ZESZYTY NAUKOWE UNIWERSYTETU PRZYRODNICZO-HUMANISTYCZNEGO W SIEDLCACH Nr 123
Seria: Administracja i Zarządzanie (50) 2019
pl ISSN 2082-5501

SYNYHETIC MEASURE AS PART OF THE ASSESSMENT OF SPATIAL DISPARITIES OF THE NATURAL ENVIRONMENT IN THE ŚWIĘTOKRZYSKIE VOIVODESHIP

MIARA SYNTETYCZNA JAKO ELEMENT OCENY PRZESTRZENNYCH DYSPROPORCJI ŚRODOWISKA NATURALNEGO WOJEWÓDZTWA ŚWIĘTOKRZYSKIEGO

https://doi.org/10.34739/zn.2019.50.07

Jarosław Wenancjusz **Przybytniowski**[1], Paweł **Dziekański**[2], Mark **Michalski**[3]

[1] Poland, The Jan Kochanowski University in Kielce, Institute of Management, ORCID number: 0000-0001-6164-2953 e-mail: j.w.przybytniowski@wp.pl

[2] Poland, The Jan Kochanowski University in Kielce, Institute of Management, ORCID number: 0000-0003-4065-0043, e-mail: pdziekan@interia.eu

[3] USA, The Catholic University of America - Busch School of Business in Washington, ORCID number: e-mail: michalski@cua.edu

Abstract: The aim of this research was to indicate the possibilities of using synthetic measure to find and analyse spatial disparities of the natural environment in 102 diagnostic communities of the Świętokrzyskie Voivodeship as a peripheral area. The research was conducted on the basis of selected diagnostic features. The data presented refer to the years 2009, 2012 and 2015 and come from the Local Data Bank. Bearing in mind the research aim, the following hypothesis was formed: The use of proper synthetic measures makes it possible to recognise spatial disparities which appear in the natural environment. This paper is a continuation of the work entitled: *Synyhetic Measure Used as Assessment of Spatial Disparities of the Natural Environment* (Przybytniowski, Dziekański, 2019). The analysis of the natural environment of municipalities occurs through human activities, and having a direct impact on the environment (indirectly related to the environment).
Keywords: ecology, synthetic measures, service quality, natural environment

Streszczenie: Celem badań było wskazanie możliwości wykorzystania miary syntetycznej do rozpoznania i analizy przestrzennych dysproporcji środowiska naturalnego diagnostycznych 102 gmin województwa świętokrzyskiego, jako obszaru peryferyjnego. Badania przeprowadzone były na podstawie wybranych cech diagnostycznych. Prezentowane dane dotyczą lat: 2009, 2012 i 2015 i pochodzą z Banku Danych Lokalnych. Mając na uwadze cel badawczy, sformułowano hipotezę: zastosowanie właściwych miar syntetycznych daje możliwość rozpoznania przestrzennych dysproporcji, jakie zachodzą w środowisku naturalnym. Opracowanie jest kontynuacją opracowania, którego tytuł brzmi: *Wykorzystanie miary syntetycznej do rozpoznania przestrzennych dysproporcji środowiska naturalnego*. Przeprowadzone potwierdziły, iż: przedstawiona metoda umożliwiają identyfikację obszarów o wyższym/niższym poziomie efektywności działania, przy wsparciu ze środków publicznych w ramach polityki regionalnej.
Słowa kluczowe: ekologia, miary syntetyczne, jakość usługi, środowisko naturalne

Introduction

Research connected with environmental protection and, consequently, problems of knowledge and ecological awareness accompanying it (Przybytniowski, 2017), have been and still are discussed by scientists (Freeland, Kirk, Petersen, 2011). Ecological awareness is a human attitude towards nature, in which there exists social responsibility for its condition. It is closely connected with precise knowledge (compare: Stanny, 2012), not only of nature but, and perhaps, most of all, of related sciences, in order to preserve it in its original condition. According to T. Burger (2000), we speak about ecological awareness in terms of the description of a complex system. It is connected with a set of information and beliefs referring to the natural environment and perception of relations between the state and the character of the environment and the conditions, as well as quality of human life. As J. Wódz (1993) writes, it is an ambiguous approach which is oriented at and

submitted to the society – consequently creating the area of social awareness which can be understood in its (Kalfas, Zagkas, Raptis, Zagkas, 2019):

1) Broader sense – where we take into consideration the entire recognised values and opinions on the natural environment and social development.
2) Narrower sense – where we take into consideration the state of knowledge, as well as views and conceptions of the society on the role of the environment in human life.

Bearing the above in mind, the lack of a complex, commonly accepted definition concerning ecological awareness, academic institutions define the term by means of two factors. According to A. Koszarek-Cyra, M. Piśniak, (2017), ecological awareness comprises:

1) ecological knowledge;
2) emotional attitude towards the environment;
3) pro-ecological attitude.

In order to speak fully about environmental protection and, consequently, about ecological awareness, we should keep ecological behaviour in mind. It includes activities undertaken by the society which have a positive impact on the environment (Milfonta, Duckitt, 2010).

Considering that knowledge and ecological awareness have an enormous impact on the process of developing social attitudes towards the natural environment functioning, it makes this problem an important category of research, particularly along the line man - environment (Best, 2010; Klöckner, 2013). In connection with that, the category complexity was to apply synthetic measurement to recognize spatial disparities of the natural environment, which will allow us to study how communities of the Świetokrzyskie Voivodeship perceive this category. The studied area of communes in the Świętokrzyskie voivodship was divided into 4 quartile groups, according to the value of a synthetic measure. Quartiles 1, 2, 3 were the thresholds of the groups. The size of the synthetic measure in the first group means a better unit, in the last the weakest in the examined aspect.

Research aim, method and material

The aim of the article is to assess spatial disparities of the natural environment in relation to the development process on the basis of selected diagnostic features of 102 of the communities of the Świętokrzyskie Voivodeship (taking into account nature, i.e. rural, urban, urban-rural communes). The data presented in the paper refer to the years 2009, 2012 and 2015 and come from the Local Data Bank.

The variables chosen directly or indirectly (as a result of human interference) influence the natural environment of the region. The natural environment was evaluated on the basis of the following factors:

1) the total use of household water per 1 resident D,
2) distribution network per 100 km^2 – water pipe system S,
3) distribution network per 100 km^2 – sewage system S,
4) woodland area S,
5) areas protected by law S,
6) protected monuments S
7) nature monuments S[1].

The selected variables are characterised by spatial variability (coefficient of variability above 0,10) and low variable correlation. According to the method of invertible matrix of correlation coefficients, diagonal elements (variables excessively correlated) of the values higher than 10 are eliminated from the set of variables (Mikhaylov, 2018; Rook, 2013).

In the next stage, the authors conducted the procedure of normalising diagnostic variables (of different names) using the zero unitarisation method, pursuant to the equation (1) and (2), i.e., for the stimulant:

$$z_{ij} = \frac{x_{ij} - \min_i x_i}{\max_i x_i - \min_i x_i} \quad (1).$$

Whereas the destimulant:

$$z_{ij} = \frac{\max x_i - x_{ij}}{\max_i x_i - \min_i x_i} \quad (2),$$

where:
$I = 1, 2, \ldots N$; $j = 1, 2, \ldots, p$ (N is the number of objects, and p – the number of features); x_{ij} – means the value of j^{th} feature for a studied unit, *max* – maximal value of j^{th} feature, *min* – minimal value of j^{th} feature (Tokarski 2005).

A synthetic measure was indicated by means of the non-pattern method which consists in averaging normalised values of simple features, in accordance with the formula:

$$S_i = \frac{1}{p}\sum_{j=1}^{p} z_{ij};\ i = 1, 2, \ldots, p, \quad (3),$$

where: S_i – a synthetic measure in a studied period, z_{ij} – the value of the unitarised feature of the synthetic indicator structure, p – number of features.

[1] Stimulants (S) and destimulants (D).

The indicator takes the value from the bracket [0,1]. The value closer to one means that the object has a high level of the analysed phenomenon (and vice versa) (Collins, Scannell, 2005).

The studied area of communes in the Świętokrzyskie voivodship was divided into 4 quartile groups, according to the value of a synthetic measure. Quartiles 1, 2, 3 were the thresholds of the groups. The size of the synthetic measure in the first group means a better unit, in the last the weakest in the studied aspect. Also, mutual compatibility of the acquired results was verified on the basis of the correlation coefficient.

There was also a scatter graph presented with a best-fit line (Dziekański, Wyszkowski, 2018; Wysocki, Lira 2005) and the gravitational effect was conducted.

Objects of high economic potential located close to each other make a stronger impact on each other (Collins, Scannell, 2005).

These interactions are described by the so-called individual and total gravitational effects. The individual gravitational effect is calculated as the relation of the value of the potential of the units to the distance between them. Individual gravitational effects between the i-th and j-poviats are described by the following equation[2]:

$$g_{ijt} = \frac{\mathrm{p_{it}\,p_{jt}}}{\mathrm{d_{ij}^2}} \qquad (4),$$

where:
pit, pjt - value of internal potential in the commune in the studied area, *dij* - distance connecting the capital of the commune and the capital of the commune *j*.

The total gravitational effect (of ith community) is defined as geometrical average of individual gravitational effects:

$$G_{it} = \sqrt[101]{\prod_{j=1 \wedge j\neq i}^{101} \left(\mathrm{g}_{ijt}\right)} \qquad (5),$$

thus:

$$G_{it} = \frac{\mathrm{P}_{it}\ \sqrt[101]{\prod_{j=1 \wedge j\neq i}^{101}(p_{jt})}}{d_i^2}, \qquad (6),$$

where:

$d_i = \sqrt[101]{\prod_{j=1 \wedge j\neq i}^{101} d_{ij}}$ is a geometrical average of the distance between the capital of the *i*th community and the capitals of other communities (Mroczek, Tokarski, 2014; Pooler, 2017).

Development-natural environment measurement

The Świętokrzyskie Voivodeship is located in the south-eastern part of Poland. It belongs to the ecologically cleanest areas of Poland (Jóźwiak, Jóźwiak, Strzyż 2010). The area has an industrial and agricultural character. The main industries of the Świętokrzyskie region are: metallurgical (Ostrowiec Świętokrzyski), metal (Skarżysko-Kamienna), machinery (Starachowice), building materials (Kielce), ceramic, foundry (Końskie), food (Pińczów, Kielce). The economy of the Świętokrzyskie region is based on the mining industry in the field of building materials (limestone, dolomites, marlstone, gypsum, sandstone), thanks to which the Voivodeship has became the capital of Polish construction. The agricultural south is the base for the production of organic food (Table 1). An introduction to the presented research on the natural environment of communes was the analysis of the economic nature of poviats.

The value of the synthetic measure allowed dividing the communities of the Świętokrzyskie Voivodeship into 4 groups. Small shifts can be observed between these groups in space and time. High up were: Kielce (1), Starachowice (1), Stąporków (3), Zagnańsk (2). These units are characterized by a strong industrial function, good finances and developed infrastructure, as well as a better position in the area of development potential (primarily group A units, the best). At the other end of the ranking were Bejsce (2), Ćmielów (3) and Gowarczów (2). These are community units of an agricultural nature. Połaniec (3) economically strong, peripherally located, is a unit with a low level of environmental potential (Table 2). This peripherality has a geographical dimension, expressed by its location in relation to the centre of the region.

[2] Por. np. K. Mroczek, T. Tokarski, M. Trojak, 2014, Grawitacyjny model zróżnicowania rozwoju ekonomicznego województw, „Gospodarka Narodowa" nr 3; K. Filipowicz, T. Tokarski, 2015, Wpływ efektu grawitacyjnego na przestrzenne zróżnicowanie rozwoju ekonomicznego powiatów, „Wiadomości Statystyczne" nr 5.

Table 1. Characteristics of selected areas (communities) of the Świętokrzyskie Voivodeship

Community	Characteristic
Opatów	Agriculture, agrotourism, industry (cement), dairy
Starachowice	Machinery and metal industry
Skarżysko	Metal industry, agriculture, commerce and services, construction
Busko	Agriculture (vegetables, orchards), agrotourism, health resorts
Sandomierz	Agriculture (horticulture, orchards), agrotourism, industry (glassworks)
Ostrowiec	Iron and steel industry, commerce, services
Końskie	Foundry, construction, commerce, hotel industry, transport
Kielce	Extraction and processing industry of mineral raw materials, food production
Włoszczowa	Agriculture, commerce, services, recreation
Staszów	Agriculture, commerce, services
Pińczów	Agriculture, commerce, services, extractive industry
Jędrzejów	Agriculture, agrotourism, agriculture and food processing
Kazimierz	Agriculture, construction, commerce, services

Source: https://bdl.stat.gov.pl/BDL/start: update: 17.12.2019.

Table 2. Quartile groups of synthetic measures of the natural environment and economic development of the communities of the Świętokrzyskie Voivodeship in the years 2009, 2012, 2015

Group	Communities of Świętokrzyskie Voivodeship	Synthetic measure of the natural environment*				Synthetic measure development**				2015 groups
		2009	2012	2015	2015/2009	2009	2012	2015	2015/2009	S_{ir}
A	Kielce (1)	0.58	0.59	0.60	0.03	0.41	0.46	0.50	0.22	A
	Starachowice (1)	0.57	0.55	0.56	-0.02	0.33	0.33	0.35	0.06	A
	Stąporków (3)	0.50	0.50	0.49	-0.02	0.26	0.26	0.28	0.08	D
	Zagnańsk (2)	0.35	0.36	0.37	0.06	0.28	0.31	0.35	0.25	A
B	Pacanów (2)	0.35	0.36	0.33	-0.06	0.26	0.27	0.29	0.12	C
	Piekoszów (2)	0.36	0.35	0.34	-0.06	0.28	0.30	0.31	0.11	B
	Radoszyce (2)	0.35	0.35	0.35	0.00	0.24	0.25	0.27	0.13	D
	Suchedniów (3)	0.32	0.32	0.32	0.00	0.32	0.30	0.33	0.03	A
C	Baćkowice (2)	0.32	0.29	0.29	-0.09	0.24	0.26	0.31	0.29	D
	Bałtów (2)	0.30	0.32	0.31	0.03	0.31	0.28	0.33	0.06	A
	Działoszyce (3)	0.31	0.31	0.32	0.03	0.32	0.32	0.33	0.03	B
	Sadowie (2)	0.27	0.30	0.29	0.07	0.23	0.28	0.29	0.26	C
D	Bejsce (2)	0.27	0.28	0.28	0.04	0.25	0.25	0.26	0.04	D
	Ćmielów (3)	0.28	0.28	0.28	0.00	0.26	0.25	0.29	0.12	C
	Gowarczów (2)	0.28	0.28	0.28	0.00	0.24	0.27	0.29	0.21	C
	Połaniec (3)	0.18	0.20	0.20	0.11	0.44	0.50	0.50	0.14	A

Legend: S_{ir} – synthetic measure of economic development; 1 – urban community; 2 – rural community; 3 – urban – rural community; 2 best in the group and the poorest; sorted according to the average of 2009-2015. Based on formula (3), a synthetic measure of the natural environment and a synthetic measure of development were determined separately for each commune.

* Synthetic measure of the natural environment - aggregate value describing the natural environment of the individual; the closer to 1.00 the better the assessment of the natural environment, the closer to 0.00 the weaker considering the area of partial variables.

** Synthetic measure of development - indicates potential development opportunities of the analyzed unit; the closer to 1.00 the greater the development potential, the closer to 0.00 the lower.

Source: own elaboration based on BDL GUS data.

No position stability was observed in the ranking, the level of the indicator is influenced by: the economic nature of the unit and the function of the area (industrial, tourist, residential), economic potential, financial situation, the natural environment and infrastructure (location rent). Therefore, the assessment should take into account local specificities in various structural and functional conditions.

The above results are confirmed by the analyses (Figure 1) showing a similar level of dispersion of units in the examined years in terms of the measure of environmental assessment and greater focus in terms of the measure of development in 2015. The group of outliers, regardless of the audited year, includes Kielce (1), Starachowice (1) and Ostrowiec Św. (1), Stąporków (3), Busko-Zdrój (3), Sandomierz (1) (for measuring environmental assessment) and Tuczępy (2), Sandomierz (1), Ożarów (3), Sitkówka-Nowiny (2), Kielce (1), Połaniec (3) (for measure of development).

Synthetic measure of the natural environment:

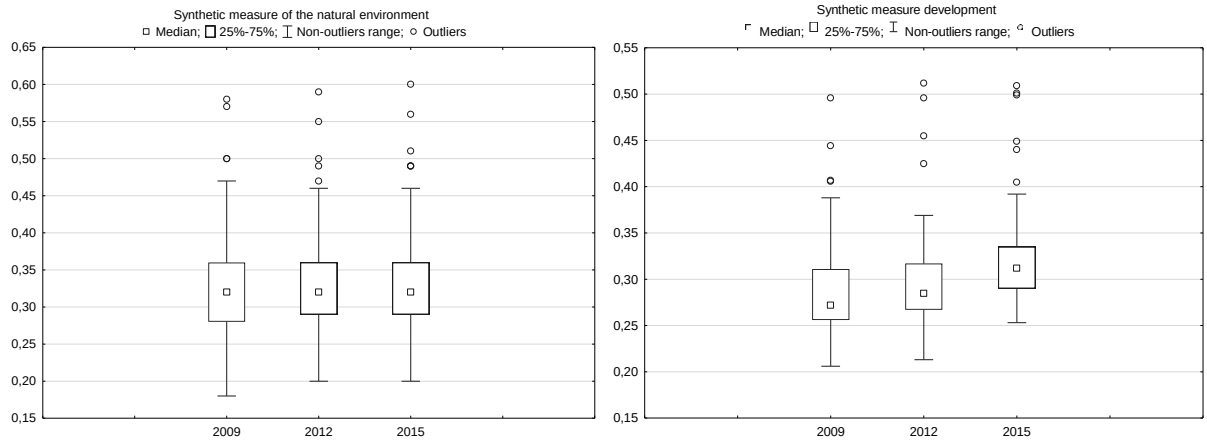

Figure 1. Graph of dispersion of rural communities in the Świętokrzyskie Voivodeship in terms of the natural environment and development in 2009, 2012 and 2015
Source: own elaboration based on BLD GUS (https://bdl.stat.gov.pl/BDL/start: update: 22.06.2019).

Figure 2 presents correlograms describing the year-to-year relationship of the measure of the synthetic assessment of the natural environment and development. The analysis of the scatter plot points out that the increasing value of the coefficients is accompanied by a change in the position of the points, which are getting closer and closer to the straight line. The Pearson's correlation coefficient in 2015 in relation to 2012 was 0.985 (at 0.983 for the relation 2012-2009) for the measure of environmental assessment and 0.886 (and 0.841) for the measure of development. Outliers are Łoniów (2), Starachowice (1), Kielce (1) (highly industrial or agricultural units; for measuring environmental quality) and Ożarów (3), Sandomierz (1), Kielce (1), Połaniec (3) Sitkówka-Nowiny (2) (units with high industrial potential; for measure of development).

Pearson's correlation coefficient (Figure 3) in 2015 in relation to the measure of environmental assessment and development was 0.274 (at 0.196 for 2009). An increase in measures indicates a slight convergence process. Measures indicate a similar level of development or financial situation of rural communities in the Świętokrzyskie Voivodeship. Outliers in relation to the studied group are Połaniec (3), Sitkówka-Nowiny (2), Ożarów (3), Kielce (1), Sandomierz (1), Starachowice (1) and Stąporków (2).

Table 3 presents the diversity of synthetic measures of the natural environment and development.The combined coefficients show that the spatial diversity of the communities was stable. In 2015, compared to 2009, the degree of diversity of municipalities in the assessment of the measure of the natural environment and development was similar. This is indicated by the standard deviation 0.07-0.07 (measure of the natural environment) and 0.05-0.05 (measure of development) with the range constant 0.40-0.40 / 0.29-0.26 and the stability of the indicator of variations of 0.20-0.21 and 0.17-0.15.

Synthetic measure of the natural environment in years 2009-2012 and 2012-2015:

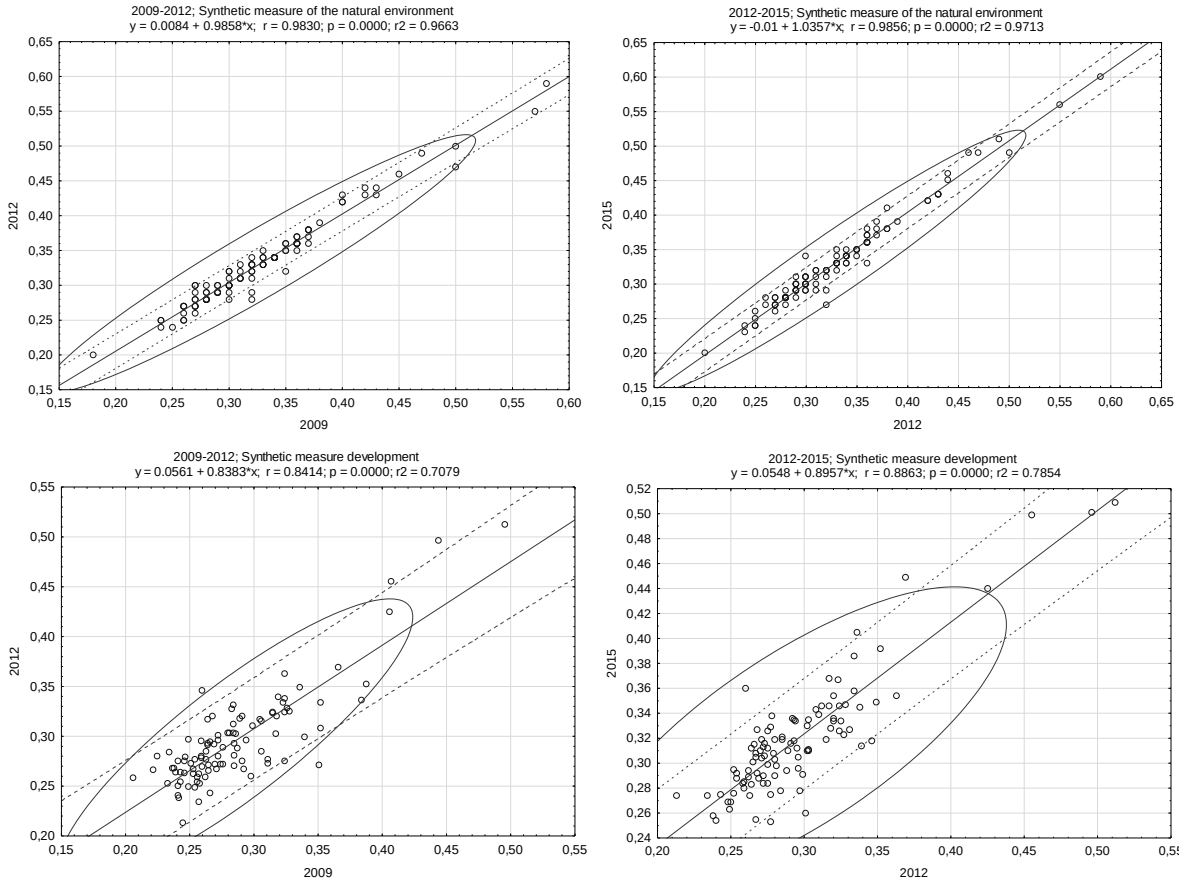

Figure 2. Scatter graph with the best-fit line of communities of the Świętokrzyskie Voivodship in 2009, 2012 and 2015
Source: own elaboration based on BLD GUS (https://bdl.stat.gov.pl/BDL/start: update: 22.06.2019).

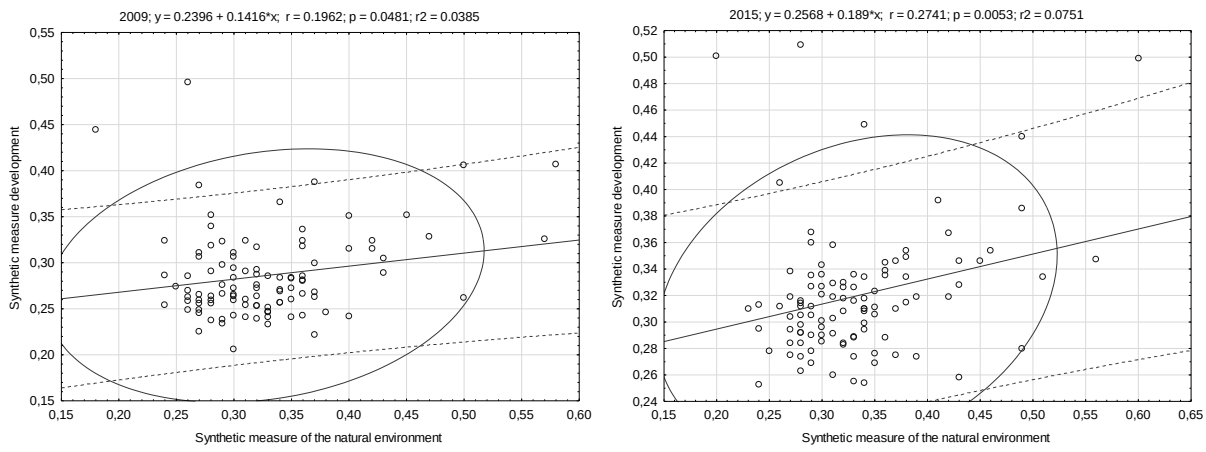

Figure 3. The relation of synthetic measure of the natural environment and development of communities of the Świętokrzyskie Voivodeship in 2009 and 2015
Source: own elaboration based on BLD GUS.

Table 3. Differentiation of the synthetic measure of the natural environment and development in 2009, 2012, 2015

Statistical description measures	Synthetic measure of the natural environment			Synthetic measure of development		
	2009	2012	2015	2009	2012	2015
average	0.33	0.33	0.33	0.29	0.30	0.32
standard deviation	0.07	0.07	0.07	0.05	0.05	0.05
classic variation coefficient	0.20	0.20	0.21	0.17	0.16	0.15
min	0.18	0.20	0.20	0.21	0.21	0.25
max	0.58	0.59	0.60	0.50	0.51	0.51
interval	0.40	0.39	0.40	0.29	0.30	0.26
Quartile 1	0.28	0.29	0.29	0.26	0.27	0.29
Quartile 2	0.32	0.32	0.32	0.27	0.28	0.31
Quartile 3	0.36	0.36	0.36	0.31	0.32	0.34
Quartile interval	0.08	0.07	0.07	0.05	0.05	0.05
skewness	1.43	1.37	1.37	1.68	2.21	1.95
concentration measure - kurtosis	3.25	2.66	2.51	4.04	7.19	5.20

Source: own elaboration based on BLD GUS (https://bdl.stat.gov.pl/BDL/start: update: 22.06.2019).

The internal potential of municipalities is of great importance for multifunctional development which consists of natural conditions (terrain, location within protected areas, resource base) and non-natural conditions (proximity of the developed communication system, proximity to urban centres, border location, human capital (labour resources), location in the socio-economic space and, in particular, its location in relation to the settlement and communication network). On the one hand, it refers to the occurrence of certain elements in a given area (primarily natural factors) and, on the other hand, to the distance from certain components of the local system or, on a larger scale, to regional or national systems (Kapsalis, Kyriakopoulos, Aravossis, 2019). Location rent can be defined as potential more or less measurable benefits resulting from the location of a given unit (e.g., community). This is a kind of attractive location bonus. The attractiveness of the location manifests itself in different ways. Generally, these phenomena can be divided into natural and non-natural conditions (Shim, Kim, Kim, Hwang, 2018).

The existence of disparities and areas with a low level of socio-economic development between territorial units means a loss of development potential. Intra-regional differences occur in both high and low development regions. The existence of infrastructure (technical and social) and adequate economic potential have a major impact on the quality of life of residents and the development of regions. For local entities, infrastructure is a prerequisite for existence, and it can also increase competitiveness. In turn, the development of economic activity stimulates the development of infrastructure (Ferguson, Tamburello, 2015).

Table 4. Correlation of a measure of synthetic assessment of the natural environment and development of community of the Świętokrzyskie Voivodeship in 2009, 2012 and 2015

S_i	Correlation Coefficient			
	gamma	Sperman's	tau Kendall	Pearson's
OE_S - OE_R 2009	0.111	0.152	0.108	0.196
OE_S - OE_R 2012	0.124	0.160	0.120	0.203
OE_S - OE_R 2015	0.196	0.258	0.190	0.274

Legend: OE_S synthetic measure of environmental assessment; OE_R measure of development
Source: prepared by the authors.

It can be concluded from the data contained in Table 4 that the synthetic measure based on the reference method was subject to slight convergence (0.196; 0.203; 0.274), which indicates intra-regional stability in the studied area, and an increase in the importance of the natural environment in the process of regional development.

The obtained results of the gravitational effect for the potential of the natural environment and development strengthen the results obtained using the synthetic measure. The analysis allowed dividing the communities into 4 groups (formed

according to the quartiles for the synthetic measure in 2015) by the potential of the natural environment and development, i.e.

1) Group 1 includes central communities, located in the orbit of the region capital, with the highest development potential (Sitkówka-Nowiny (2), Kielce (1), Morawica (2), Daleszyce (3), Zagnańsk (2), Miedziana Góra (2), Busko-Zdrój (3), Suchedniów (3), Bodzentyn (3)) and the natural environment (Kielce (1), Starachowice (1), Morawica (2), Zagnańsk (2), Ostrowiec Świętokrzyski (1), Staszów (3), Stąporków (3), Sitkówka-Nowiny (2), Skarżysko-Kamienna (1), Sobków (2), Stopnica (3));
2) Group 2 is in the development perspective: Starachowice (1), Staszów (3), Połaniec (3), Skarżysko-Kamienna (1), Ostrowiec Świętokrzyski (1), Małogoszcz (3), Bodzechów (2), Opatów (3)); in terms of the natural environment: Nowa Słupia (2), Bodzechów (2), Strawczyn (2), Łagów (2), Szydłów (2), Wąchock (3), Końskie (3), Małogoszcz (3), Pacanów (2), Rytwiany (2);
3) Group 3 is in the development perspective: Rytwiany (2), Pacanów (2), Ożarów (3), Końskie (3), Klimontów (2), Waśniów (2), Kazimierza Wielka (3); in terms of the natural environment: Nowy Korczyn (2), Sadowie (2), Wiślica (2), Skarżysko Kościelne (2), Waśniów (2), Opatów (3), Krasocin (2), Klimontów (2), Włoszczowa (3), Sandomierz (1), Opatowiec (2);
4) Group 4 includes the weakest peripheral municipalities of the region and their gravitational effect may concern units located in other regions (in terms of development potential: Sandomierz (1), Sędziszów (3), Bałtów (2), Włoszczowa (3), Dwikozy (2), Zawichost (3): in terms of the natural environment: Ożarów (3), Kazimierza Wielka (3), Koprzywnica (3), Bałtów (2), Połaniec (3), Dwikozy (2), Moskorzew (2), Zawichost (3).

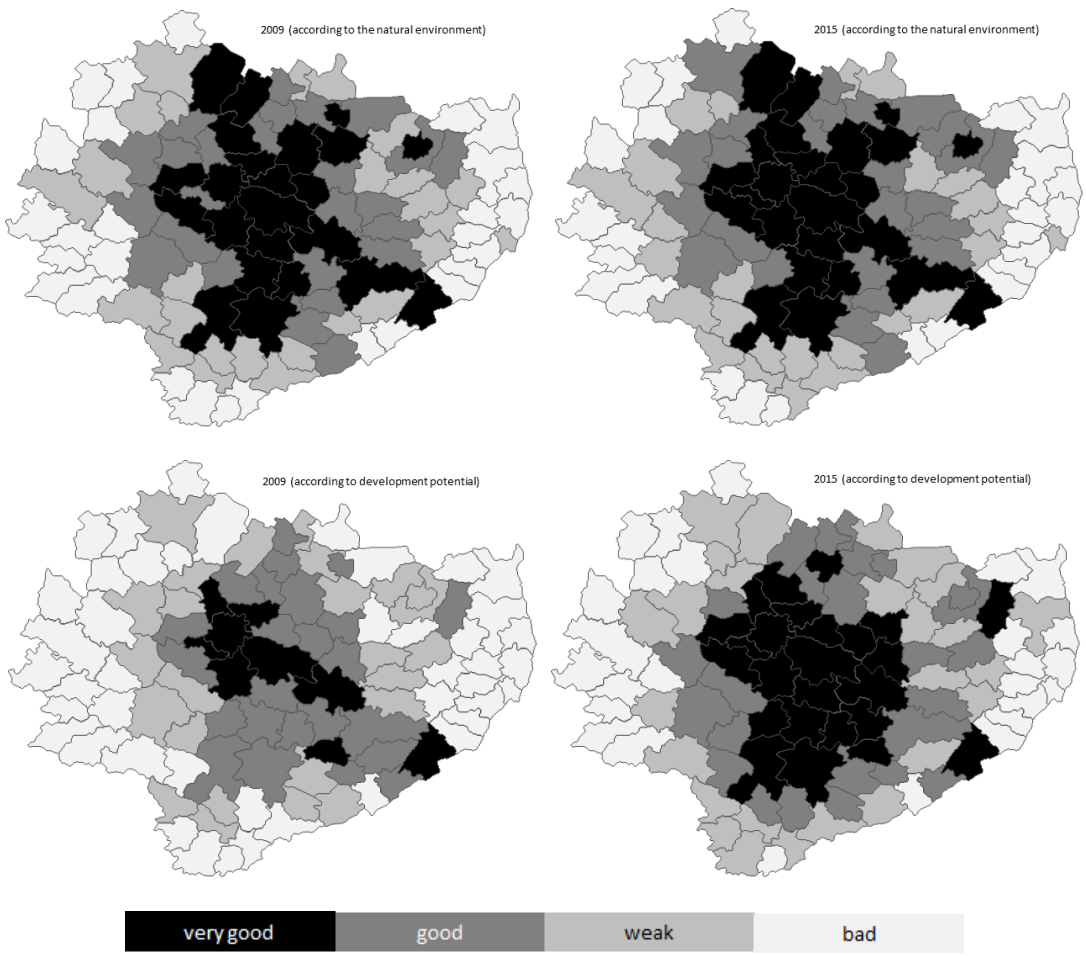

Figure 4. Spatial diversity of the regional gravitational effect of communities of the Świętokrzyskie Voivodship in 2009 and 2015. Division into groups was made according to the value of quartiles for 2015
Source: own study.

Conclusion

Bearing in mind the content of this study, the authors of this study, being aware of the complexity of the studied category, in order to prove the research hypothesis set out at the beginning, applied a synthetic measure that gave the opportunity to recognize spatial disproportions of the natural environment. In addition, it allowed the authors to examine how the society of the Świętokrzyskie Voivodeship perceives this category. Based on the studies carried out, it was found that:

1. Local development is highly dependent on the processes taking place in the so-called development centres. A comparison of the spatial distribution of the most developed municipalities indicates an increase in communities with a high level of development around the capital of the region.
2. The activities of communities are of a multi-criteria category, their level of activity is affected by location rent, finances, economic and infrastructural potential, natural resources, etc. The peripheral areas of the Voivodeship are characterized by weak potential. Characteristic for them is the "leaching" effect, e.g., human capital, social or economic potential.
3. The presented methods enable the identification of areas with a higher / lower level of performance effectiveness, and then programming their support from public funds under regional policy. It can be a helpful tool for local authorities assessing the accuracy of past decisions and the effectiveness of instruments of regional management applied in the past.

References

Burger, T. (2000). *Świadomość ekologiczna społeczeństwa polskiego u progu XXI w*., Raport 1, Warszawa: 7.

Collins, J.B., Scannell, C.G. (2005), *Natural environment data services in distributed modeling and simulation*. Net-Centric Approaches to Intelligence and National Security: 149-174.

Dziekański, P., Wyszkowski, A. (2018). *Ocena przestrzennego zróżnicowania sytuacji finansowej gmin województwa świętokrzyskiego z wykorzystaniem miary syntetycznej*, OPTIMUM. ECONOMIC STUDIES NR 1 (91) 2018: 219-238.

Ferguson, T.W., & Tamburello, J.A. (2015). *The Natural Environment as a Spiritual Resource: A Theory of Regional Variation in Religious Adherence*, Sociology of Religion 76 (3): 295--314.

https://bdl.stat.gov.pl/BDL/start, update: 17.12.2019.

Jóźwiak, M.A., Jóźwiak M., Strzyż M. (2010). *Predyspozycje naturalne regionu świętokrzyskiego do rozwoju turystyki, Krajobraz a Turystyka, Prace Komisji Krajobrazu Kulturowego* Nr 14, Komisja Krajobrazu Kulturowego PTG, Sosnowiec.

Kalfas, D.G., Zagkas, D.T., Raptis, D.I., Zagkas, T.D. (2019). *The multifunctionality of the natural environment through the basic ecosystem services in the Florina region, Greece*, International Journal of Sustainable Development and World Ecology, 26 (1), pp. 57-68.

Kapsalis, V.C., Kyriakopoulos, G.L., Aravossis, K.G. (2019). *Investigation of ecosystem services and circular economy interactions under an inter-organizational framework,* Energies, 12(9), 1734, https://doi.org/10.3390/en12091734.

Klöckner, C.A. (2013). *A comprehensive model of the psychology of environmental behaviour – A meta-analysis*. Global Environmental Change 23: 1028-1038.

Koszarek-Cyra, A. Piśniak, M. (2017). *Świadomość ekologiczna studentów Wydziału Zarządzania Politechniki Częstochowskiej,* Zeszyty Naukowe. Organizacja i Zarządzanie*,* Politechnika Śląska z. 108: 193-202.

Mikhaylov, A.S. (2018). *Socio-spatial dynamics, networks and modelling of regional-milieu*, Entrepreneurship and Sustainability Issues *5(4)*: 1020-1030.

Milfonta, T.L., Duckitt J. (2010). *The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes*. Journal of Environmental Psychology, 30: 80-94.

Mirowski, W. (1996). *Environmental awareness and sustainability*, Issues of Science Studies, 3: 10--15.

Molecular genetics in ecology. In: Freeland, J.R., Kirk, H., Petersen, S.D. (2011). *Molecular ecology*. Second Edition. John Wiley and Sons Ltd, 2011: 32;

Przybytniowski, J.W. (2017). *Wiedza ekologiczna czynnikiem wzrostu świadomości i zachowań mieszkańców województwa świętokrzyskiego*; Studia i Materiały. Miscellanea Oeconomicae, Wydziału Prawa, Administracji i Zarządzania, Uniwersytetu Jana Kochanowskiego w Kielcach, t. II: Kielce: 171-182.

Przybytniowski, J.W., Dziekański, P. (2019). *Synyhetic Measure Used as Assessment of Spatial Disparities of the Natural Environment,* Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach, Seria: Administracja i Zarządzanie 49 (122).

Pooler, I. (1987). *Measuring Geographical Accessibility: a Review of Current Approaches and Problems in the Use of Population Potentials. Geoforum*, vol. 18, no. 3.

Rook, G.A. (2013). *Regulation of the immune system by biodiversity from the natural environment: An ecosystem service essential to health.* Proceedings of the National Academy of Sciences of the United States of America, 110 (46): 18360-18367.

Shim, J.E., Kim, S.-J., Kim, K., Hwang, J.-Y. (2018). Spatial disparity in food environment and household economic resources related to food insecurity in rural Korean households with older adults, Nutrients, 10 (10), 1514, DOI: 10.3390/nu10101514

Stanny, M. (2012). *Level of social and economic development in Poland – measurement for a complex phenomenon.* Retrieved form http://admin.www.irwir-pan.waw.pl/dir_upload/site/files/Monika/PomiarZjawiskaZlozonego_IRWIR20 12.pdf (15.09.2019).

Tokarski, T. (2005). *Statystyczna analiza regionalnego zróżnicowania wydajności pracy, zatrudnienia i bezrobocia w Polsce*, Wydawnictwo Polskiego Towarzystwa Ekonomicznego, Warszawa: 207.

Wódz, J., Wódz, K. (1993). *Społeczne znaczenie świadomości ekologicznej.* In: Wódz J., (ed.), *Zagrożenia ekologiczne. Warunki życia*. Wizje przyszłości Katowice 1993: 17.