

SUSTAINABLE DEVELOPMENT OF THE RURAL AREAS IN POLAND IN THE ASPECT OF ENVIRONMENTAL ORDER

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Abstract

The aim of the elaboration is to evaluate the level, changes and spatial diversity of selected parameters of the environmental order in the context of realization of conception of sustainable development in the rural areas of Poland in the cross-section of voivodships in years 2005-2015. The research proceedings consisted of three stages. In the first stage, based on the literature, the indicators describing the thematic areas of the environmental order were reviewed. The second stage embraced the analysis of the level and changes and spatial diversity of the selected five components of the environmental order. The last, third stage was based on creating synthetic measurer of the development's level of the environmental order and on showing the spatial diversity in this range in the cross-section of the voivodships. The results of the conducted research indicated substantial spatial diversity, both in case of particular elements creating environmental order in the rural areas of Poland and the phenomena as a whole.

Keywords: *environmental domain, Poland, rural area, sustainable development*

JEL classification: *Q01, Q56, O18*

1 Introduction

1.1 Sustainable development of the rural areas

The supporters of the idea of sustainable development primarily emphasize the fact that people should be responsible for what is happening to the Earth and also for the condition in which our planet will be passed to the next generations. They

consider the governments of the countries and the local authorities should be interested in implementing suitable legislation protecting both the natural environment from the robbery activities of the goods' producers and aiming primarily increasing their benefits (Iova, Cretu, Lascar, 2017, Wierzbicka, 2016).

Sustainable development of the country recognized as a Constitutional Principle of Republic of Poland (Constitution of the Republic of Poland, 1997), in Environmental Protection Law from 2001 is defined as 'social-economic development in which in order to balance the chances of access to the environment of particular societies or their citizens – both the current and the future generations – the process of integration of the political, economic and social activities takes place, maintaining the environmental balance and the durability of the basic environmental processes (Ustawa prawo ochrony środowiska, 2001, Mikula, 2017). The Ecological Policy, a document adopted by Polish country, also took a stand in the matter of sustainable development and it expressed the will the government's policy was compatible with the assumptions of ecological policy in all of the economy branches and the ecological criteria received equivalent rank with economic criteria (Dalecka, Michalska, 2015, Wierzbicka, 2016).

The conception of sustainable development takes on special significance in reference to the rural areas which in Poland constitute over 93% of the country's area (Dolata, 2015,). The domination of the rural areas causes accumulation of various public goods which are socially, economically and environmentally valuable (Woś, Zegar, 2002, p.48). It decides about their huge meaning for the life's quality because they fulfill the basic environmental function for the whole society (Iagaru, Iagaru, 2017).

Moreover, the idea of sustainable development, taking into consideration the prior meanings of the natural environment with realization of the strategic development aims, is especially relevant in the forms of activities whose results depend on the environment. The conception of sustainable development of the rural areas embraces the activities whose aim is to improve the conditions of running a business and the conditions of living in the rural areas, simultaneously not violating specific resources of a village, including the qualities of the natural environment, the country landscape, traditions and the cultural heritage.

According to the conception of sustainable development the environmental order is strictly connected with the definition of natural capital and with the principle of its' durability. Maintaining of that order will allow to keep the owned environmental heritage intact and to pass it to the future generation as a capital which will provide them conditions ensuring the quality of life (Dudek, Wrzochalska, 2017).

To summarize the reflections on the conception of sustainable development in reference to the rural areas, it should be noticed that their realization encounter various social obstacles (low level of the citizens' affluence), intellectual obstructions (low level of the ecological awareness of the citizens) and the ethic impediments (tolerating improper behaviors). Those difficulties also result from the fact that it is a conception trying to reconcile often contradictory aims, especially in a short period of time (Žmija, 2014).

1.2 Measurers of sustainable development in the rural areas

Development and evolution of the conception of sustainable development caused increased interest in indicators of its' measurement. In the literature there are propositions of quantification of sustainable development, both in the spatial layout on various territorial levels (global, country, regional, sub-regional and local), and in the time layout. The indicators of sustainable development are a type of data-diagnostic tools and as the measurers of the calculable effects of implementing idea of sustainable development are used for operationalization its' conception for the needs of controlling the realization of the goals saved in the strategic documents of a given territorial units (Borys, 2005, p. 14, Stanny, 2013, p. 65).

The research on construction of measurements of the sustainable development in Poland were initiated in the 90s of XX century (Borys, Fiedor, 2008). However, in the first decade of XXI century the works on developing homogeneous indicators of measuring of sustainable development on various levels of territorial division of the country (NUTS) were started. Their crowning was elaboration of a number of indicators grouped in accordance with the principle of integrated order, in the range of public statistics (Local Data Bank, 2018, Stanny, Czarnecki, 2011, pp. 26-27).

Nowadays the indicators of sustainable development are divided according to four orders: social, economic, environmental and institutional-political. Each of the orders embraces areas to which suitable indicators are ascribed. (Local Data Bank, 2018). It is compatible with the conception elaborated by EU according to which the set of indicators of sustainable development consists of ten thematic areas (from the economic, through social and environmental, ending with institutional and global partnership dimension). Those areas are divided into sub-subjects which allow to present the operational goals and activities of Strategy of Sustainable Development. The actual set contains over 130 indicators, 10 of which were considered the primary ones (Sustainable development in the European Union, 2015).

Measurement of the effects of implementing the conception of sustainable development of the rural areas, due to considerable difficulties, demands using

suitable system of indicators and measures. It results from the fact that in the public statistics on the level of aggregation which are the rural areas there is no statistical data necessary to construct various indicators of environmental order.

2 Data and Methods

Realization of the adopted in the present elaboration aim demanded multidimensional approach. Thus, beside short reflections embracing theoretical issues connected with sustainable development mentioned above, the analysis of the values of selected indicators describing the environmental order was performed, using selected statistical methods. The basic data source was the internet analysis shared by the Central Statistical Office – Local Data bank. The spatial range of the research embraced rural areas of Poland in the cross-section of voivodships, whereas the time range were the years 2005-2016.

For the purpose of the present elaboration, in order to show the level of environmental order and its' spatial diversity, the indicators from so called long list of indicators of sustainable development were chosen, more specifically from the part of the list concerning the environmental dimension with elements of spatial order.

Guided by the essential and statistical reasons, five indicators (diagnostic features) of the environmental order of sustainable development of the rural areas were chosen for the research purposes:

- percentage of the forests in general area of the rural areas in % (woodiness),
- mixed waste in kg/person (waste),
- percentage of population using wastewater treatment plants in general population in % (wastewater treatment),
- percentage of population using water supply network in general population in % (waterworks),
- percentage of population using sewage network in general population in % (sewerage).

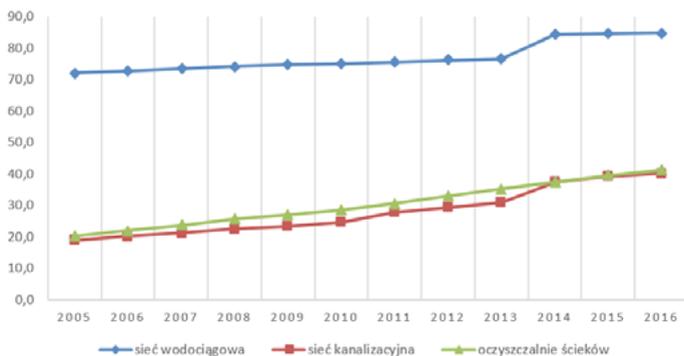
The first stage of the empirical research embraced the analysis of the changes, level of development and spatial diversity of the selected components of the environmental order in the rural areas both throughout the country and in particular voivodships. The following stage was based on showing the level of development and spatial diversity of the environmental order as a complex phenomenon. In order to do that, a measurer used in the issue of subordination of multi-feature object was used, meaning a synthetic measurer of the level of development. The designated values of the measurer allowed to organize the voivodships according

to their level of development into the chosen elements of environmental order. The measurer was also used in order to divide all of the researched voivodships into four typological groups focusing the voivodships with similar level of environmental order. The isolation of the groups was done using a method based on analysis of differences between the level of value of the measurer calculated for the neighboring voivodships, ordered according to decreasing value of that measurer.

3 Results and Discussion

A relevant component in evaluation of the level of sustainable development in the context of environmental order is the water supply system. In the analyzed in the elaboration period the length of distribution of water supply network in the rural areas increased by 42,5 thousand of km, meaning by 22,2%. In each of the research years the lengths of networks increased on average by 1,5%. In 2016 for each 100 km² of rural area there was 80,2 km of waterworks, and in 2005 the analogical amount was smaller by 14,7 km. Increase of the length of the waterworks network was accompanied by increase in the number of its' connection to the residential buildings and by rise of share of the receivers of water supplied in that way in the general population of the country. Within 12 years the number of water connections to the residential buildings increased by 695 522 pcs., that is by 25,3%. In 2005 the 72,2% of citizens of Polish country had the possibility of water intake from the water supply network, and in 2016 that percentage shaped at the level higher by 12,8 pp. (Figure 1). The annual average rate of changes in share of people using water supply network in the general population was 1,8%. Along with the development of water supply network the water usage in the rural areas increased. When in 2005 one person was allocated 23,6 m³ of water, in 2016 it was more by 5,6 m³.

Figure 1 **Population using the water supply network, sewage network and water treatment plant in % of general population living in the rural areas of Poland in years 2005-2016**



Source: Calculations and the author's study based on Local Data Bank CSO, 2018.

The water supply network was one of the least diversified elements of the water-sewage infrastructure in the rural areas. In 2016 the highest level of percentage of rural areas' population using water supply network characterized Opolskie voivodship (95,1%) and Wielkopolskie voivodship (94,7%), whereas the lowest characterized Małopolskie voivodship (68,4%). During the twelve researched years its' highest increase took place in Mazowieckie voivodship (by 19,7 pp.), and the lowest increase took place in Opolskie voivodship (by 4,2 pp.). Furthermore, the greatest density of the water supply networks characterized Śląskie voivodship (118,5 km/100 km²), when the smallest density characterized Lubuskie voivodship (35,4 km/100 km²). The greatest progress in development of network was noticed in Mazowieckie voivodship (by 27 km/100 km²), whereas the least progress was noticed in Lubuskie i Opolskie voivodships – accordingly – 6,2 and 6,5 km/100 km²).

The average annual rate of changes of selected indicators of environmental order of sustainable development of rural areas for the country and particular voivodships was presented in Table 1.

Table 1 Average annual rate of changes of the selected indicators of environmental order of sustainable development of rural areas in Poland in years 2005-2016

Voivodship	Woodiness	Waste	Waterworks		Sewerage		Waste-water treatment
			using	length	using	length	
Polska	0,23	4,5	1,8	1,5	7,1	8,5	6,6
Dolnośląskie	0,20	2,6	1,9	1,3	6,8	7,6	6,7
Kujawsko-pomorskie	0,12	6,8	1,4	1,4	4,8	5,9	4,2
Lubelskie	0,36	3,0	1,8	1,8	7,1	9,1	5,6
Lubuskie	0,09	3,3	1,6	1,6	8,5	11,1	8,4
Łódzkie	0,29	3,6	0,9	1,4	8,0	9,7	8,8
Małopolskie	0,08	5,7	2,3	2,2	8,4	9,7	7,9
Mazowieckie	0,49	4,9	2,7	2,5	8,8	11,5	8,1
Opolskie	0,06	2,3	0,9	0,4	10,6	12,0	10,5
Podkarpackie	0,40	2,9	1,1	1,3	6,5	6,1	5,9
Podlaskie	0,26	2,9	1,8	1,0	3,6	6,8	3,7
Pomorskie	0,14	4,5	2,5	1,2	5,7	8,7	5,1
Śląskie	0,05	3,9	1,4	1,0	7,8	9,2	7,4
Świętokrzyskie	0,22	2,5	1,8	1,9	9,9	10,5	9,2
Warmińsko-mazurskie	0,40	5,8	2,8	1,7	6,0	8,0	5,1
Wielkopolskie	0,10	5,7	1,2	0,9	6,8	8,1	6,5
Zachodniopomorskie	0,21	6,2	3,2	0,9	4,3	8,3	3,8

Source: Calculations and the author's study based on Local Data Bank CSO, 2018.

For the sustainable development, next to effective water usage, protection from pollution whose source is primarily waste, is also significant. Therefore, while shaping environmental order, a drainage and water treatment system is extremely important.

In years 2005-2016 in the rural areas of Poland, compared to the development of water supply network, much higher increase in developing sewage network took place. Average annual rate of changes of length of distribution of sewage network increased by 8,5%, which expressed in absolute numbers gave almost two and half times increase of that length (from 36,8 thousand km in 2005 to 90,5 thousand km in 2016). The density of network also increased, from 12,7 km

per 100 km² to 31,1 km/ km². As a result of such fast increase in the length of sewage network, the number of its' connections to the residential buildings also raised – from 598 thousand in 2005 to 1 462 thousand in 2016, that is almost two and half times increase. Large revival of investment processes in the sewage drainage network found its' reflection not only in the increase in the length of the network and the number of its' connection to the residential buildings, but also in systematic, progressing each year increase in population using its' services. When in 2005 percentage of population of Polish country serviced by sewage network was 19% of the general number of people living there, in 2016 its' value shaped at the level higher by 21,3 pp. (Figure 1). In each of the researched years the share of population using the sewage network in the general population increased on average by 7,1%.

The development of the sewage network in the rural areas of Poland in the cross-section of voivodships was characterized by considerable diversity, taking into consideration both the availability and the density. The analysis of the spatial diversity of possibility to use the sewage network in the last year of research indicates that the voivodship in which it was relatively large was Pomorskie voivodship (61,5% of country citizens), whereas it was relatively low in Lubelskie (21,1%) and Podlaskie (21,8%) voivodships. In turn, the greatest density of sewage network occurred in Podkarpackie voivodship (76,0/100 km²) and in Małopolskie voivodship (76,3 km/100 km²) and the smallest one occurred in Podlaskie voivodship (8,9/100 km²). In years 2005-2016 the largest development in the range of increasing the availability to sewage network services was noticed in Podkarpackie voivodship (by 35,2 pp.), whereas in the range of increasing density – in Małopolskie voivodship (by 48,8 km/100 km²). The least favorable changes characterized voivodship with relatively high level of availability, that is Pomorskie voivodship (by 7,9 pp.) and the voivodship with the lowest network density, which is Podlaskie voivodship (by 4,6 km/100 km²).

Water treatment plants, next to the water supply network and the sewage network, are the indispensable elements of water protection and the sanitary protection of population. In years 2005-2016 in the rural areas of Poland 497 water treatment plants were built (in 2016 there was 2 506 of them). Along with the increase in the number of water treatment plants, a systematic increase of population using their services occurred, from 22,0% in 2005 to 41,3% in 2016 (Figure 1). The average annual rate of changes of rural population share using the services of collective water treatment plants in general number of citizens was 6,6%.

The spatial distribution of the indicator describing percentage of population using water treatment plants in the rural areas of Poland suggests that in 2016 its' highest level, as in the case of sewage network, was noticed in Pomorskie

voivodship (62,1%), whereas the voivodship in which within twelve years the highest increase in the population serviced by water treatment plants was observed was the Opolskie voivodship (by 34,1 pp.). The greatest neglect in this area characterized the country of Podlaskie voivodship which is indicated by both relatively low level of percentage describing share of population using collective water treatment plants in general number of citizens (22,8%) and a small change (by 6,5 pp.).

Increasing the share of forests' area in general Poland's area is one of the priorities of the forest policy run by the country. The woodiness indicator allows to monitor the realization of the first of aims of the Strategy for Energy Security and the Environment which is balanced management of the natural resources, where reaching the woodiness at the level of 30% in Poland in 2020 is assumed (Kierunki rozwoju obszarów wiejskich – założenia do Strategii zrównoważonego rozwoju wsi i rolnictwa 2010).

The analysis of the woodiness indicator of the rural areas of Poland suggested a positive and expected direction of changes, wherein the rate of those changes in the analyzed years was relatively slow. In 2016, compared to 2005, the value of woodiness indicator describing the rural areas in the whole country increased by 0,79 pp. The greatest level of woodiness characterized the area of Lubuskie voivodship (50,4%), whereas in the other end of the ranking there was Łódzkie voivodship (22,1%). In the analyzed period in the elaboration in all of the voivodships there was an increase of share of wooded areas in the general area. The highest growth of woodiness took place in Podkarpackie voivodship (by 1,7 pp.), whereas the lowest – in Wielkopolskie voivodship (by 0,3 pp.).

A significant component in evaluation of level of sustainable development in the context of environmental order is the municipal waste. The amount of waste collected throughout the year successively increases and it is a negative phenomenon, however, it is simultaneously inevitable according to increasing consumption.

In 2016 in the rural areas 2 326 thousand of tones of mixed waste were collected, which constituted 68% more than twelve years earlier. In 2005 the amount of collected waste per capita was 95kg and it increased to the level of 152,1 kg/person in 2016. Each year the value of this indicator increased on average by 4,5%.

It is worth noticing that spatial diversity of the phenomenon is relatively large (the coefficient of variation in 2016 shaped at the level of 32,9%). The largest amount of waste per capita fell in the Zachodniopomorskie voivodship (241,2 kg/person.) and also in this voivodship the highest increase of the indicator took place in the researched period (by 116,8 kg/person.). On the opposite pole there

was Świętokrzyskie voivodship where in 2016 70,8 kg of mixed waste fell per capita, that is more than in the first year of the research.

Table 2 Selected indicators of environmental order of sustainable development of the rural areas in Poland in the cross-section of voivodships in 2005 and 2016.

Voivodship	Woodiness		Waste		Wastewater treatment		Waterworks		Sewerage	
	2005	2016	2005	2016	2006	2016	2005	2016	2005	2016
Polska	29,4	30,1	94,0	152,1	22,0	41,3	72,2	85	19,0	40,3
Dolnośląskie	29,5	30,1	159,0	211,6	24,1	45,8	77,2	88,8	21,5	44,2
Kujawsko-pomorskie	23,5	23,8	78,8	163,1	25,8	37,8	80,0	93,1	22,9	38,4
Lubelskie	22,9	23,8	58,7	81,5	15,1	24,8	66,1	80,3	9,9	21,1
Lubuskie	49,9	50,4	163,6	233,1	19,3	42,9	75,4	89,5	16,7	40,8
Łódzkie	21,4	22,1	91,1	133,8	11,2	25,5	79,0	92,5	10,7	24,9
Małopolskie	29,0	29,3	73,6	136,0	18,6	39,0	53,7	68,4	15,8	38,5
Mazowieckie	22,5	23,7	82,9	140,7	14,3	30,0	63,7	83,4	11,6	29,2
Opolskie	26,8	27,0	148,5	191,5	20,6	54,7	90,9	95,1	17,3	52,5
Podkarpackie	37,7	39,4	70,2	96,4	32,4	57,1	62,2	71,5	28,1	55,9
Podlaskie	30,6	31,4	82,2	112,6	16,3	22,8	72,3	81,1	14,7	21,8
Pomorskie	36,5	37,1	118,0	191,6	37,9	62,1	80,3	91,7	33,3	61,5
Śląskie	33,4	33,6	102,6	156,9	23,2	46,2	78,4	87,8	20,3	46,6
Świętokrzyskie	28,0	28,6	53,9	70,8	15,2	37,2	71,0	87,2	12,6	35,7
Warmińsko-mazurskie	30,4	31,8	92,5	172,1	27,5	46,5	73,7	88,8	22,9	43,5
Wielkopolskie	26,1	26,4	111,8	204,9	25,2	46,4	85,8	94,7	22,6	46,6
Zachodniopomorskie	36,0	36,9	124,5	241,2	39,4	57,1	84,4	93,2	36,0	57,4

Source: Calculations and the author's study based on Local Data Bank CSO, 2018.

While analyzing the development of particular elements of the environmental order, it is hard to talk about the level of its' development as a whole in each voivodship. Thus, in the following stage of research in order to determine the condition of development of the environmental order as a whole in particular voivodships a synthetic measurer of level of development of the environmental

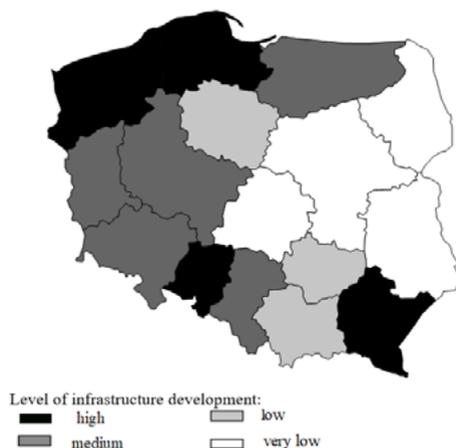
order was calculated for each voivodship. On the basis of the made calculations, four typological classes were determined.

In order to present the diversity of environmental order in the rural areas in Poland more clearly, the results of performed classifying procedure were presented on a map (Figure 2).

Four voivodships were classified to the first class, characterized by high level of environmental order: Zachodniopomorskie, Podkarpackie, Pomorskie and Opolskie voivodships. The average values of the indicators in this class characterizing the level of environmental order suggest primarily high level of equipment in the range of availability of the rural population to the services of water treatment plants (58,1% of general population) and the sewage network (57,1% of the general population) and large share of the forests in general area (36,3%).

The second typological class consists of the voivodships whose rural areas are characterized by medium level of environmental order. This class contains five voivodships: Wielkopolskie, Śląskie, Dolnośląskie, Warmińsko-Mazurskie and Lubuskie voivodships. Those areas are characterized by large share of population in using the water supply network (90,7% of general population) and relatively high value of indicator describing the amount of produced mixed waste (90,7 kg per person). In case of the indicators describing other parameters of environmental order in the second class, which are woodiness, sewage network and water treatment plants, their values shaped on the slightly higher level than the values for the rural areas of the whole country.

Figure 2 **Delimitation of the rural areas of Poland taking into consideration the level of sustainable development in environmental order's dimension in 2016 (in the cross-section of voivodships)**



Source: Calculations and the author's study.

The smallest, third class embraced three voivodships with low level of environmental order: Małopolskie, Kujawsko-Pomorskie and Świętokrzyskie voivodships. The lacks in this class primarily concern disseminating services of water supply network (78,7% of general population). However, what draws attention is far lower amount of produced waste, compared to the first and second class and the average value for the whole country (129,2 kg/person).

The fourth class, to which voivodships characterized by low level of environmental order were assigned, consists of the following voivodships: Mazowieckie, Podlaskie, Łódzkie and Lubelskie. The average values in this class indicate very low condition of the environmental order in the range of woodiness, water treatment, sewage network and none of the values describing those factors does not exceed the average values calculated for the rural areas of Poland. The feature which distinguishes this group is the fact that the average amount of waste per one rural resident is lower than in other classes and in the whole country.

4 Conclusions

The analysis of data received during the research concerning environmental order of sustainable development of rural areas in Poland in the cross-section of

voivodships, presented in the elaboration, allows to formulate the following conclusions:

- In years 2005-2016 in the rural areas of the whole Poland and in particular voivodships the changes favorable to implementing the conception of sustainable development in its' environmental aspect took place. The development of equipment of rural areas in the range of water-sewage infrastructure occurred and the woodiness indicator increased, however, it happened at different pace in various areas. However, the only unfavorable change was the increase in production of waste.
- The phenomenon which is absolutely positive in the context of environment protection is the fact that throughout the researched years the shares of rural population using services of the water treatment plants and sewage networks shaped on a similar level.
- Still, significant disproportions between the level of availability to the services of water supply network and the level of availability to the services of water drainage and treatment systems constitute a huge problem. Despite the dynamic development of sewage network and water treatment plants, they are not used even by half of the Polish rural residents.
- In the end of 2016 statistical view of diversity (expressed by the coefficient of variation) of analyzed elements of environmental order in the rural areas of particular voivodships indicated that the largest diversity characterized the amount of mixed waste per capita (32,9%), whereas the lowest diversity – percentage of the availability of the rural residents to the water supply network (9,1%).
- The analysis of spatial distribution of the rural areas in the cross-section of the voivodships, according to their affiliation to the separated typological classes focusing units with similar level of environmental order, allows to notice that the high and medium level of environmental order characterized mainly the voivodships of the northern, western and southern part of the country. On the other hand, the classes focusing the voivodships with low and very low level of environmental order were placed in the central and eastern part of Poland.

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