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RURAL AREAS ENDANGERED WITH DEPOPULATION AS PROBLEM AREAS – THE EXAMPLE OF POLAND

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Abstract: The article deals with the problem of population decline in Poland in local terms. The aim of the study was to present the changes in the population number in rural areas in the period 1998-2018 and to indicate the negative socio-economic consequences that occur in rural areas affected by depopulation, which means that they have the characteristics of problem areas. The data from Statistics Poland and the results of own research carried out in a rural commune in Podlaskie voivodeship were used. In statistical data analysis, the multiple linear regression method was applied. It was found that 41.5% of rural communes were characterized by a population decline of over 5%, while in 7.7% of communes the decline in the population was greater than 15%. The own author's research revealed that the problem of population decline is accompanied by other negative phenomena, such as a distorted structure of the population by age, gender, limited access to services and infrastructure development.

Keywords: rural areas, problem areas, commune, local development, depopulation.

1. Introduction

The concept of problem areas should be understood as part of the geographical space (a given spatial unit) characterized by negative socio-economic and technical phenomena, which results in the emergence of internal anomalies (Zagożdżon, 1988, p. 138). A problem area is a spatial unit that is characterized by the abnormality of

one or more elements of space (Bański, 2011, p. 10). Problem areas appear in many definitions and classifications of areas, where, despite the fact that they are treated differently, they are united by pointing to difficulties in development resulting from the accumulation of negative phenomena (Ciok, 1994; Domański, 1987; Markowski 1996; Pastuszka, 2019; Proniewski, 2014; Rosner, 2000, 2002; Szmytkie & Tomczak, 2018; Zagożdżon, 1988).

The features of problem areas include demographic aspects, which makes it possible to distinguish population problem areas or areas with demographic depression (Bański, 2002; Pastuszka, 2019; Śleszyński, Bański, Degórski, & Komornicki, 2017; Zagożdżon, 1988). One of the many indicated features of such areas is an accelerated outflow of population. Depopulation is understood as the process of population decline in a certain area over a longer period of time (Eberhardt, 1989, p. 148; Szukalski, 2015, p. 3).

Rural areas characterized by a lagging behind in the level of development in relation to other areas, especially cities (Grosse, 2004), occupy an important place in the considerations on regional and local differences, including the delimitation of problem areas (see *Identyfikacja...*, 2009). It is specific of rural areas that they show weak links with cities, are insufficiently multifunctional (Churski, 2011) and spatially distant on a national scale (peripheral areas), which means that they are often classified as problem areas (Bład & Bołtomiuk, 2003).

The decrease in the population number may constitute the basis for distinguishing population-related problem areas, where there is an accumulation of many negative phenomena limiting the course of local development processes (Jakubowski & Bronisz, 2019; Szmytkie & Tomczak, 2018; Wesołowska & Jakubowski, 2018). Among the main potential problems of areas characterized by a decrease in the number of the population, the following can be indicated: (1) unfavorable changes in the population structure by age and gender (Gwiazdźńska-Goraj, 2018; Stasiak, 1992), which may cause difficulties in the functioning of individual families or entire communities, e.g. impediments to the implementation of nursing and care functions for the elderly (Stockdale, 2002; Szukalski, 2015); (2) difficulties on the labour market related to the unfavorable structure of the population by economic age groups; reduction of resources in the labour market, weakening of entrepreneurship and innovation (Celińska-Janowicz, Miszczuk, Płoszaj, & Smętkowski, 2010; Wesołowska & Jakubowski, 2018); (3) deformation of the local goods and services market, including the real estate market (falling prices due to low demand); (4) inefficiency of the public finance system at local level and the accompanying increase in the costs of maintaining the infrastructure (Li, 2015; Mann, 2004; Wojewódzka-Wiewiórska, 2019), especially the social one.

In recent years, in Poland one can speak of a decline in the population in cities and an increase in the number of rural population (of 0.1-0.3% annually). In 1998, rural areas were inhabited by 14.7 million people (i.e. 38.1% of the total population), while in 2018, 15.3 million people lived in the countryside, i.e. 39.9% of the total

population (Local Data Bank (LDB), 2020). However, in the case of rural areas, the course and intensity of the outflow of population differs in time and space (Bański, 2005, 2008). The reasons for the change in the population number are also different – nowadays in rural areas, in view of the declining birth rate, the migration processes play an increasingly important role in the spatial differentiation of the population (Eberhardt, 1994; Stanny, 2010). However, the influence of local conditions and the way of defining rural areas are of great importance. There are rural areas located around large cities (strongly related to cities, but defined as rural according to Statistics Poland) (Biegańska & Szymańska, 2013), which are characterized by an increase in the number of people, which means that there is a generally positive net migration in rural areas (Bański, 2005).

The phenomenon of population shrinkage, including the rural population, is also observed in other countries (Cena & Fernandez-Cavada, 1986; Johnson & Lichter, 2019; Kotowska & Józwiak, 2003; Kuczabski & Michalski, 2013; Li, 2015; *Shrinking...*, 2017), which is often related to the peripheral nature of the area (Penzes, Pasztor, & Tatrai, 2015; Wesółowska & Jakubowski, 2018).

The research on depopulation has conducted so far focuses mainly on the identification of changes in the number of people over a specific period of time, usually within the administrative boundaries of territorial units, often at regional level (high aggregation level). This was the premise for undertaking detailed studies of the phenomenon of population decline at local level. The study concerns rural areas defined on the basis of the DEGURBA classification (and not the commonly used definition of Statistics Poland TERYT), which represents the objective trend of delimiting rural areas (Rakowska, 2019, pp. 56-60). The classification is not based on distinguishing units on the basis of an administrative criterion, but it is reflected in the collection of data from official statistics in Poland and allows for international spatial analyses. These features determined the use of this tool in research. It is also important that the article shows the negative effects related to the outflow of population at local level (lower than the commune), indicating specific consequences important from the point of view of communities and local authorities, which makes rural areas problematic areas.

The aim of the research was to present changes in the population number in rural areas in Poland at local level and to indicate the negative socio-economic consequences that occur in rural areas affected by depopulation, which means that they have the characteristics of problem areas.

2. Methodology

The research process consisted of successive stages. The first stage included an analysis of the literature on the subject in the field of delimitation of population problem areas and the identification of the potential negative effects resulting from the decline in the population in rural areas. Based on the analysis of the literature

on the subject (Eberhardt, 1989, p. 148; Strzelecki, 1995), it was assumed that areas with depopulation are characterized by a population loss of more than 5%, whilst areas where there has been a decrease in the number of people greater than 15% were defined as extreme depopulation. In the next stage, using the data from Statistics Poland (LDB, 2020), the changes in the population in rural areas at local level (i.e. communes) in the period 1998-2018 were determined, which allowed to identify areas characterized by depopulation. The choice of such a time range was related to the availability of data in public statistics covering changes in the population number and the possibility of making a comparative analysis of the selected indicators in the longest possible time horizon. The work uses the definition of rural areas according to DEGURBA in the 20/05/2020 version, where rural areas are those sparsely populated. The study included 1,875 communes recognized as rural areas according to the above-mentioned classification (*Statistics Poland*, 2020). In the third stage, on the basis of substantive and formal criteria, including those resulting from the availability of statistical data as well as statistical criteria, the relations between changes in the population number and selected variables describing the course of the studied phenomenon were indicated. Then, in-depth research was carried out in the selected rural commune of Dubicze Cerkiewne in the Podlaskie voivodeship, which is one of the communes where the greatest outflow of population in Poland was seen in 1998-2018. Telephone interviews were the method used with employees of the commune office dealing with population records (CATI, 2019, $n = 2$) and telephone interviews with village leaders of selected village councils (CATI, 2020, $n = 3$), where the changes in the population number were the highest (the information obtained from interviews with the employees of the commune office and the 2011 Census data were used (*Polska w liczbach*, 2020)).

In the analysis of statistical data, the method of multiple linear regression was used, where the method of least squares was employed to estimate the parameters. The results are presented graphically in the form of maps and tables, using the QGIS software and the R-CRAN statistical package.

3. Results

3.1. Identification of depopulated rural areas at regional and local level

Among the analysed communes classified as rural areas in Poland (n communes = 1,875), the dominant ones are those where the population decreased by more than 5% in 1998-2018. These communes constitute 41.5% of all communes; extreme depopulation occurred in 145 of them, i.e. in 7.7% of all the examined communes. Taking into account the spatial distribution of changes in the number of people in the analysed period, there are clear regional differences in terms of changes in the number of people, including the course of the depopulation process (Figure 1). The

most disadvantageous structure of rural areas characterises the Podlaskie, Opolskie and Lubelskie voivodeships, where in over 70% of the communes classified as rural areas, a decrease in the number of inhabitants by more than 5% was found. Extreme depopulation, i.e. a population change by more than 15%, occurred in 30.1%, 23.5% and 21% of the communes in these voivodeships, respectively. At the same time, it is accompanied by a small share of communes where the population has grown. A large share of rural areas with an increase in population (by more than 5%) was found in the Pomorskie, Małopolskie and Wielkopolskie voivodeships. The highest dynamics of population growth (an increase by more than 15% compared to 1998) concerned the following voivodeships: Pomorskie (29% of communes), Małopolskie (19.4%) and Dolnośląskie (18.2%).

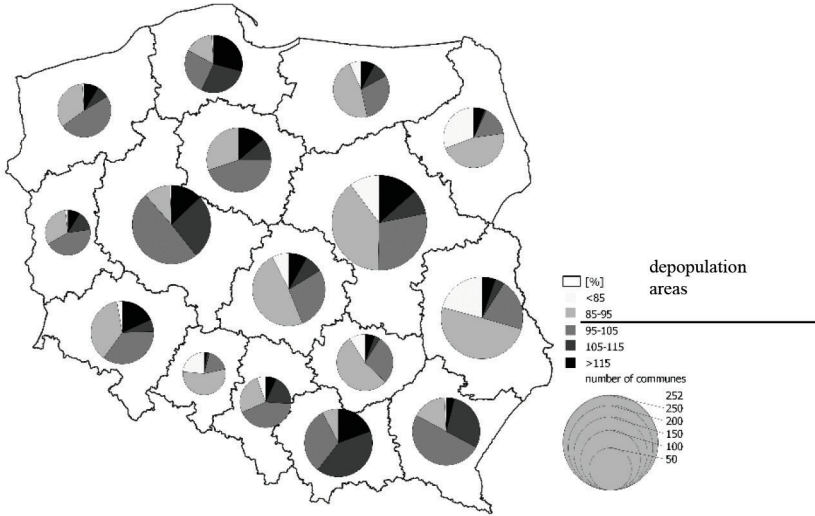


Fig. 1. The structure of rural areas in voivodeships in Poland according to population changes in 1998-2018 (1998 = 100%)

Source: own work based on (LDB, 2020).

Locally, there are also very clear differences in rural areas in terms of population changes in the analysed period (Figure 2). The communes where the population decreased the most, compared to 1998 are Czyże (by 34.3%), Dobrzeń Wielki (34.1%) and Dubicze Cerkiewne (32.3%). The rural areas of the Podlaskie voivodeship, located directly on the eastern border of Poland (Stanny, Rosner, & Komorowski, 2018), are in a disadvantaged situation. They constitute a relatively compact area where the outflow of population exceeded 15%, which confirms the previous conclusions drawn from the analysis of data at regional level. Rural areas located in the vicinity of large cities are characterized by high dynamics of population growth. In the case of nine such communes, the population increased more than two-fold,

while in two of them, i.e. the Kosakowo and Dopiewo communes, the population increased 3 and 2.8-fold, respectively. There are also intra-regional differences,

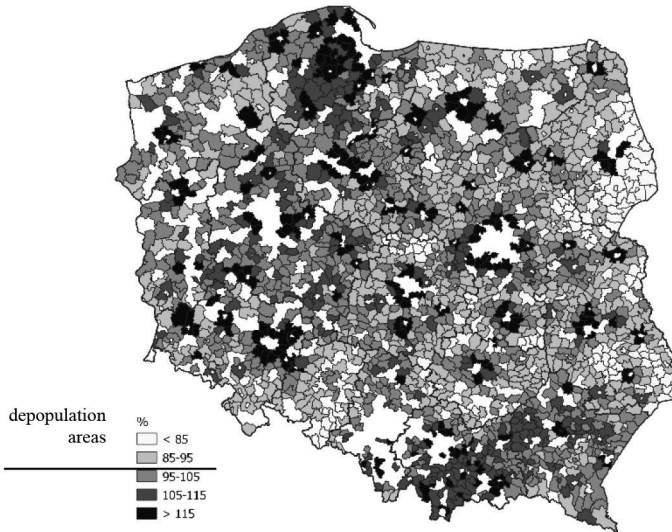


Fig. 2. Population changes in rural areas in Poland at the level of communes in 1998-2018 (1998 = 100%)

Source: own work based on (LDB, 2020).

which means that in the voivodeships there are also rural areas where very intense declines were found, and areas with a large increase in the number of people.

3.2. Determinants of population changes in rural areas

Multiple linear regression was used to determine the relation between the population change in rural areas in the cross-section of communes in Poland in the period 1998-2018 and the selected variables. This allowed to establish statistically significant determinants influencing the course of the studied phenomenon. From among the variables collected on the basis of substantive and formal criteria (including those describing the level of feminization, demographic burden, number of primary school students, incomes of commune budgets, birth rate and migration), the variables that had a statistical impact on the course of the phenomenon were selected. Ultimately, an additive linear multiple regression model was proposed to determine the relationship between the independent variables and the dependent variable, in the form:

$$Y_i = x_1 + x_2 + \log(x_3),$$

where Y_i – population change in 1998-2018 (%), x_1 – average net migration in 1998-2018 (persons), x_2 – change in the number of children aged 7-12 in 1998-2018 (%)

and a log transformed variable: x_3 – average annual own revenue of the commune budget in 2009-2018 (PLN).

The verification of statistical hypotheses about the significant influence of the variables on the dependent variable allows to state at the significance level $\alpha = 0.05$ that each variable has a statistical influence on the course of the phenomenon. At the same time, on the basis of the Fisher-Snedecor test, the entire model can be considered correct, i.e. statistically significant (at the significance level $\alpha = 0.05$ and the number of degrees of freedom 1870). In the estimated model (Table 1), the real p -value was $2.2e-16$, and the standard error of the residuals was 6.43. Based on the values of multiple R-squared (0.8715) and the adjusted R-squared (0.8713), a good fit of the model to the data can be found. The intercept for the estimated model was 19.34. The coefficients of the independent variables took positive values, which should be interpreted as the average increase of the variable in relation to the studied phenomenon by one unit. A 1% change in the population in rural areas is associated with an increase of the dependent variable x_1 by 0.09 persons, an increase of x_2 by 0.57% and an increase of x_3 by 2.58 PLN.

Table 1. Summary of the multiple regression model for population change in rural areas in Poland

Variables	Estimate	Std. Error	<i>t</i> value	Pr(> t)
Intercept	19.333806	4.122193	4.690	2.93e-06
X_1	0.085300	0.004964	17.182	< 2e-16
X_2	0.569646	0.012530	45.461	< 2e-16
X_3	2.580261	0.263239	9.802	< 2e-16

Source: own work.

The verification of the distribution of the residuals in the model first of all consisted in examining the normality of the distribution. The results of the Shapiro-Wilk test ($W = 0.94438$, p -value < $2.2e-16$) gave grounds for rejecting the null hypothesis that the distribution of residuals is normal. In the next step, the homoscedasticity of the model rests was examined. The result of the Goldfeld-Quandt test ($GQ = 1.1034$, $df_1 = 652$, $df_2 = 651$, p -value = 0.1047) allows to state that the variance is constant. The last stage of the verification was to examine the first degree autocorrelation, for this purpose the Durbin-Watson test was used, where the null hypothesis is responsible for the lack of dependence in the residuals. The results of this test (D-W: 1.4, p -value: 0) allow for the rejection of the null hypothesis for the alternative.

3.3. Socio-economic effects of depopulation from the local perspective

The analysis of the available statistical data was supplemented by qualitative research carried out in the Dubicze Cerkiewne commune and in the selected villages, as a result of which problems were identified that occur in rural areas characterized

by a high outflow of population. Rural areas suffering from depopulation are characterized by unfavourable values of the selected indicators in relation to other rural areas in Poland (Table 2). There is a negative natural increase and a negative net migration in their area. These areas are also characterized by the most unfavourable population structure by age, sex and an ageing population. At the same time, local self-governments have relatively the lowest own incomes in the commune budget.

Table 2. Selected indicators in rural areas in Poland depending on changes in the population number

Specification	Dubicze Cerkiewne	Change in population number in 1998-2018 (%)				
		<85	85-95	95-105	105-115	>115
Natural increase 1998-2018 (persons)	-33	-25	-9	4	23	32
Net migration 1998-2018 (persons)	-9	-21	-19	-6	15	103
Number of children aged 7-12 per 1 primary school 2018	50*	116	129	132	140	179
The number of women per 100 men 2018	103.00*	101.30	100.41	100.25	100.32	101.16
Post-working age population per 100 working age population 2018 (persons)	79.50*	40.73	33.54	30.01	27.69	25.64
Own income of the commune budget 2009- -2018 (thousand PLN)	2793.98	5549.52	6848.46	8605.37	11759.32	21133.80

Apart from the data marked with *, the average values of the indicators are given.

Source: own work based on (LDB, 2020).

According to data from 2019 (LDB, 2020), 1,484 people live in the Dubicze Cerkiewne commune, which means a decrease by 38% compared to 1995. Taking into account the problem of the discrepancy between the population data from public statistics, based on registration data, and the actual state (Jończy, 2012, 2014), it can be assumed that the actual number of people in the analysed commune may be even smaller, mainly due to unregistered migration (Jończy, 2014). In 2013, when introducing the principles of waste management resulting from the Act on maintaining cleanliness and order in communes in the analysed commune (Ćwieluch, 2015, p. 25), it turned out that the commune has 1,350 inhabitants (according to data from Statistics Poland, as of 31 December 2013, the population was 1,661 people). The surveyed village leaders also confirmed the discrepancies in this respect, pointing to the much smaller number of people actually living in all the villages.

Apart from the depopulation problem of the Dubicze Cerkiewne commune, other negative social and economic phenomena were identified, particularly visible at the level of village councils and villages. First, there is a distorted age and gender structure of the population. The population in post-working age definitely predominates (the level of old age in the commune, measured by the share of the elderly, i.e. 65 and over in the total population, was 66.6% in 2019 (LDB, 2020), which makes the commune one of those with the highest increase in the level of the old-age population in Poland (Rakowska, 2016, p. 18). Women dominate among the inhabitants of the commune (Table 2), while in one of the village councils the inhabitants aged 70 and over dominate. This is reflected in the development of the demographic indicators. In 2018 (LDB, 2020), 4 children were born in the commune (“the birth of a child is a great event for the entire village”), 53 people passed away, and 6 marriages were celebrated. New residents occasionally appear in the villages surveyed, who buy old houses, renovate them and use them rather for recreational purposes (they do not build new ones, 8 building permits were issued in the commune in 2018).

Demographic changes translate into the specificity of the living conditions of local communities, including the emergence of specific problem phenomena. The studied areas are characterized by scattered development, which limits interpersonal contacts and causes the village ‘to die’. As a result of the decreasing number of children, there is currently 1 primary school in the commune. In some village councils there are no school-age children, in one of the village councils (consisting of 4 villages), out of 27 actual residents (according to the electoral register there are 47 inhabitants) there is only 1 preschool child. The distance to the school is big, e.g. 11 km. In the school, classes are joined, teachers (e.g. the head teacher), in search of better working conditions, move to other institutions, which may reduce the quality of teaching (Ćwieluch, 2015, p. 27).

Healthcare needs are met in a commune village or a county (“powiat”) town, mainly with the use of own car transport. Despite the necessity to cover the distance (e.g. 17 or 30 km), the travel time is short, which does not constitute a barrier for residents in accessing health care facilities.

There are no economic entities in the analysed village councils (115 entities of the national economy entered into the REGON register were active in the commune in 2018, LDB, 2020), the nearest city (Hajnówka) is an important centre on the labour market. The small number of inhabitants and their age make it difficult to choose the village leader, generally there is a low level of entrepreneurship among the inhabitants – “no ideas” for changes or development.

Inhabitants stock up on groceries and basic industrial products in a door-to-door store, there is no village (stationary) store, which means that residents have limited access to products (the service is available 2-3 times a week).

In villages, poor Internet access was indicated (mainly due to natural conditions), which may partly be the reason for no influx of new inhabitants. Due to the relatively

low local demand for the Internet, operators are not interested in investing in improving its accessibility.

A positive phenomenon in the surveyed villages is the great mutual help of a neighbours in everyday life, in caring for people in need, also in reaching a place of religious worship or transport to a hospital. Individual village councils also cooperate with each other, which enables the implementation of investments (e.g. when building a road). Due to the lack of financial resources (similarly to the entire commune), small investments are carried out in the surveyed villages, but they are locally important (e.g. a bus shelter as a meeting place in the absence of a community day-centre). All the respondents pointed to the very limited investment opportunities of the commune, resulting from the unfavourable financial situation and the necessity to incur high costs of infrastructure maintenance, including the social infrastructure, i.e. the commune office, school and healthcare centre.

4. Conclusions

Based on the research, it can be concluded that depopulation is a serious problem in rural areas in Poland – a decrease in the population in 1998-2018 by more than 5% occurred in 41.5% of communes classified as rural areas. The situation is particularly unfavourable in the Podlaskie, Opolskie and Lubelskie voivodeships. These regions are characterized by a significant decline in the population and a high percentage of local governments struggling with this problem (over 70% of the region's communes), which may also have negative consequences for the socio-economic development of these regions.

In rural areas where the phenomenon of depopulation occurs, numerous problems accumulate, especially visible at the level of the smallest units of settlement, i.e. village councils and villages. The problems concern various spheres of life, both the functioning of local communities and the development of individual local government units. A statistically significant correlation was found between the change in the population number and the migration balance, the number of school-age children and the amount of own incomes of commune budgets.

It should be borne in mind that the data on the population number available in public statistics may not reflect the actual state of the depopulation phenomenon, which meant a certain limitation of the research conducted. This fact was confirmed by the author's own research carried out at the level of village councils. The use of the latest data from the Census carried out in 2021 could shed new light on the problem of depopulation in rural areas in Poland and show its real spatial diversity.

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OBSZARY WIEJSKIE ZAGROŻONE DEPOPULACJĄ JAKO OBSZARY PROBLEMOWE – PRZYKŁAD POLSKI

Streszczenie: Artykuł dotyczy problemu zmniejszania się liczby ludności w Polsce w ujęciu lokalnym. Jego celem było przedstawienie zmian liczby ludności na obszarach wiejskich w latach 1998-2018 oraz wskazanie negatywnych konsekwencji społeczno-ekonomicznych, jakie pojawiają się na obszarach wiejskich dotkniętych depopulacją, co powoduje, że mają one cechy obszarów problemowych. Wykorzystano dane Głównego Urzędu Statystycznego oraz wyniki badań własnych przeprowadzonych w gminie wiejskiej w województwie podlaskim. W procesie analizy danych statystycznych wykorzystano metodę liniowej regresji wielorakiej. Stwierdzono, że 41,5% gmin wiejskich charakteryzowało się ubytkiem ludności powyżej 5%, przy czym w 7,7% gmin ubytek ludności w badanym okresie był większy niż 15%. Badania własne ujawniły, że problemowi ubytku ludności towarzyszą inne negatywne zjawiska, tj. zaburzona struktura ludności według wieku i płci, ograniczony dostęp do usług oraz problemy związane z rozwojem infrastruktury.

Słowa kluczowe: obszary wiejskie, obszary problemowe, gmina, rozwój lokalny, depopulacja.