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INDICATORS OF SUSTAINABLE DEVELOPMENT OF THE PROVINCE OF WARMIA AND MAZURY IN THE ENVIRONMENTAL ASPECT

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K e y w o r d s: sustainable development, indicator method.

A b s t r a c t

The purpose of this study has been to identify the degree of sustainability in the development of the Province of Warmia and Mazury. The theoretical and empirical investigations were conducted between 2003–2014 based on data from the Local Data Bank. Using a comparative indicator method, 20 indicators were developed, with different directions of preference. The evaluation involves the concept of uniform preference, hence the higher the assessment indicator, the better the situation in the evaluated area unit. Our studies on the sustainable development of the Province of Warmia and Mazury suggest that the indicators measuring the environmental dimension and consequently the quality of life of the residents (in this aspect) score higher than the country's average values. It is also optimistic that some progress, however small, can be seen in this area based on the analyzed dynamics of changes.

WSKAŹNIKI ZRÓWNOWAŻONEGO ROZWOJU WOJEWÓDZTWA WARMIŃSKO-MAZURSKIEGO W ASPEKCIE ŚRODOWISKOWYM

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S ł o w a k l u c z o w e: rozwój zrównoważony, ocena wskaźnikowa.

A b s t r a k t

Celem badań było określenie stopnia zrównoważenia rozwoju województwa warmińsko-mazurskiego w aspekcie środowiskowym. Badania teoretyczne i empiryczne prowadzono w latach 2003–2014 na bazie danych zebranych z zasobów Banku Danych Lokalnych (BDL). Wskaźnikową

metodą porównawczą opracowano 20 wskaźników o różnych kierunkach preferencji. Dla każdego wskaźnika obliczono tzw. ocenę pokazującą, o ile procent wskaźnik jest lepszy lub gorszy od średniej dla porównywanych województw. Z badań nad zrównoważeniem rozwoju w województwie warmińsko-mazurskim wynika, że wskaźniki charakteryzujące ład środowiskowy, a tym samym jakość życia mieszkańców (w tym aspekcie) są wyższe niż średnio w kraju. Optymistyczne jest również to, że analizując dynamikę zmian można zauważyć postęp, choć znikomy.

Introduction

According to DIEFENBACHER (2009, p. 194–208), the concept of "sustainability" is not obvious *per se*. In politics, it is often perceived in line with the economic interest of the involved persons. In academic debates, especially in discussions on sustainable development, definitions are far more consistent. Whenever the issue of sustainable development is raised, it almost invariably pertains to a situation of strong permanence that should ensure intra- and inter-generation fairness. Prior to discussing the general concept of sustainable development, it is advisable to proceed first through the process of operationalization, from the identification of the dimensions of sustainable development to the establishment of relevant indicators, which will lend themselves to the task of making an assessment of how far the contemporary society is distant from attaining sustainability. This will allow for an evaluation of the current situation and identification of areas which need further action. The following study is an effort to apply some indicators for the sake of presenting changes in the environmental dimension of sustainability.

Until the 1990s, Poland was one of the most severely polluted countries in Europe. Industralization and urban development in Poland had been progressing at the expense of environmental protection and conservation. Social and economic considerations had prevailed over ecological concerns. A significant stimulus for striving towards sustainable development came from the prospective European Union membership. Provisions of the Accession Treaty posed enormous challenges that Poland had to face. Within the European Union, the economic backwardness of East European countries has been diminishing gradually over the past decade. Conversely, internal differences between regions in each country have grown bigger (KOSIEDOWSKI 2009, p. 194–208).

One of the essential goals of sustainable development is to improve the broadly understood quality of life for both present and future generations. However, a question arises as to the meaning of the quality of life. The way it is understood by individual people depends on numerous factors, including culture, religion, social bonds and the degree to which both material and spiritual needs are satisfied. KRUK (2009, p. 64–75) cites several definitions,

which proves that the term "quality of life" has been defined on a number of occasions. What all these definitions share is the claim that quality of life is the feeling of having one's needs satisfied. In our search for measures of the quality of life, we distinguish objective and subjective appoaches. Two terms should be mentioned: "quality of life" and "the sense of the quality of life". "Quality of life" pertains to the external sphere, which is a source of stimuli and experiences for individual persons. The quality of life is a product of subjective measurements. "The sense of the quality of life" refers to the sphere of emotions and lacks subjective meaures. These questions are discussed broadly, with numerous references to the literature, by OWSIŃSKI and TARCHALSKI (2008, p. 59–95).

The perception of the quality of life keeps changing as our civilization is developing and the level at which people's needs are satisfied is raised higher and higher. Apart from principal societal order indicators such as health (life expectancy), welfare, education, economy (access to products and services, income per capita), measurements of life quality also involve indicators related to the environmental dimension of sustainability, e.g. access to environmental protection infrastructure. Sustainable development indicators facilitate the monitoring of the environmental dimension of sustainability, which would be best done through cyclic assessments. The literature (BORYS 1999, p. 247–334) suggests indicators which can be applied in practice to different levels of organization, including regions, and which can serve for calculating various indices (ŁAGUNA, WITKOWSKA-DĄBROWSKA 2008, p. 92–102).

Research methodology

The purpose of this study has been to identify the degree of sustainability in the development of the Province of Warmia and Mazury, Poland, in the area of environmental order.

The theoretical and empirical investigations were conducted between 2003–2014 (10 years in the European Union) based on data from the Local Data Bank. Using a comparative indicator method, 20 indicators were developed, with different directions of preference (Tab. 1).

The research employed a theme-based classification of indicators, which led to the construction of a pyramid of indicators. A similar type of classification is used by the Local Data Bank, which facilitated the use of their data. Within the environmental dimension, several themes were distinguished. The proposed indicators underwent some modifications and transfer or adjustment to various themes during the research (WITKOWSKA-DĄBROWSKA 2011, p. 263–274). As a result, a theme-based system was achieved.

Table 1
Themes and the number of indicators selected for the study on sustainable development in the Province of Warmia and Mazury

Themes and indicators	Number of indicators
Protection of nature and landscape	6
Protection and sustainable development of forests, parks and urban greenery	4
Waste and sewage management	5
Water economy	5
Total	20

Source: adapted from *Wskaźniki zrównoważonego rozwoju* (2005, p. 62–321).

Our selection of indicators was based on the principle of causality, which posits that human activity influences the environment and is a cause of favourable and unfavourable changes (Tab. 2).

These indicators are associated with groups of goals defined in the Environmental Policy of the State, in which conservation of biodversity is mentioned as one of the objectives. It is manifested by the delineation of legally protected areas, and by protection of soils and forests. In this article, certain biodiversity problems have been included within the indicators identifying the level of afforestation and protection of the environment and landscape. They illustrate the current state and implicate major sources of problems as well as possible ways to reverse or alleviate consequences of anthropopressure. The state's Environmental Policy dedicates much attention to the protection of natural resources. Biodiversity of nature has a high value in Poland. Currently, Poland's territory comprises various forms of legally protected most valuable natural assets, although the total area of 23 national parks and 400 reserves equals just 1.5% of the country's area, and the area of 120 landscape parks corresponds to 8% of Poland's area. Woodlands are an immensely valuable natural resource of Poland, as they cover nearly 30% of the country's area. The biggest challenge facing the State Forests at the moment is to transform the forest economy from the one dominated by economic goals to a multifunctial economy, in line with the priciples of permanently sustainable forest management, because forests perform many valuable functions apart from timber production, e.g. protecting natural diversity, improving water retention, preventing soil erosion, providing space for human recreation and relaxation[1].

The so-called demonstrative value was calculated for each indicator, showing by what per cent a given indicator is better or worse than the mean for all

[1] Polityka ekologiczna państwa w latach 2009–2012 z perspektywą do roku 2016. 2008. Ministerstwo Ochrony Środowiska, https://www.mos.gov.pl (access: 1.06.2016).

Table 2

Themes, indicators and directions of preferences in environmental order

No	Themes and indicators	Direction of preference
1.	Protection of nature and landscape	stimulating/destimulating
1.1.	share of farmland in total area of the province (%),	stimulating
1.2.	share of nature reserves in total area of nature protected lands (%)	stimulating
1.3.	share of ecological utilities in total area of nature protected lands (%)	stimulating
1.4.	share of landscape parks and protected landscape areas in total area of nature protected lands (%)	stimulating
1.5.	share of the coverage of legally protected land in total area of the province (%)	stimulating
1.6.	ratio of funds from the province's budget to total inputs to nature conservation and protection (%)	stimulating
2.	Protection and sustainable development of forests, parks and urban greenery	stimulating/destimulating
2.1.	forested land (%),	stimulating
2.2.	ratio of reforested and afforested land to total area of the province (%)	stimulating
2.3.	forest fires (in ha per 1000 ha of forests)	destimulating
2.4.	reproduction of public greenery, tree stands, etc. to total area (%)	stimulating
3.	Waste and sewage management	stimulating/destimulating
3.1.	ratio of households served by WTPs to total population (%)	stimulating
3.2.	ratio of the population served by the sewage system to total population (%)	stimulating
3.3.	length of the sewage system to length of waterworks (m)	stimulating
3.4.	share of disposed waste to total amount of waste generated in a year (%)	destimulating
3.5.	volume of investment inputs to waste management economy in PLN per capita	stimulating
4.	water economy	stimulating/destimulating
4.1.	share of the population connected to waterworks to total population (%)	stimulating
4.2.	volume of water used in agriculture and forestry to total water consumption by domestic economy and households (%)	destimulating
4.3.	volume of water used by households and consumed by domestic economy per capita (m^3)	destimulating
4.4.	volume of water drawn from groundwater resources for industrial purpose to total consumption of water in industries (%)	destimulating
4.5.	volume of investment inputs to water and sewage management in PLN per capita	stimulating
Total	20 indicators	15/5

Source: the authors, based on: *Wskaźniki zrównoważonego rozwoju* (2005, p. 62–321).

compared provinces (ROGALA 2005, p. 237–246). The evaluation involves the concept of uniform preference, hence the higher the assessment indicator, the better the situation in the evaluated area unit, while the mean for the other units stands for 100%. The method used in the research was the one known as zero unitarization, in which "unitarized" indicators are referred to the mean through the following equations (BORYS, ROGALA 2004, p. 601–608):

1. for stimulating indicators
   $O_P = [(W_i - W_{min})/(W_{max} - W_{min})] \times 100\%$;
2. for destimulating indicators
   $O_R = [(W_{max} - W_i)/(W_{max} - W_{min})] \times 100\%$;
3. for the mean of a stimulating indicator
   $O_{P\text{-}mean} = [(W_{śred.} - W_{min})/(W_{max} - W_{min})] \times 100\%$;
4. for the mean of a destimulating indicator
   $O_{R\text{-}mean} = [(W_{max} - W_{śred.})/(W_{max} - W_{min})] \times 100\%$;

where:
O_P or O_R – point assessment of W indicator for the province,
$O_{P\text{-}mean}$ lub $O_{R\text{-}mean}$ – a score assessment of the mean value of indicators for the whole group of units (provinces) compared; this assessment depends on the distribution of the level of an indicator:
W_i – the level of a given indicator in the unit submitted to assessment,
W_{min} – the minimum level of the indicator in a given sample,
W_{max} – the maximum level of the indicator in a given sample,
$W_{śred.}$ – the mean of the indicator in a given sample;

5. The calculated indicators were referred to the mean level achieved in the compared group of units according to the formula:
   $[(O_p/O_{P\text{-}mean}) \times 100\%] - 100\%$ or $[(O_R/O_{R\text{-}mean}) \times 100\%] - 100\%$.

Based on the results, the dynamics of changes in 2003–2009 was determined, with the year 2003 serving as the base reference for the indices.

Research results

The surface area of the Province of Warmia and Mazury is 24,203 km^2, which corresponds to 7.7% of Poland's total area, and this makes it the fourth largest province in the country. It has varied land relief and diverse natural resources, including inland freshwaters (over 6%). Woodlands cover around 30%, which is close to the country's average percentage. Over 54% of the area is made up of farmland. The population is 1.4 million and its density is the country's lowest, at 59 persons per 1 km^2. There is some ethnic diversity

among the province's residents. The population is relatively young: 23.2% are pre-working age people, 13.3% are working age and 63.5% are post-working age. This province is among the least polluted ones in Poland. The major industries are: food processing and the furniture industry. Owing to the local natural resources, tourism and aquaculture thrive in this area (WITKOWSKA-DĄBROWSKA, BĄCZKOWSKI 2010). In 2015, there were 123,876 business entities registered in the REGON system (as of the end of the year), i.e. 0.09 per capita.

Fig 1. presents data collated for individual areas in the years: 2003, 2005, 2007, 2009 and 2014. The specific orders and themes have been discussed previously, but values of some indicators might be different than the ones given in the table because the selection of indicators has been somewhat modified while the adopted research method was being verified in the curent study (WITKOWSKA-DĄBROWSKA 2009, p. 61–71).

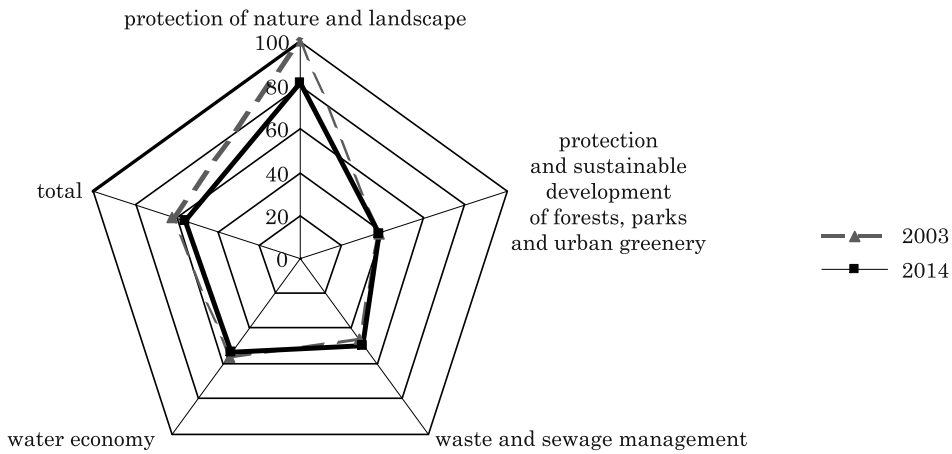

Fig. 1. Assessment of the sustainability of environmental order in the Province of Warmia and Mazury compared to other Polish provinces (%)
Source: the authors, based on the data from Local Data Bank (BDL) and Central Statistical Office (GUS) in Poland.

Within the environmental dimension, all the indicators selected within the themes attained higher values than the mean values for the other Polish provinces. The highest score was noted for the theme identified as the protection of the environment and landscape. Nature and landscape protection scored very well mostly because of the high values assigned to two indicators: inputs allocated from the Province's budget to nature protection and the share of areas under legal protection in the whole province. Our study has also demonstrated high dynamics of changes (Fig. 2). The time span was divided into stages: 2003 – prior to the EU accession, 2005 to 2007 – the time when the

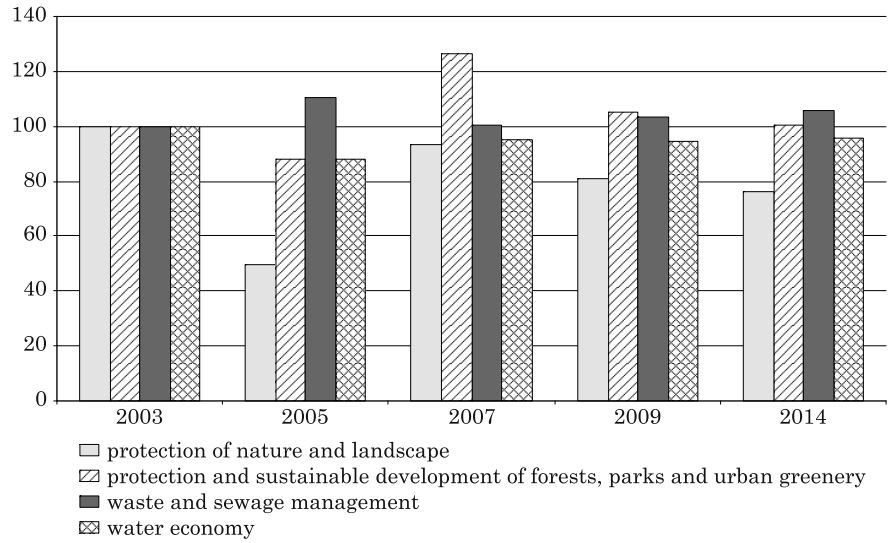

Fig. 2. Dynamics of changes in the assessment of sustainability in environmental order
Source: the authors, based on the data from Local Data Bank (BDL) and Main Statistical Office (GUS) in Poland.

state's previous environmental policy was binding, 2009 – the currently binding environmental policy was brought to life, 2013 – ten years in the EU. The index value of 2005 relative to the base one of 2003 was just 52.44%, but it rose to 93.32% in 2007 and oscillated around 80% in 2009 and on. The other themes were characterized by considerable changes as well, with the differences versus the base year 2003 ranging from 88.00% to 126.68%. Nevertheless, only one area, i.e. such as waste management, presented higher dynamics of changes relative to 2003 in all the analyzed years.

The regional problem that remains unresolved in the scope of environmental order is the low saturation of sewage and gas pipeline installations (Tab. 3). While the accessibility of sewers improves, both in the region and in whole Poland, the number of households connected to piped gas installations is on the decrease. Noteworthy, the Province of Warmia and Mazury had a distinctly higher share of the population using water and sewage networks throughout the analyzed decade, while having a lower percentage of households connected to gas pipes. During the whole time period of 2003–2014, the share of population in Poland living in households connected to waterworks increased by nearly 10%. In 2012, over 64% of inhabitants of urban municipalities across Poland used waterworks as compared to 67% of residents of the Province of Warmia and Mazury[2]. As with waterworks, the share of households connected

[2] More detail in: (Witkowska-Dąbrowska 2015, p. 55–65).

to sewage systems in the rovince of Warmia and Mazury was about 5% higher (4% since 2008) than in whole Poland. However, the percentage of population living in households connected to sewage systems was considerably lower in rural communes than in rural-urban (by nearly two-fold) and in urban (by nearly four-fold) communes, both in the province and in whole Poland.

Table 3

Share of population using the linear environmental protection infrastructure in Poland and in the Province of Warmia and Mazury (%)

Wyszczególnienie	Years				
	2003	2005	2007	2009	2014
Share of population with access to waterworks					
Poland	85.1	86.1	86.7	87.3	91.6
Warmia and Mazury	86.4	87.9	88.3	88.9	94.6
Share of population with access to a sewage system					
Poland	57.4	59.2	60.3	61.5	68.7
Warmia and Mazury	62.7	64.4	65.0	65.7	73.4
Share of population with access to a gas network					
Poland	54.2	51.7	51.7	52.6	52.2
Warmia and Mazury	45.1	44.8	44.2	43.9	42.8

Source: the authors, based on the data from Local Data Bank (BDL) and Central Statistical Office (GUS) in Poland.

The dynamics (Fig. 3) of these changes in the analyzed years testifies to the general increase in sustainability, in this regard. During that decade, the percentage of households connected to waterworks and sewage systems increased steadily. The dynamics of changes demonstrated by the index with the constant base shows a rather stable growth, with the accessibility to sewage systems slightly dominating. The largest disproportion existed in the number of households having a piped gas supply. The share of the population in Poland using piped gas systems is slightly more than 50%, while in this province it is lower by about 9 per cent points. Moreover, a decrease by 2 per cent points occurred in the analyzed decade relative to the first year (2003). The share of population with piped gas connection varied over a small range. Eventually, a decrease in the percentage of households connected to piped gas appeared in urban communes in Poland and in the Province of Warmia and Mazury. However, differences in the accessibility of piped gas between urban, urban-rural and rural communes remain the most serious problem. Nationally, the share of households in rural areas with piped gas connection was 21.6% in 2012, while in the rural communes of Warmia and Mazury it was as low as 4.8% (WITKOWSKA-DĄBROWSKA 2015, p. 55–65).

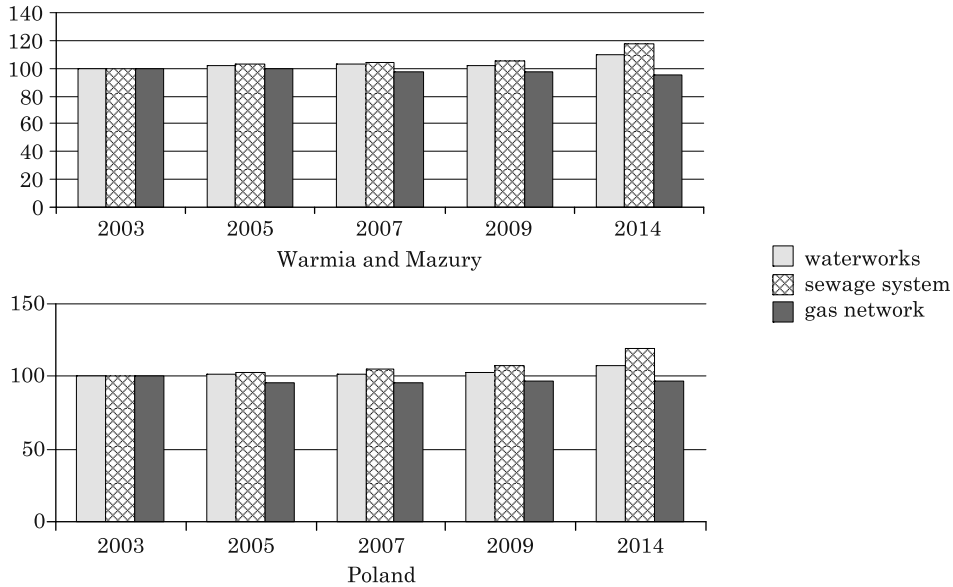

Fig. 3. Dynamics of changes in the share of population using linear environmental protection infrastructure

Source: the authors, based on the data from Local Data Bank (BDL) and Central Statistical Office (GUS) in Poland.

Until 2009, however, the above differences had never exceeded a few per cent. Afterwards, an evident growth was observed until 2014, especially in the share of households having access to sewage systems. Similar tendencies were noted in the Province of Warmia and Mazury and in whole Poland. With regard to households connected to piped gas, in most of the years submitted to our analysis, a decrease was observed in the province compared to the base year of 2003. Similar data were collected in whole Poland. KRUK (2009, p. 64–75) after F.J. Ayala-Carcedo claims that economic growth precedes social growth, and only afterwards it is possible to pursue sustainable development, which entails care for nature.

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