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## ASSESSMENT OF ENVIRONMENTAL QUALITY AS THE MAIN FACTOR OF SUSTAINABLE DEVELOPMENT OF RURAL AREAS – A CASE STUDY

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**Abstract.** The protection of the environment is a priority in all development activities. It is based on the concept of sustainable development which aims to improve standards and quality of living in societies taking into account the environmental conditions and the possibility of using its resources by future generations. Presented in this study are the activities that have influence on the environment quality of rural areas such as the Dolny Śląsk. Indicators of sustainable development for four spheres were used: ecologization of the spatial planning, protection and sustainable development of forests, trending the water proportions and the water quality. The study included 78 rural communes of Dolny Śląsk. The analysis was made in the period from 2008 to 2014. The results showed an increase in the value of indicators of environmental quality in rural areas of Dolny Śląsk.

**Keywords:** rural areas, condition of the environment, sustainable development, sustainable development indicators

### INTRODUCTION

The sustainable development paradigm is a new management model based on a holistic, human-friendly approach with no risks to the natural environment. It is applicable to specific fields of activity: the economy, the society and the environment, which should be interlinked and complementary, and should not cause any disturbance to socio-economic development.

Pursuing the environmental goals means preserving the green infrastructure and maintaining the productivity of ecosystems. This comes down to managing the environmental resources so as not to disturb the environmental balance and not to reduce their contribution to social welfare (Adamska, 2015). Today, the protection and shaping of the natural environment is a priority for all activities, and is backed by the sustainable development concept.

The components of the environment (water, air and soil) are the very foundation of life for most of the organisms, including humans, and therefore must be protected under relevant measures. The protective actions should be primarily be based on:

- deliberately shaping the environment and managing the environmental resources as per the sustainable development principles;
- combating pollution;
- restoring the natural assets to an appropriate condition (Ustawa..., 2001).

Human activities boost the emission of pollutants to the environment, and therefore it seems appropriate to regard humans as intruders who deteriorate the environmental values. However, the development of new techniques and technologies helps eliminating some threats. It may be therefore concluded that, from a technical perspective, there is a chance that the environment will be properly maintained so it may be used

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by future generations (Pawłowski and Pawłowski, 2008).

The quality of the environment is a factor that affects the dynamics of the economic growth within a system of permanent feedback. A decline in the environmental quality makes it impossible to maintain high growth rates on a long term. Also, the decreasing quality of the environment requires additional measures to be taken in order to restore its capacity to carry out its functions. Such additional expenditure results in impeding the economic growth (Dubel, 2000). Many countries have experienced, and continue to experience, economic growth to the detriment of the environment and without regard for the preservation of natural assets for future generations. As a consequence, the costs incurred to maintain the current condition of the environment (which depend on the wealth and awareness of the societies) have also emerged as a growing problem.

With a share of 90% in the national territory, rural areas have a significant environmental impact. As they are an inseparable part of the country, they are affected by various factors, including industry and urbanization. However, their population is mainly engaged in agriculture, a source of primary products for the agri-food sector and many other industries. Hence, preventing the rural environmental degradation and maintaining the production function becomes a priority not only for the environmental actions but also for the socio-economic area.

The agricultural and rural development is not readily compatible with environmental protection, and therefore special measures are required. The search for a new farming model implied by the environmental protection requirements drives new forms of rural activities based on the sustainable development paradigm.

## PURPOSE, MATERIALS AND METHODOLOGY OF STUDIES

The purpose of this paper was to assess the environmental quality of rural areas, as illustrated by the example of the Dolnośląskie voivodeship, with the use of selected sustainable development indexes. The detailed survey covered 78 rural municipalities in the Dolnośląskie voivodeship, located in five subregions. The development objectives vary from one functional subregion to another: I – intensive agriculture subregion with a dominant agricultural sector; II – agricultural and leisure subregion based on the development of tourism and leisure activities; III – industry,

leisure and tourism subregion, mostly including mountain and foothill areas; IV – agricultural and industrial subregion impacted by the copper industry; V – agricultural, industrial and leisure subregion affected by three economic functions: industry, agriculture and tourism (Studia..., 2001). The survey period was from 2008 to 2014. The detailed analysis was based on environmental protection expenditure and sustainable development indexes that illustrate the environmental dimension. The indexes were considered in two aspects (domains): the greening of spatial planning processes; and water quality. The above domains covered 9 indexes. The greening of spatial planning processes included 7 indexes: the area of legally protected high natural values per inhabitant; the share of legally protected areas in the total territory; population density; the share of agricultural area in the total territory (%); the share of arable land in the agricultural area (%); agricultural area per inhabitant; the share of other land and wasteland in the total territory (%). Water quality was analyzed with two indexes: the population served by treatment plants; and the length of the sewage network. A synthetic index of environmental quality was defined, taking into account 7 indexes related to the greening of spatial planning processes, 1 index for the protection and sustainable development of forests (share of forests in the total territory), 1 index for the development of water conditions (water consumption per inhabitant), and 2 indexes for water quality. The above indexes were selected because of their importance for, and impact on, the environmental quality and their availability throughout the survey period.

Input data was converted into comparative values. This allowed to analyze the abovementioned indexes classified by domains and to define the synthetic index of environmental quality. The zero unitarization method was used, which resulted in standardizing the index values within the [0:1] interval. The standardization of features was based on the following formulas:

for the indexes with a stimulating effect:

$$Q_i = (W_i - W_{\min}) / (W_{\max} - W_{\min})$$

for the indexes with an inhibiting effect:

$$Q_i = (W_{\max} - W_i) / (W_{\max} - W_{\min})$$

with:

$Q_i$  – standardized index value

$W_i$  – index value for feature  $i$  (Borys, 2005)

$W_{\max}$  – maximum value

$W_{\min}$  – minimum value

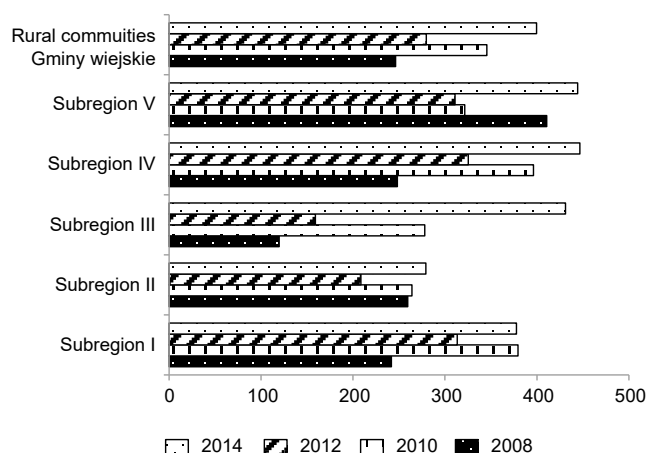
Two indexes had an inhibiting effect: the population density and water consumption per inhabitant; other indexes demonstrated stimulating effects.

## RESULTS OF THE STUDY

Enhancing the environment is a process that depends on multiple factors, primarily including the financial resources. This is the decisive enabler of environmental investments which help enhancing the environment and, as a consequence, contribute to the higher standards of living for the society in accordance with the sustainable development concept.

The amount of environmental expenditure in 2008–2014 varied from one municipality to another and from one subregion to another. A positive development in all of the subregions was the increasing environmental expenditure per inhabitant. In the 2008–2014 period, the highest environmental expenditure was recorded in 2010 and 2014. This could result from the initiation or completion of environmental investments. Note also that 2014 marked the end of financial support under the Norwegian Financial Mechanism as a part of the 2007–2014 “Infrastructure and Environment” operational program. When considering specific subregions of the Dolnośląskie voivodeship, the highest amounts of environmental expenditure per inhabitant were incurred in 2014. The highest (PLN 446 per inhabitant) and the lowest (PLN 279 per inhabitant) levels were recorded in subregion IV and subregion II, respectively. In turn, the lowest environmental expenditure was seen in 2008. This was apparent in nearly all subregions of the Dolnośląskie voivodeship, except for subregion V where the lowest environmental expenditure was recorded in 2012 (Fig. 1).

The greening of the spatial planning processes is of major importance for the quality of the environment. The plans are developed because of the condition of natural resources and the presence of threats to the environment, taking into account the existing needs and opportunities. Land-use management processes and socio-economic decisions involve (and result in changes to) spatial aspects, and therefore affect the environment. Thus, space is one of the basic development drivers, and must be optimally developed because of the condition of the environment and the implementation of the sustainable growth concept.



**Fig. 1.** The expenditure incurred for environmental protection in functional subregions of rural areas in Dolny Śląsk (zł per capita)

Source: own elaboration based on Bank Danych Lokalnych.

**Rys. 1.** Wydatki ponoszone na ochronę środowiska w subregionach funkcjonalnych obszarów wiejskich woj. dolnośląskiego (zł/mieszkańca)

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.

A key factor for spatial planning, the land use structure undergoes changes, as demonstrated in relevant studies carried out in rural areas by the Marshall Office of Dolnośląskie voivodeship (Analiza..., 2015). Reasons behind these changes include the rural investment processes in progress which are related to construction projects and to the afforestation of marginal land by beneficiaries of financing under the 2007–2013 RDP. As a consequence, the area of agricultural land has decreased while that of forests and forestry land has increased. From the economic (agricultural production) perspective, these trends are not favorable. However, positive aspects can be identified when considering the impact of these developments on the environment and its quality.

The analysis of greening of spatial planning processes in rural areas of the Dolnośląskie voivodeship takes account of 7 sustainable development indexes used as a basis for defining the synthetic index. In 2008–2014, the values of spatial planning greening indexes were quite homogeneous. This could be observed in all functional subregions of rural areas in the Dolnośląskie voivodeship. However, the values of the spatial planning

greening index significantly vary from one subregion to another. The highest values were recorded in subregion I (from 0.437 in 2008 to 0.539 in 2014) and subregion II (from 0.504 in 2008 to 0.552 in 2014). In turn, the lowest values were reported in subregion III (from 0.332 in 2008 to 0.369 in 2014) and subregion V (from 0.394 in 2008 to 0.424 in 2014). The variation of the spatial planning greening index was definitely higher in municipalities of particular subregions, translating into minimum and maximum values. Higher levels were experienced in municipalities with a larger share of agricultural land (including arable land) while lower levels were

observed in municipalities with less favorable natural areas and with no legally protected areas (Table 1, Fig. 2).

Water quality is another determinant for the condition of the environment. As a basic natural element, water affects the existence of all living organisms. Therefore, water quality protection actions become a matter of key importance. Insufficient protection of water resources and quality could threaten the existence of living organisms which are essential for the proper functioning of the environment.

In rural areas, water quality risks result from the not-yet-regulated waste water management issues,

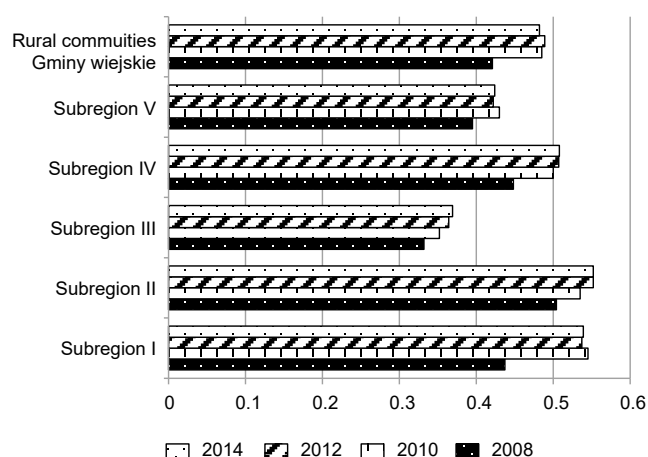
**Table 1.** Synthetic spatial planning greening index (2008–2014)

**Tabela 1.** Syntetyczny wskaźnik ekologizacji planowania przestrzennego (2008–2014)

Specification Wyszczególnienie	Years – Lata			
	2008	2010	2012	2014
Subregion I				
Average – Średnia	0.437	0.545	0.537	0.539
Max.	0.620	0.625	0.651	0.652
Min.	0.244	0.331	0.288	0.286
Subregion II				
Average – Średnia	0.504	0.535	0.552	0.552
Max.	0.765	0.767	0.760	0.761
Min.	0.337	0.440	0.434	0.434
Subregion III				
Average – Średnia	0.332	0.352	0.364	0.369
Max.	0.416	0.512	0.509	0.515
Min.	0.194	0.182	0.168	0.175
Subregion IV				
Average – Średnia	0.448	0.500	0.507	0.508
Max.	0.547	0.619	0.664	0.663
Min.	0.347	0.423	0.407	0.409
Subregion V				
Average – Średnia	0.395	0.430	0.422	0.424
Max.	0.541	0.497	0.511	0.512
Min.	0.289	0.251	0.215	0.216

Source: own elaboration based on Bank Danych Lokalnych.

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.

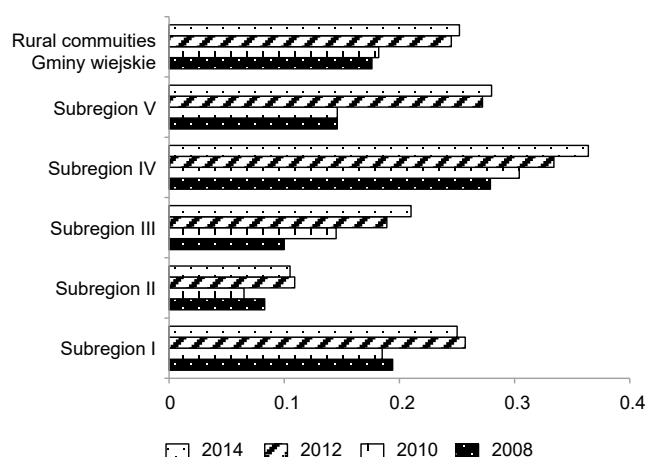


**Fig. 2.** Value of the synthetic spatial planning greening index in 2008–2014

Source: own elaboration based on Bank Danych Lokalnych.

**Rys. 2.** Wartość syntetycznego wskaźnika ekologiczacji planowania przestrzennego w latach 2008–2014

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.



**Fig. 3.** Value of the synthetic index of water quality in 2008–2014

Source: own elaboration based on Bank Danych Lokalnych.

**Rys. 3.** Wartość syntetycznego wskaźnika jakości wód w latach 2008–2014

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.

the absence of sewage systems and illegal water discharges. Thus, it becomes necessary to take measures to regularize the waste water management processes, involving the construction of waste water treatment plants and sewage networks.

According to research, the quality of water tends to improve, as demonstrated by the increasing values of the synthetic water quality index which takes into account the percent of the population served by treatment plants and the length of the sewage network.

In all subregions of rural areas of the Dolnośląskie voivodeship, the average value of the synthetic water quality index increased in the 2008–2014 period. The highest increase in the average value of the index (by more than 100%) was recorded in subregion III (from 0.100 in 2008 to 0.210 in 2014) and in subregion V (from 0.145 in 2008 to 0.280 in 2014). The smallest changes in the average index values were observed in subregion II (from 0.083 in 2008 to 0.105 in 2014) (Fig. 3).

Specific subregions include municipalities with no treatment plants, no sewage networks and no investment activities to address that problem. This is demonstrated by the minimum values (0) of the synthetic water quality index. On the other hand, in some municipalities, the quality of water is of tremendous importance, and

therefore actions focused on improving water quality have been and continue to be carried out, as shown by the maximum values of the index (Table 2).

The synthetic index of environmental quality took into account all of the analyzed indexes relating to: the greening of spatial planning; water quality; protection and sustainable development of forests; and development of water conditions. According to the analysis, there was an increase in the average value of that index. This could be observed in all functional subregions of rural areas in the Dolnośląskie voivodeship. The following improvements were stated: from 0.418 to 0.492 in subregion I; from 0.453 to 0.487 in subregion II; from 0.356 to 0.399 in subregion III; from 0.437 to 0.490 in subregion IV; and from 0.406 to 0.449 in subregion V (Fig. 4).

The minimum and maximum values recorded in specific subregions indicate that some municipalities exist where the environmental measures are being implemented to varying degrees. A positive development is that both the minimum and maximum values of the synthetic index of environmental quality tend to increase in specific subregions. Only in subregion V, no increase of the maximum values was reported in 2008–2014 (Table 3).

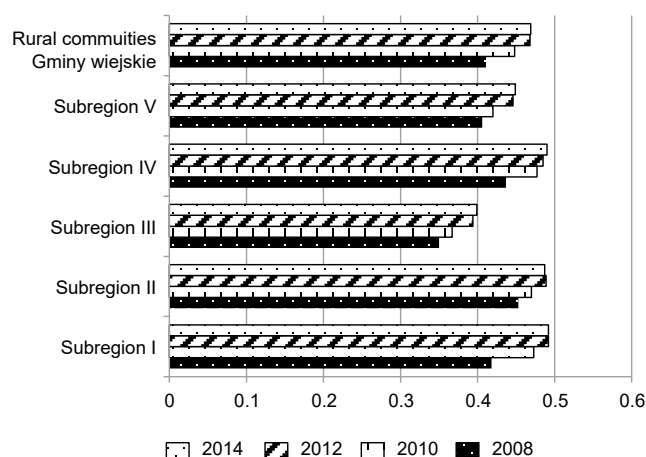
**Table 2.** Synthetic index for the domain of water quality in 2008–2014

**Tabela 2.** Syntetyczny wskaźnik jakości wód w latach 2008–2014

Specification Wyszczególnienie	Years – Lata			
	2008	2010	2012	2014
Subregion I				
Average – Średnia	0.194	0.185	0.257	0.250
Max.	0.733	0.517	0.620	0.537
Min.	0.000	0.000	0.000	0.000
Subregion II				
Average – Średnia	0.083	0.065	0.109	0.105
Max.	0.371	0.215	0.256	0.320
Min.	0.000	0.000	0.000	0.000
Subregion III				
Average – Średnia	0.100	0.145	0.189	0.210
Max.	0.205	0.690	0.356	0.454
Min.	0.000	0.000	0.104	0.038
Subregion IV				
Average – Średnia	0.279	0.304	0.334	0.364
Max.	0.481	0.470	0.510	0.958
Min.	0.070	0.097	0.126	0.131
Subregion V				
Average – Średnia	0.146	0.146	0.272	0.280
Max.	0.405	0.330	0.510	0.555
Min.	0.000	0.000	0.012	0.018

Source: own elaboration based on Bank Danych Lokalnych.

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.



**Fig. 4.** Value of the synthetic index of environmental quality in 2008–2014

Source: own elaboration based on Bank Danych Lokalnych.

**Rys. 4.** Wartość syntetycznego wskaźnika jakości środowiska w latach 2008–2014

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.

**Table 3.** Synthetic index of environmental quality in functional subregions of rural areas in Dolny Śląsk in 2008–2014

**Tabela 3.** Syntetyczny wskaźnik jakości środowiska w subregionach funkcjonalnych obszarów wiejskich woj. dolnośląskiego w latach 2008–2014

Specification Wyszczególnienie	Years – Lata			
	2008	2010	2012	2014
Subregion I				
Average – Średnia	0.418	0.473	0.492	0.492
Max.	0.554	0.566	0.632	0.617
Min.	0.328	0.354	0.387	0.371
Subregion II				
Average – Średnia	0.453	0.470	0.487	0.487
Max.	0.621	0.621	0.619	0.620
Min.	0.345	0.393	0.393	0.389
Subregion III				
Average – Średnia	0.356	0.367	0.394	0.399
Max.	0.400	0.421	0.450	0.451
Min.	0.287	0.268	0.298	0.301
Subregion IV				
Average – Średnia	0.437	0.477	0.485	0.490
Max.	0.494	0.584	0.545	0.557
Min.	0.375	0.409	0.415	0.415
Subregion V				
Average – Średnia	0.406	0.420	0.446	0.449
Max.	0.539	0.486	0.494	0.502
Min.	0.340	0.364	0.391	0.390

Source: own elaboration based on Bank Danych Lokalnych.

Źródło: opracowanie własne na podstawie Banku Danych Lokalnych.

## SUMMARY

In addition to socio-economic aspects, the environment is fundamental for the sustainable development concept. It should be respected on equal terms because any creature has the same right to live as the current and future generations. Losing even the smallest part of the environment means restricting the development capacities in the future. Therefore, the operators such as entrepreneurs, authorities at all levels and the society should focus their actions on the quality of the environment.

According to the study, between 2008 and 2014, an increase was recorded in the values of sustainable growth indexes used to assess the quality of the rural environment in the Dolnośląskie voivodeship. However, the synthetic indexes for spatial planning, water quality and environmental quality varied from one subregion to another. The lowest index values were reported in subregion III, mostly including mountain and foothill areas with unfavorable environmental conditions. Compared to other subregions, the specific features of subregion III allow for a lesser degree of environmental actions.



However, an improvement is noticeable which is a positive signal. Also, the development activities in progress address the environmental aspects in accordance with the sustainable development concept.

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## OCENA STANU JAKOŚCI ŚRODOWISKA JAKO GŁÓWNEGO CZYNNIKA ZRÓWNOWAŻONEGO ROZWOJU OBSZARÓW WIEJSKICH – STUDIUM PRZYPADKU

**Streszczenie.** Ochrona środowiska przyrodniczego jest priorytetem we wszystkich działaniach rozwojowych. Jej podstawą jest koncepcja zrównoważonego rozwoju, której cel stanowi poprawa poziomu i jakości życia społeczeństwa, ze szczególną troską o stan środowiska oraz o możliwość korzystania z niego przez przyszłe pokolenia. W pracy dokonano oceny stanu jakości środowiska obszarów wiejskich na przykładzie województwa dolnośląskiego. Wykorzystano wskaźniki zrównoważonego rozwoju w ramach czterech dziedzin: ekologizacji planowania przestrzennego, ochrony i zrównoważonego rozwoju lasów, kształtowania stosunków wodnych oraz jakości wód. Badaniami objęto 78 gmin wiejskich województwa dolnośląskiego. Analizy przeprowadzono w latach 2008–2014. Uzyskane wyniki wykazały wzrost wartości wskaźników oceniających jakość środowiska na obszarach wiejskich.

**Słowa kluczowe:** obszary wiejskie, stan środowiska, zrównoważony rozwój, wskaźniki zrównoważonego rozwoju

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