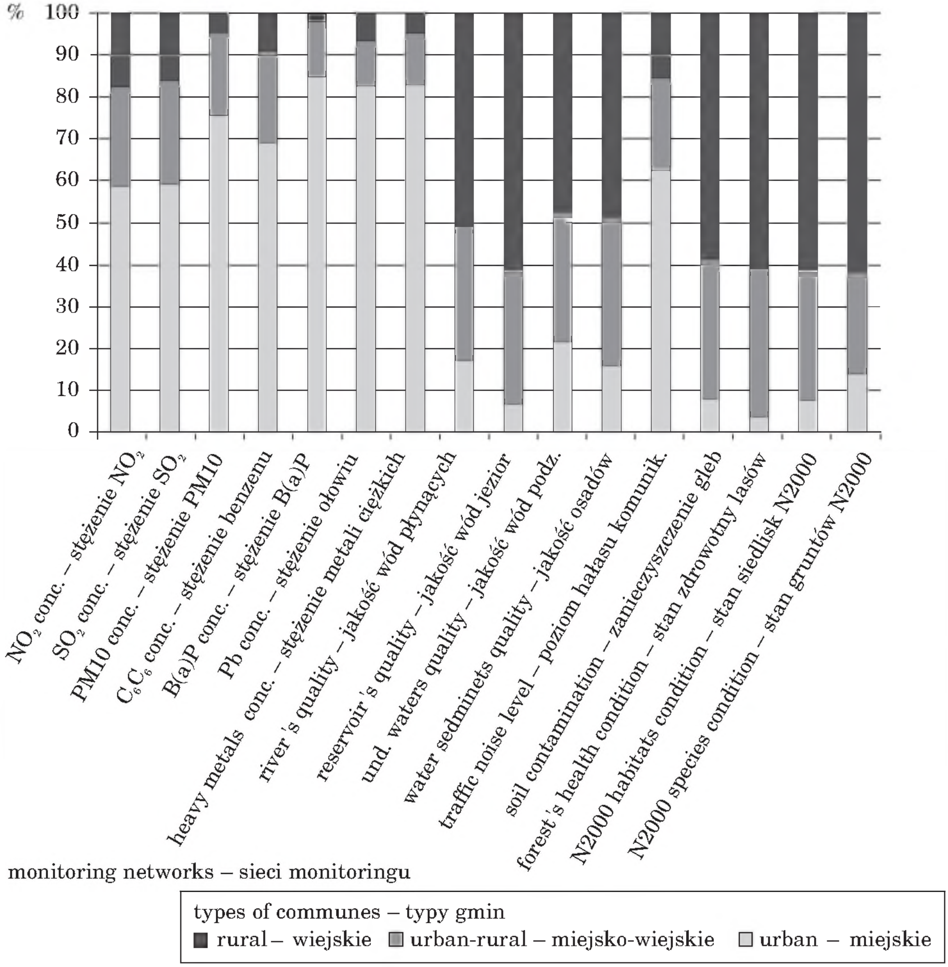


Fig. 3. The distribution of monitoring points of particular networks in three types of communes [%]
Rys. 3. Rozkład punktów monitoringu poszczególnych sieci w trzech typach gmin Polski [%]
Source: Author's own study based on SEM data
Źródło: Opracowanie własne na podstawie danych PMŚ

In the analysed decade, the majority of networks were operating, obviously, in cities (particularly exposed to the strong anthropopressure, with populations over 100 thousand), but also in some rural communes, where a significant number of networks were observed (Fig. 4). Among the 16 analysed networks, from 12 to 15 of them were operating in border communes (Sejny, Dorohusk, Widuchowa, Jabłonka), which can be associated with the localization of border monitoring points. There were also communes located under the influence of industry (Włocławek – nitric fertilizer industry; Rudna – a basin of post-floatation wastes Żelazny Most), and communes where there are

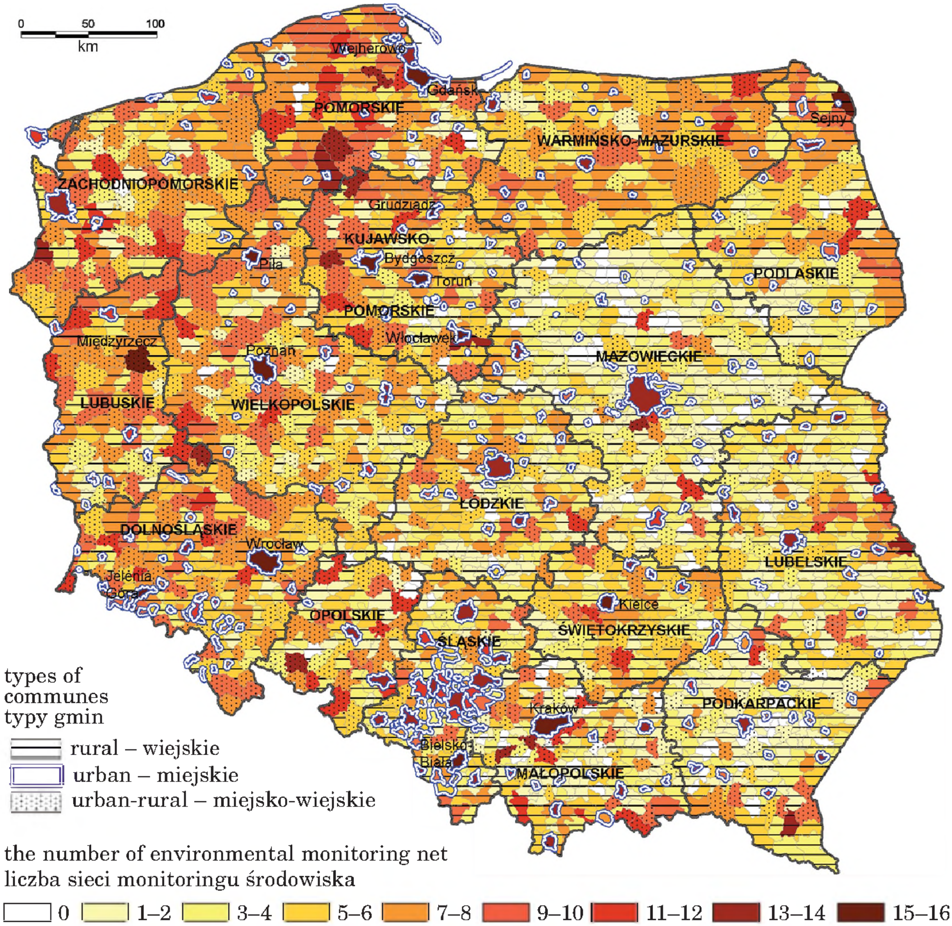


Fig. 4. The number of environmental monitoring networks in Polish communes during 2000–2009
Rys. 4. Liczba sieci monitoringu środowiska w gminach Polski działających w latach 2000–2009
Source: Author's own study based on SEM data
Źródło: Opracowanie własne na podstawie danych PMŚ

important reservoirs supplying drink water (Solina, Stargard Szczeciński – Lake Miedwie) as well as communes where a significant number of networks are hard to explain (Chojnice, Kościerzyna). In addition, among the urban-rural communes there are also areas which are characterized by numerous networks in rural areas. Among them are communes located in the vicinity of large cities (Piaseczno, Nakło upon Noteć, Skawina) as well as tourist communes with a forest (Brusy, Tuchola) or an agricultural character (Kartuzy).

Much greater disproportions were observed between the number of monitoring points in urban communes than in the two other types of communes. The ratio was 5:1 (Fig. 5). In the cities with the most advanced monitoring (Bydgoszcz, Łódź), during the

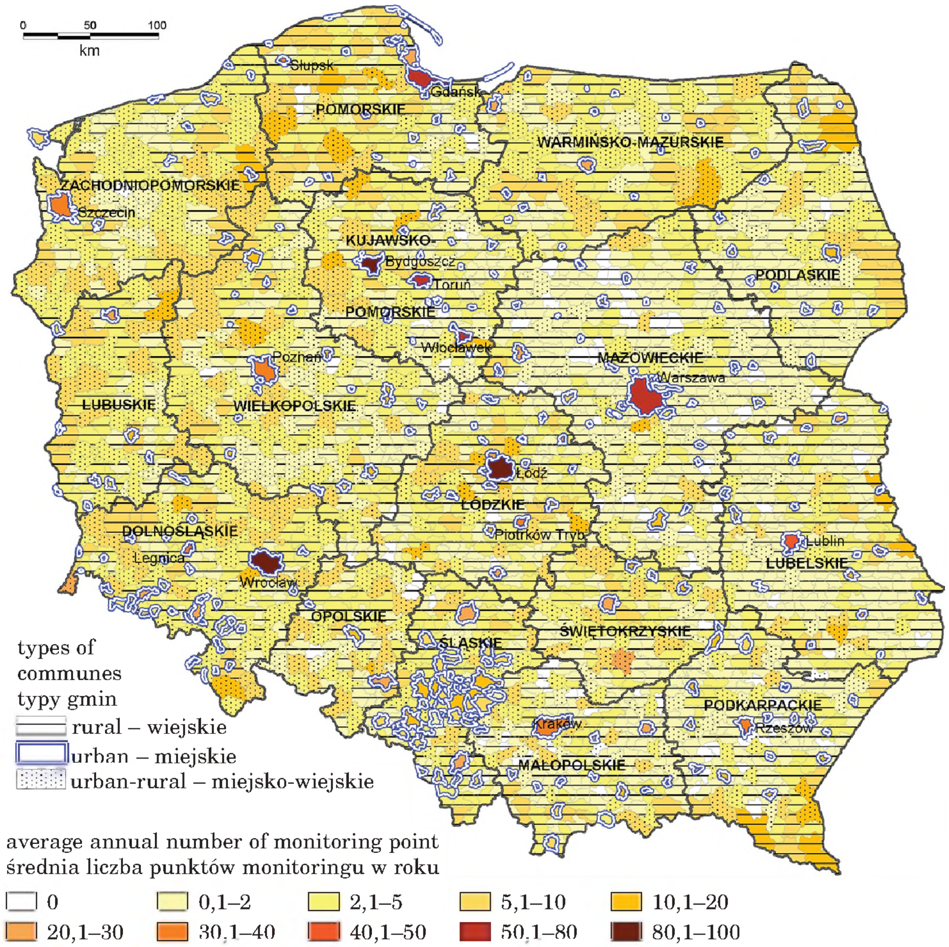


Fig. 5. The average annual number of monitoring points in Polish communes during 2000–2009
Rys. 5. Średnia roczna liczba punktów monitoringu w gminach Polski w latach 2000–2009
Source: Author's own study based on SEM data
Źródło: Opracowanie własne na podstawie danych PMŚ

area (Nakło upon Noteć, Stryków, Aleksandrów Łódzki, Kąty Wrocławskie, Piaseczno) or the development of forest health condition monitoring (Miastko, Drezdenko, Pisz, Ustrzyki Dolne), location near health resorts (Busko-Zdrój) or areas with natural values (Zwierzyniec, Tuchola).

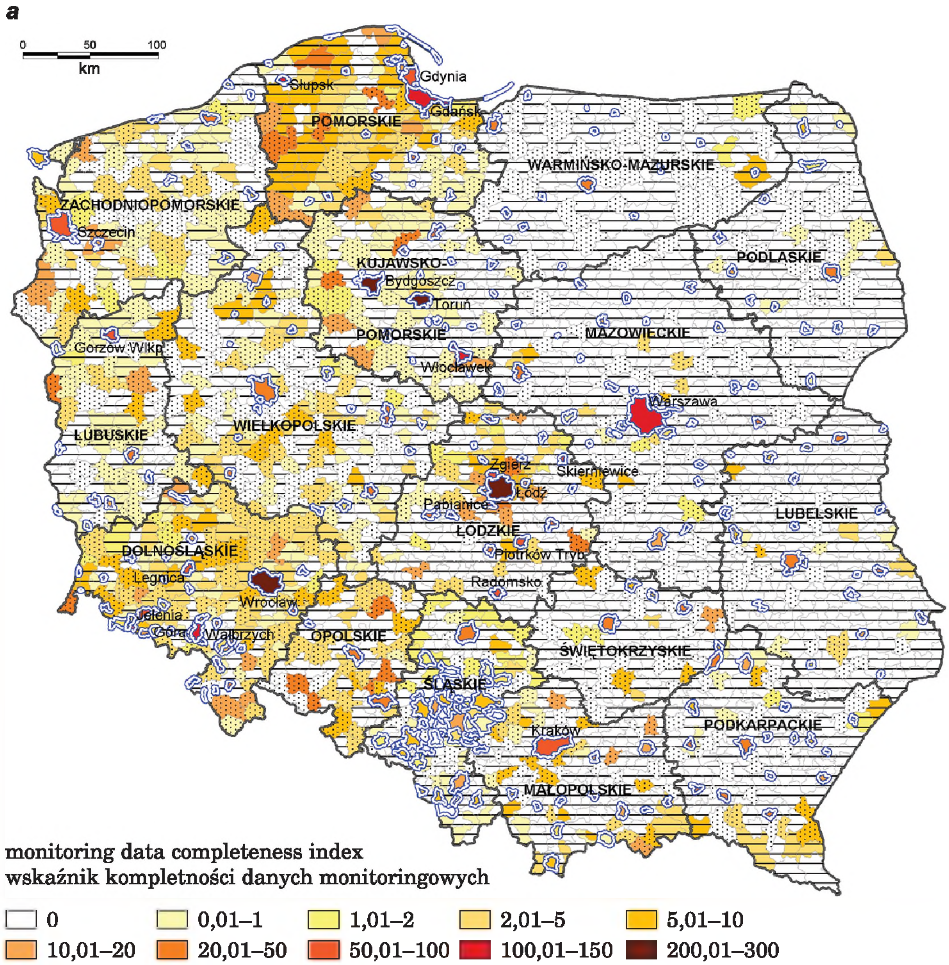
The analysis of figures 4 and 5 shows underdevelopment of the monitoring networks in the communes of the eastern part of the country, especially in the following voivodeships: Masovia, Lesser Poland, Podkarpackie, Lublin and Podlaskie. A relatively good situation can be observed in: Pomerania, Kuyavian-Pomerania and Silesia.

As mentioned previously, the monitoring networks of air pollution concentration and traffic noise level are mainly focused on the cities. In rural areas, in the case of the concentration of NO_2 and SO_2, they are slightly better developed in a few voivodeships, such as: Pomerania, Kuyavian-Pomerania, West Pomerania, Lower Silesia and Łódź (Fig. 6). In Pomerania, it also refers to the condensation of benzene. The highest absolute indexes of data completeness are within the rural communes (still 10 times lower than in the cities, however) for the concentration of air pollution, which is characteristic of communes which are under the influence of industry (Żukowice, Kotla, Zdzieszowice, Włocławek, Polkowice, Rudna.

Bogatynia, Zgorzelec, Świecie, Inowrocław) which are located near urban areas (Stryków, Rzgów, Ksawerów, Pabianice, Nakło upon Noteć, Łysomice, Nowa Wieś Wlk., Jabłonna), a few health resorts communes and those located in areas of natural value (Horyniec-Zdrój, Główczyce). Taking the completeness monitoring networks' index of the commune's population into consideration, the high values are also characteristic (apart from the majority of the above-mentioned communes) for health resort communes with a small population and those located near national parks (Krempna, Smołdzino, Urszulin, Krasnobród, Nałęczów), as well as those located near industrial areas. In the voivodeships of Masovia and Świętokrzyskie, as well as the areas of eastern Poland, the monitoring networks for air quality are located in a few rural communes.

The remaining monitoring networks are of a different distribution character. A much more even distribution character of networks can be observed for the quality of rivers and underground waters monitoring networks (however, for the latter, the number of points is quite small in Masovia, Podkarpackie and Małopolska voivodeships – partially due to the lower reservoirs of those waters). The best-developed monitoring networks for the rivers are in the rural areas located near hydrographical nods (e.g. Elbląg, Rudzieniec, Widawa, Sulejów, Czechowice-Dziedzice) (Figure 7), while for the underground waters the best-developed networks are in regions of water uptake for urban agglomerations (e.g. Rzgów, Wręczyca Wlk., Osielsko). Having compared these indexes to the population, the highest values in both cases can be observed in the case of communes in the Łódź region and also for the rivers in the communes located along national borders – on the Bug and Odra rivers. The monitoring of the quality of lakes and water sediments operates mainly in the communes of young-glacial areas in northern and western Poland as well as in the Łęczna-Włodawa Lake District and near the largest artificial water basins (Jeziorsko, Sulejowski, Siemianówka, Goczałkowicki, Czorsztyński). The monitoring of forest health condition is best-developed in the communes of northern and western Poland as well as in Bieszczady and Roztocze. When factoring in the population size, the best-developed monitoring networks are in the following communes: Cisna, Lutowiska, Komańcza, Płaska, Giby, Białowieża, Narewka, Nowe Warpno, Człopa, Biały Bór and Borne Sulinowo).

The complex completeness index for communal environmental monitoring data (Fig. 8) reaches the maximum values in the urban communes (e.g. Bydgoszcz – 34.3) where it averages 1.82 in urban communes. Its average value is only 0.125 in rural communes and 0.42 in urban-rural communes.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monitoring data completeness index
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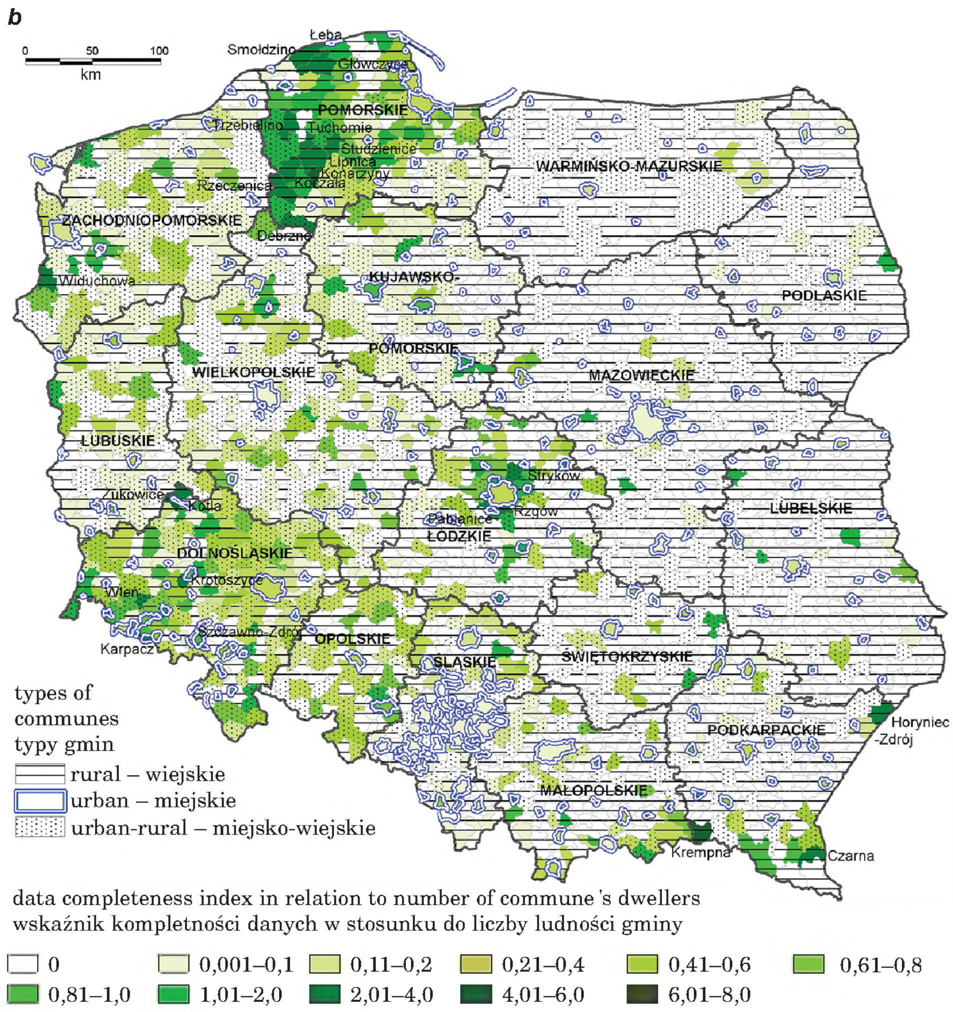
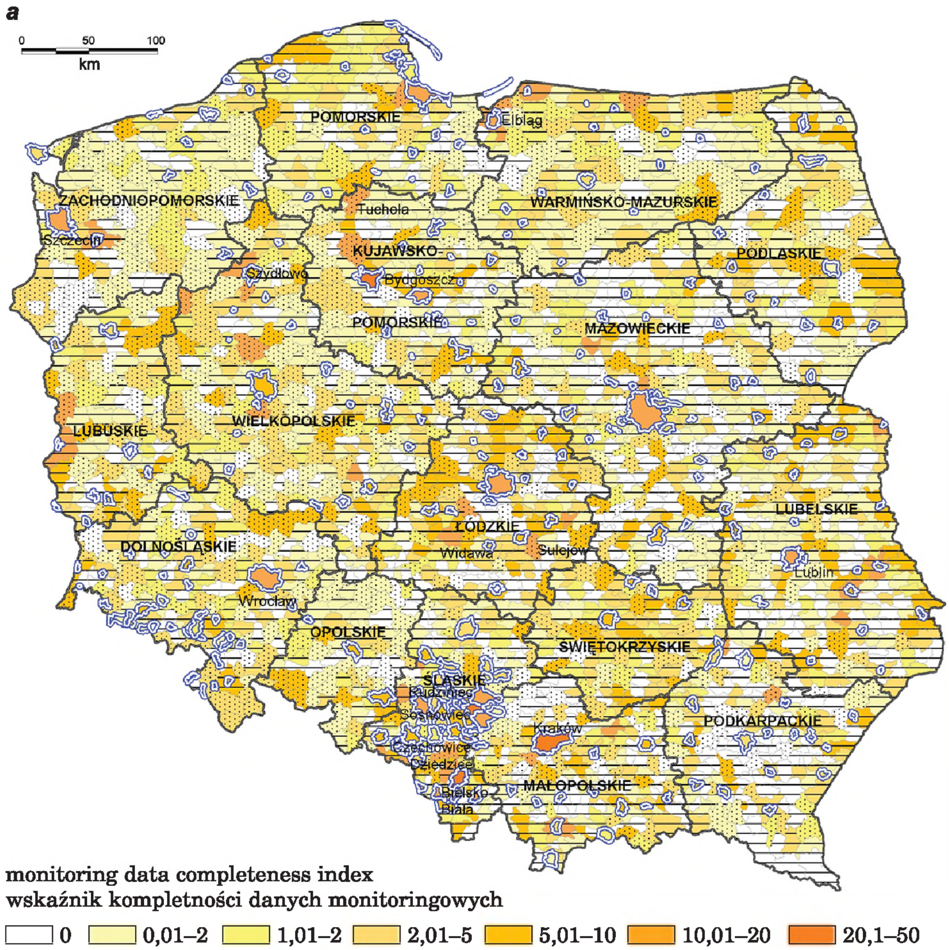


Fig. 6. The completeness index for communal NO_2 air concentration data during 2000–2009: *a* – basal, *b* – in relation to the average commune population (1000 persons)

Rys. 6. Wskaźnik kompletności danych monitoringu stężeń NO_2 w powietrzu w latach 2000–2009: *a* – podstawowy, *b* – odniesiony do średniej liczby mieszkańców gminy (1000 osób)

Source: Author's own study based on SEM data

Źródło: Opracowanie własne na podstawie danych PMŚ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monitoring data completeness index
wskaźnik kompletności danych monitoringowych
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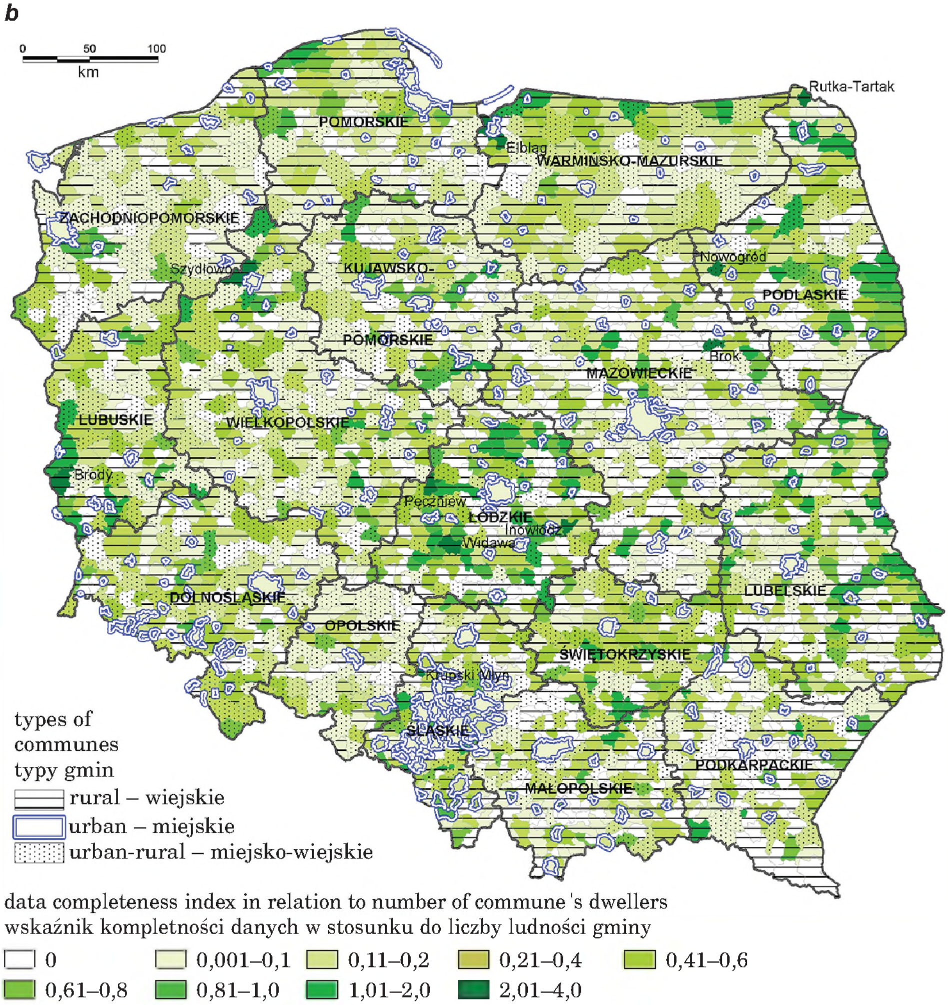

Fig. 7. The completeness index for communal river water quality data during 2000–2009: *a* – basal, *b* – in relation to the average communal population (1000 persons)

Rys. 7. Wskaźnik kompletności danych monitoringu jakości wód płynących w latach 2000–2009: *a* – podstawowy, *b* – odniesiony do średniej liczby mieszkańców gminy (1000 osób)

Source: Author's own study based on SEM data

Źródło: Opracowanie własne na podstawie danych PMŚ

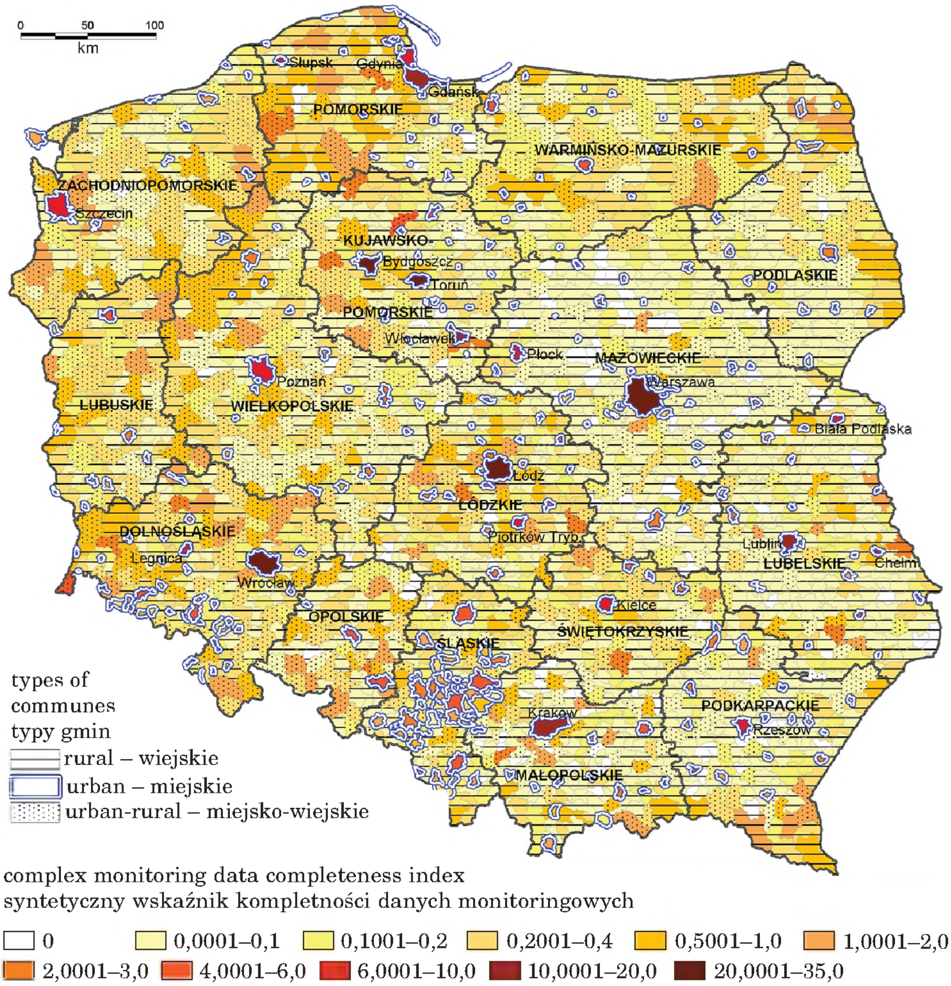

Fig. 8. The complex completeness index for communal environmental monitoring data (2000–2009)

Rys. 8. Syntetyczny wskaźnik kompletności danych monitoringu środowiska w latach 2000–2009:

Source: Author's own study based on SEM data

Źródło: Opracowanie własne na podstawie danych PMŚ

In the rural areas, it reaches the highest values in the communes endangered by industry (especially in the following communes of Legnicko-Głogowski Cupric District: Kotla, Polkowice, Rudna, Żukowice; and other communes: Włocławek, Świecie, Zdzieszowice, Bierawa), the border communes (Dorohusk, Włodawa, Widuchowa, Gryfino) as well as those near health resorts or areas of natural value (Busko-Zdrój, Szczecinek, Główczyce, Tuchola, Komańcza, Solina, Suwałki, Giby, Zwierzyniec).

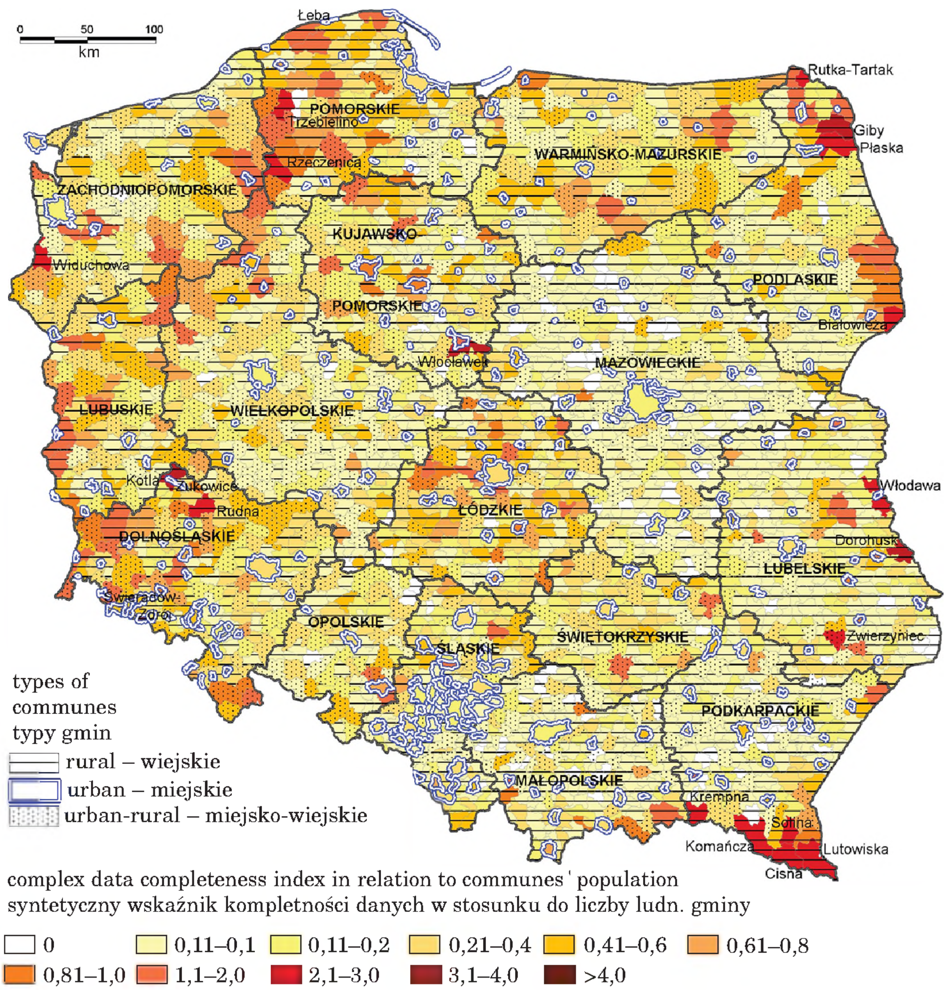

Fig. 9. The complex completeness index for communal environmental monitoring data from 2000–2009 in relation to the average communal population (1000 persons)

Rys. 9. Syntetyczny wskaźnik kompletności danych monitoringu środowiska w latach 2000–2009 odniesiony do średniej liczby mieszkańców gminy (1000 osób)

Source: Author's own study based on SEM data

Źródło: Opracowanie własne na podstawie danych PMŚ

The greatest underdevelopment can be observed in the following voivodeships: Masovia (up to 34 rural communes are devoid of monitoring networks), Małopolska (20) and Podkarpackie (17).

The above index, referring to the area of communes, increases the disproportions of the completeness of the data even more because of the smaller area of the cities than the rural communes, to the disadvantage of the latter. However, the distribution of this index is quite interesting while referring to the population in the communes (Fig. 9).

The maximum and average values of this index are similar for all three types of communes: for the urban communes – 4.16 and 0.32, respectively; rural communes – 3.96 and 0.21 as well as the urban-rural ones – 2.77 and 0.29. It is significant that among the cities – excluding Włocławek – the highest values of the index are reached in the tourist and health resort cities (Łeba, Świeradów-Zdrój, Szczawno-Zdrój, Karpacz, Ciechocinek). This tendency can also be observed in the urban-rural communes (Zwierzyniec, Krasnobród, Sieraków, Tuchola). However, in the rural communes, we deal with the previously-mentioned tendencies of the concentration of monitoring networks due to three main reasons: intensification of industrial influence (Kotla, Żukowice, Włocławek, Zdzieszowice, Bogatynia), being under border monitoring – mainly for water and air (Dorohusk, Włodawa, Rutka-Tartak, Nowe Warpno, Widuchowa) as well as the occurrence of the valuable natural resources, especially forests (Krempna, Cisna, Lutowiska, Giby, Płaska, Białowieża, Zwierzyniec, Krasnobród, Tuchola, Sieraków).

DISCUSSION AND CONCLUSIONS

The characteristics presented above regarding the distribution of environmental monitoring networks in Poland, with special focus on the rural area, within the general framework, shows that their distribution has been adapted to the needs within the frame of environmental protection as well as the population's health. This tendency is particularly noticeable in the case of the measurement of air pollution concentration. However, the result of such actions – due to the poorer development of some networks (e.g. monitoring of soils or habitats and species) – is seen in the lack of information about environmental quality in the rural areas. This refers mainly to the agricultural areas, however, also to some tourist areas, located mainly in eastern Poland. Relative development of the monitoring networks in some areas endangered by industrial establishments and those situated in the border areas, along major roads as well as in areas which are naturally valuable (mainly national parks and vast forest complexes), do not meet all the protection needs of these rural areas. The absence of the measuring networks undermines the satisfactory (sufficient, adequate) assessment of the environmental quality of areas which are influenced by agriculture (besides the influence of nitrogen compounds on the waters) and connected with its industrial branches, which are under the influences of intensive tourism (mainly the ones at the sea, lakes and in the mountains) as well as those located along urban agglomerations (especially near Poznań, Warsaw, Cracow and Lublin). The environmental monitoring network in rural areas should be assessed as not-well developed and insufficient, even after taking into consideration the up-dated tendencies to shift from preventive monitoring to a warning role. The financial condition of the country shows that there is hardly any chance to improve this situation. That is why the national government and local administrations of the voivodeships and districts should participate in efforts to improve environmental monitoring, which is more and more often directed towards commercial subjects.

REFERENCES

Czyżkowski B., 2009. Określenie kryteriów optymalności sieci monitoringu wód. Określenie zasad i algorytmów realizacji optymalności sieci. Określenie podstaw analizy finansowej prowadzenia monitoringu w różnych wariantach sieci. PW, Warszawa.

Kistowski M., 2010. Koncepcja diagnozowania sozologicznego dla potrzeb gospodarowania przestrzenią w skali krajowej i regionalnej. [In:] Gospodarka przestrzenna społeczeństwu, Red. W. Ratajczak, K. Stachowiak, t. 1, Bogucki Wyd. Nauk, Poznań, 261–272.

Kistowski M., 2011. Diagnoza sozologiczna Polski w ujęciu gminnym w latach 2000–2009 – metody i wstępne rezultaty badań. Inżynieria Ekologiczna 27, 60–71.

Kistowski M., 2012. The environmental quality profiles of Polish cities in the context of air and water pollution (2000–2009). Laufener Spezialbeiträge 2012, Bayerische Akademie für Naturschutz und Landschaftspflege, Laufen, 79–84.

Kobus D., Iwanek J., Mitosek G., Mill W., 2007. Organization of air quality monitoring data collection in Poland. Review of available air quality data. Institute of Environmental Protection, Warsaw.

Roose A., Kalev S., Erki S., Are K., Tõnu O., 2007. Neighbourhood-defined approaches for integrating and designing landscape monitoring in Estonia. Landscape and Urban Planning 79, 177–189.

Sarigiannis D., Saisana M., 2008. Multi-objective optimization of air quality monitoring. Environ. Monit. Assess. 136, 87–99.

Skotak K., 2002. Europejska sieć monitoringu zanieczyszczeń powietrza – Euro AirNet. Inżynieria Ekologiczna 67, 197–205.

Strobl R., Robillard P., 2008. Network design for water quality monitoring of surface freshwaters: A review. Journal of Environmental Management 87, 639–648

MOŻLIWOŚCI OCENY JAKOŚCI ŚRODOWISKA OBSZARÓW WIEJSKICH POLSKI NA PODSTAWIE DANYCH PAŃSTWOWEGO MONITORINGU ŚRODOWISKA W LATACH 2000–2009

Streszczenie. W artykule przedstawiono rezultaty analizy 16 sieci monitoringu środowiska w Polsce, funkcjonujących w latach 2000–2009, w układzie gminnym, ze szczególnym uwzględnieniem terenów wiejskich. Dla każdej sieci oraz sumarycznie obliczono autorskie wskaźniki kompletności danych. Rezultaty wskazują na znacznie słabszy rozwój monitoringu środowiska w gminach wiejskich niż w miastach, szczególnie w zakresie jakości powietrza i hałasu komunikacyjnego. Poza miastami najpełniej realizowany jest monitoring wód oraz stanu zdrowotnego lasów. W układzie przestrzennym monitoring środowiska obszarów wiejskich najpełniej prowadzony jest w województwach: pomorskim, dolnośląskim i łódzkim, a najsłabiej w Polsce wschodniej, głównie w województwie mazowieckim. W szczególności objęto nim tereny narażone na wpływ przemysłu, przygraniczne i najcenniejsze przyrodniczo.

Słowa kluczowe: jakość środowiska, sieci monitoringu środowiska, tereny wiejskie, Polska

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